TIME-LAG AND COST OVERRUN OF INFRASTRUCTURAL INVESTMENTS WITH SPECIAL REFERENCE TO POWER PROJECTS IN KERALA

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Certified that the thesis "**TIME-LAG AND COST OVERRUN OF INFRASTRUCTURAL INVESTMENTS WITH SPECIAL REFERENCE TO POWER PROJECTS IN KERALA**" is the record of bona fide research carried out by **Mr.Baby Thomas** under my guidance and supervision. The thesis is worth submitting for the degree of Doctor of Philosophy in Economics under the Faculty of Social Sciences.

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Chapter 1

INTRODUCTION

Theoretically there exists a cumulative and circular relationship between investment and economic development of a nation, ie., investment - production - employment - income - saving - investment, one leading to the other. Thus investment, normally, should result in greater income generation and capacity creation in the economy. So most of the discussions in India about raising the rate of economic growth and expanding employment opportunities have centered around the quantum of plan outlay and its sectoral allocation. Similarly the economic development of states is increasingly related to the quantity of plan outlay and the quantum of Central-State Financial Transfers. For example, often the poor economic performance of Kerala is related to the comparatively less flow of funds from centre to the state.

India is a country deficient in capital outlay resulting mainly from law availability of investment funds, paradoxical though it may seem that the very fact that we were short of capital, has encouraged us to rely excessively on capital as the principal resource in all our developmental projects as well as in the pursuit of social justice. By virtue of this attitude towards capital in economic development and social activities we often stress more on the quantity of capital in economic development.

In India development is not taking place commensurately with increase in savings and investment. During 1950's the main hurdle in the way of raising the growth rate was the paucity of capital. The saving level was less than 10 per cent of the gross domestic product. This was pointed out as the major constraint in stepping up levels of investment and raising the growth rate. But by 1985-86 the level of savings has risen to around 25 per cent of the gross domestic product. But there was no corresponding spurt in the overall rate of growth, which varied between 2.5 to 4.5 per cent during this period.

The sad fact is that though India surpassed most of the developing countries, in respect of the level of savings, she remained far behind in the rate of economic growth. With the present level of saving and investment around 25 per cent of the G.D.P., India could have achieved much higher rate of growth.

The experience of the developed countries shows that both the quantity of investment funds and the effectiveness of its use are equally important for economic development. The incremental capital-output ratio (ICOR) is one of the traditional methods of measuring the efficiency of investment. The experience that we gather from our developmental investment expenditure shows that the effectiveness of investment is also highly influenced by the timely completion of the developmental projects and programmes at the original estimated cost. So the more the output per unit of investment at the shortest possible period, the better the criterion of efficiency of investment. The level and rate of growth of an economy is largely determined by the size of investment and the achievement of targets at the scheduled time and at the original estimated cost.

One of the major factors that contributed to inefficiency and low growth rate in the Indian economy is the slippage of projects and the consequent cost overrun. Slippage of projects and the consequent overrun not only result in wasteful use of the scarce capital but also reduce and delay the income generating and capacity creating effect of investment.

Even today it takes nearly 36 months to set up a steel plant in India against only 16 months in Japan or in

Korea. This shows that the original time schedule and cost of the projects in India are comparatively higher and the time-lag and cost overrun occur over and above this higher original time and cost schedule. As a result the economy of our country is adversely affected.

The occurrence of time-lag and cost overrun adversely affects the economic viability of the project itself. The formative stage of a project is crucial to the particular project itself because it substantially determines its competitive and survival prospects in its subsequent years of production and marketing. Once escalation of cost gets embodied in the capital outlay of a project it adversely affects the operational results right through the life expectancy of the project. Where the escalation is a multiple of the original estimate, its adverse consequences cannot be offset easily even by the most mature and efficient management.

Time lag and cost overrun may also result in the generation of disproportionality crises in the economy. This results in the retarded development of the related sectors. For example a cut in power supply resulting from time-lag and cost overrun of power projects, as in Kerala, adversely affects all vital areas of production.

Further, ultimately, time-lag and cost overrun restrict the current and future rate of growth of the economy. The size of the investment, the target achievement and the consequent growth rate are limited by time-lag and cost overrun factors. The size of the current investment and its resource base have its origin in the success of earlier investment on projects and programmes. Time lag in the earlier investments on projects delays target attainment and cost overrun reduces the real size of investments. It reduces the extent of the success of the earlier investments. So the income generating and capacity creating effect of the earlier investments both through direct and linkage effects is delayed or reduced. Thus the current rate of growth of the economy is reduced or delayed by time-lag and cost overrun. This delayed and reduced growth rate of the economy also reduces rate of growth of its resource base, in financial front and material aspect. This again reduces the size of the future investments and the future rate of growth of the economy.

Further, time-lag causes cost 'overrun' and spill over the effect. The delay caused by time-lag results in the extension of the current project work to future plan periods and it often leads to the diversion of the scarce resources of the plans for the completion of the earlier plan projects. Thus it reduces the size of future plan projects and programmes. This situation is aggravated by cost overrun. Normally time-lag breeds cost overrun which makes transfer of funds that could be used for the current plan to the projects of the earlier plans at a higher level and rate. Thus time-lag and cost overrun can reduce or delay the current and future rate of growth of the economy of any nation. This reduced current growth rate makes the availability of resources scarce for the future plans and restricts the size of investment and future growth of the economy. Thus time-lag and cost overrun act as a cause and an effect of reduced investment. The resultant effect is that the economy gets weakened and the growth rate slows down.

In a state like Kerala with a retarded development, low resource base, time-lag and cost overrun in project implementation are bound to cause certain economic problems in the state economy, which will reinforce each other heavily and spread to other areas. This can lead to a vicious circle and ultimately pushing the economy into the trap of low development and economic stagnation.

Time lag normally results in revision of original estimated cost which leads to cost overrun. The heavy investments in projects unaccompanied by increased output due to time-lag adds to the rate of inflation. The resultant increase in prices of inputs required in the project cause further increases in cost.

In a state like Kerala where fiscal and financial crises are acute, cost overrun makes investment funds more scarce, which breeds further time-lag.

To meet increased demand for funds due to spill over effect generated by time-lag and cost overrun, along with the proliferation of new projects and programmes of the new plan, the government is forced to borrow heavily. The borrowed funds and its investment are kept barren for a long period due to time-lag. This results in cost overrun which consumes away a sizeable portion of the borrowed funds on the existing projects without any corresponding increase in output and income. So the repayment of the principal amount along with interest adds to the gap between the revenue and expenditure of the government. Thus the government is forced to impose additional taxes on the society.

In Kerala the lion's share of the tax revenue is from indirect tax. This increase in indirect tax system adds to the inflationary tendency in the state leading to further increase in the prices of inputs of the projects. This increase in input price calls for further revision of the already revised estimate, leading to further cost overrun. In the context of acute shortage of funds, this cost overrun, along with other factors, causes further time-lag and delay of the project. This results in further cost overrun. Thus time-lag and cost overrun obstruct the efficient and optimum use of investment funds and it prevents the generation of new capacity, increase output, employment and income.

If time-lag and cost overrun occur in infrastructural sectors like Hydro-electric Projects (HEP) its negative impact on the growth rate of the economy will be very high. This is because of the very high linkage effect of investment, both forward and backward.

Power generation in Kerala is entirely hydro based and the scarcity of power is increasing over the years. The worsening disequilibrium in the supply and demand for power has come to a grave situation. Enough and assured supply of power is a pre-condition for the growth of new projects and the better utilisation of existing capacity. Power is both an input and an output. If time-lag occurs in power projects, particularly in a power deficit state, it will cause a disproportionality crisis in the state leading to under-utilisation of existing plant capacity in different sectors as a result the growth of new enterprises is adversely affected.

Time lag and cost overrun of projects and programmes have been a common feature in the economy of Kerala. This can be realised from the following facts: Only one example each from different areas is analysed here. Kallada Irrigation Project which started in 1961 has a long history of 32 years of project construction and it still remains incomplete despite frequent revisions. This ultimately led to time-lag and high cost overruns. The project had an original estimated cost of Rs.1,328 lakhs, but had increased to Rs.45,780 lakhs as on 1.1.1990, giving birth to a cost overrun of Rs.44,452 lakhs. This comes to about 3347.1 per cent increase over the original estimate, still the project is not yet complete.

Almost all the public sector industries in Kerala, both Central and of the State, witnessed years of time-lag and heavy cost overrun. Kerala Mineral and Metals Ltd., Quilon which started in 1978 has resulted in a time-lag of 32 months which comes to about 76 per cent increase over the original estimated time schedule of project completion. The project also resulted in a cost overrun of Rs.3,340.18 lakhs, which is calculated as 51.5 per cent increase over the original estimated cost.

The infrastructural sector of the state economy is also not an exception to the phenomenon of time-lag and cost overrun. All the hydro-electric projects of the state, which are the only source of power generation in this power scarce state, met with time-lag and cost overrun. Projects like Edamalayar took nearly 25 years to get completed bringing in 500 per cent increase in cost.

So time-lag and cost overrun are very common defects persistently prevalent in the case of most of the projects in all the sectors of Kerala economy.

At the all India level too time-lag and cost overrun are so common and the consequences are too high.

It has been estimated that the cost of 181 major irrigation projects has gone up from Rs.13,154 crores to Rs.32,633 crores and the cost has risen up spirally by Rs.19,476 crores. The increase in project cost due to time-lag and cost overrun is more than the initial project outlay. This means that Rs.19,479 crores more have to be spent on the existing projects to meet cost overrun alone. At this instance, it is to be noted that a good number of these 181 irrigation projects are not yet completed and hence could not be commissioned. The additional expenditure on the projects will still increase if this trend is continued. Also, here we have to take into account the loss of employment output and income that could have been generated by the projects, had they been commissioned as planned originally.

REVIEW OF LITERATURE

The role of investment, both the quantity of investment and the quality of investment, in economic development are well recognised by economists from the classical period onwards. With the development of Keynesian Economics, the role of investment on economic development has become all the more important. The availability and accessibility of financial resources and the volume of investment are closely related. This fact is all the more important when we realise the fact that the state is facing serious financial crisis and low rate of growth.

A few studies are available relating to the financial crisis and the low level of development of Kerala economy. But almost all these studies are centered around the scarcity of investment funds and the resultant low growth rate of the economy. So, naturally, only limited literature is available on the inefficient use of financial resources and the resultant low growth rate of the state. No comprehensive academic study is made on time-lag and cost overrun of projects and programmes in the state, which is an important factor contributing to the inefficient use of scarce resources and the resultant low growth rate of the economy. Here an attempt is made to survey the available literature on the subject.

Sankaranarayanan (1985) observes that finance is the life blood of all the economic activities. Developmental schemes get stuck and achievements fall short of targets because of the non-availability of adequate finance. The author further highlights the fact that ever since the formation of the state, Kerala witnessed financial stringency characterised by successive budget deficits and continued depletion of cash balances.

While analysing the financial and fiscal position of Kerala Economy, George (1990) finds that the financial crisis and the economic crisis reinforce each other.

Gupta and Lal (1981) have come to the conclusion that the Indian Economy is facing serious financial resource crisis, particularly after the fifth plan period. The authors comment that India will find it difficult to attain the estimated targets of savings and investment required to finance the public sector projects of the subsequent plans. This will make the public sector plans not feasible.

Pandit (1986) explains that the generation of surplus funds in different sectors of the economy is not at all promising. He further goes to the extent of saying that the surplus generated by the public sector is poor, irrespective of the fact that the share of the public sector in the Net Domestic Product (NDP) has been constantly growing but the rate of public sector savings has decreased sharply over the past years.

Trivedi (1986) argues that the inefficient use of investment funds in public sector enterprises has resulted in poor generation of surplus funds for investment in India. This inefficiency in public enterprises should make Indian planners to move from a policy of big push to a policy of big stick, ie., a new policy which should stress the efficient use of resources should be introduced.

Nayanar (1981) is of opinion that owing to the institutional and policy frame-work related defects of the planning system of Kerala, the efficient use of the available resources and the generation of additional financial resources are poor in the state. So we are not yet able to achieve the plan targets of rapid growth, social justice, self-reliance, eradication of poverty and unemployment.

The study of Sinha (1990) shows that most studies in India about economic growth are centered around the quantum of plan outlay and its sectoral allocations and there is little discussion about raising efficiency.

While analysing the need for efficient use of resources, Jha (1986) highlights the fact that India succeeded in doubling the rate of savings in the first quarter of a century of planned development. But due to the inefficiency in the use of resources there was no corresponding increase in the rate of growth of the economy. He recommends a measure for the efficient use of resource, ie., the plan resource should only be used for new projects and should not be used for meeting time-lag and cost overrun of projects and if these occur, should be financed by non-plan resources. So to the author time-lag and cost overrun stand in the way of efficient use of resources.

Gulati (1988) brings out the fact that the occurrence of time-lag and cost overrun is a common feature of the projects implemented in India.

The existence of time-lag and the resultant cost overrun is considerable in Kerala State, both in sanctioning and starting new units of traditional industries and in the expansion of existing units (Baby Thomas, 1983).

Time-lag and cost overrun are so common and their extent is very high in all the hydro-electric projects and in all the irrigation projects of Kerala (Roy, 1986 and Rajendhran, 1991). To them time-lag and cost overrun consumes away a good share of the state's resources.

Johnson (1990) argues that, in comparison with other states in India, time-lag add cost overrun are higher in Kerala, particularly in the irrigation projects and Hydro Electric projects. Ravi Varma Thampuran (1992), by taking the Kakkadu Hydro Electric project, points out that the extent of time-lag and cost overrun is higher in the case of ongoing Hydro Electric projects of Kerala.

The occurence and the extent of time-lag and cost overrun are very high in the industrial and power projects of Kerala (The High Level Committee Report on Industry, Trade and Power, 1984). The committee on public undertakings (1986-87) also identifies the existence of time-lag and cost overrun in the projects of Kerala.

The Annual Report of KSEB (1973-92) contains certain cases of delay, and cost overrun in the generation and transmission projects of KSEB. The 8th plan proposal of KSEB (1991) analyses some cases of time-lag and cost overrun of the projects of KSEB.

The report of the assisted projects of IDBI (1984) on time-lag and cost overrun shows that both in the private sector and in the public sector majority of the projects met with time-lag and cost overrun. The study reveals that this kind of time-lag and cost overrun of projects is found in all the states. The Annual Reports of the Ministry of Programme Implementation (1986-91), throw light on the fact that time-lag and cost overrun is a common feature of almost all the central sector projects in different sectors in all the states.

Rangachari (1987) points out that even in the utilisation of foreign aid extended by the IMF and the World Bank, there is considerable time-lag which results in cost overrun and frequent revisions of their foreign exchange component.

Today time-lag and cost overrun of projects and programmes have become a common feature in India and are treated as a routine matter (Chowdhry, 1991). So they do not evolve much discussion and the implementing agency seek upward revision of the estimates and the competent authority sanctions the escalated cost.

Jha (1986) has identified the basic cause of the massive occurence of time-lag and cost overrun as the proliferation of controls and controling systems in India. To him decontrol and delicencing are the measures to avoid time-lag and cost overrun.

Rajendhran (1991) argues that the thin spreading of resources, lack of priorities in allocation of funds, mismanagement etc. are the reasons for time-lag and cost overrun in the irrigation projects and HEP of Kerala. But Roy (1986), stresses the legal issues, contract related issues, labour problems etc. as the major reasons for time-lag and cost overrun of the irrigation projects of Kerala. Corruption, favouritism, red tapism and ecological issues etc. are the major factors responsible for time-lag and cost overrun. Johnson (1990) and Radhakrishnan (1990) also underline these reasons as the major factors of cost overrun.

Jain (1988) comments that the impact of time-lag and cost overrun on the project itself is crucial. If time-lag and cost overrun occurs in the project then will adversely affect the operational efficiency of the project.

Sebastian Morris (1990) says that the delays and cost overrun in the public sector investment can raise the capital- output ratio in the sector and in the related sectors, which will bring down the efficiency of investment.

Patodia (1987) commends that Indian Economy has turned to be a high cost economy. The capital cost of setting up industrial units in India is much higher compared to that of other countries. Sethuraman (1987) highlighted the high cost of energy production in India, particularly in the area of the thermal power generation. Among other reasons, time-lag and cost overrun also have played its role in making things so.

Time-lag and cost overrun in the infrastructural sectors have created a disproportionality crisis in Indian Economy, contributing much to the economic stagnation of the State (Ahuluwalia, 1984). With the help of a distributive lag model of investment, Majumdar (1985) has shown the total plan investment as a function of pre as well as post terminal rates of growth of capacity output. Time-lag and cost overrun dilute this relationship and reduces the plan size.

RESEARCH DESIGN

The Statement of the Problem

The size of the investment and the achievement of targets in the original time schedule and at the original estimated cost are the best indicators of the economic performance of an economy. This is one of the most important factors that determine the level and rate of growth of the economy. The quantity and quality of investment are adversely affected by time-lag and cost overrun. Time-lag delays the target attainment and reduces the capacity creating and income generating effect of investment, which often affects the resource base of the economy and the size of investments and the growth rate.

In an economy like Kerala which is characterised by low level of development and poor supply of investment funds; the negative impact on growth on account of time-lag and cost overrun is high. If time-lag and cost overrun occur in the infrastructural sector, particularly, in the power generation, its adverse impact will be very high as the inter-industrial and inter-sectoral linkages of power and hydro-electric projects are very high. In Kerala, power is entirely hydro-based and about 19 per cent of the plan outlay of the state is made on power projects. But in the state no hydro-electric project is completed in time and at the original estimated cost. Slippages of the project and the consequent cost overrun are seen to be high in all the hydro-electric projects of the state. This is all the more paradoxical when we realise the fact that such things are heppening when the state is experiencing acute power shortage. Time-lag and cost overrun in the hydro-electric projects are not only high but show an increasing trend.

Hence the problems posed in the study are:

1. To what extent are time-lag and cost overrun high in the infrastructural investments in Kerala?

2. Whether the present extent of time-lag and cost overrun are able to affect negatively the economic viability of the projects and their future profitable running?

3. To what extent the time-lag and cost overrun of the infrastructural investments create disproportionality crisis in the state, contributing negatively to the growth rate of the related sectors of the economy?

4. Whether time-lag and cost overrun cause a major bruden on the resource base of the economy and negatively contribute to the attainment of targets.

5. Whether time-lag and cost overrun restrict the level and rate of growth of the economy, and whether it can explain the present economic stagnation of the state economy?

The Objectives of the Study

1. To analyse the extent and trends in time-lag and cost overrun in the infrastructural investments in Kerala, particularly in the hydro-electric and irrigation projects of Kerala.

2. To make a causative analysis of time-lag and cost overrun.

3. To analyse the relationship between time-lag and cost overrun.

4. To analyse the impact of time-lag and cost overrun of the hydroelectric projects
   - i) on the concerned project
   - ii) on the related industries and
   - iii) on the economy.

Hypothesis

Time-lag and cost overrun are high in the infrastructural investments in Kerala, particularly in the hydro-electric and irrigation projects. Hence it is hypothesised that there is a positive and significant relationship between time-lag and cost overrun.

Methodology

The present study consists of an empirical documentation and analysis of time-lag and cost overrun of infrastructural investments, particularly power and irrigation projects which consumed 36 per cent of the total plan expenditure of the state during 1951-1990. The role of time-lag and cost overrun in restricting or reducing the rate of growth of the economy is tried to be identified in the study.

A census study of all the ongoing and completed Hydro-electric and irrigation projects of Kerala during the period 1933-1991 is carried out. In order to have a microlevel analysis of the extent and causes of time-lag and cost overrun, a case study of Sabarigiri HEP is done. The extent of time-lag and cost overrun of secondary sector is also studied through the sample study of public sector and private sector industries.

Time-lag and cost overrun of central sector investment is studied by considering all the 331 mega, major and medium ongoing projects, based on the data made available by the monitoring system of Ministry of Programme Implementation (MPI), Government of India as on 1-1-1990. The trends in time-lag and cost overrun at the all India level are analysed by studying all the completed central sector mega, major and medium projects during 1988 to 1991.

The primary information used for the study are also collected by means of personal interview method. Interviews and discussions were held with the officials of KSEB, the retired persons from KSEB, leading contractors, workers, and trade union leaders.

The primary data were supplemented by secondary data which were collected from publications, reports, and documents of KSEB. The State Government publications like Economic Review, Statistics for Planning, Five Year Plan Documents, Budget Papers, Working Committee Reports etc. were the other major sources.

Statistical tools like average, percentage and ratio are used to analyse and interpret the data.

Chapter 2

KERALA ECONOMY: A MICRO ANALYSIS OF ITS RESOURCE BASE

Kerala has completed four decades of planned economic development. The growth pattern of Kerala has been at variance with that of the nation as a whole (Sankaranarayan, 1985). This has been so because of the difference in the sectoral growth rate between the state economy and the national economy. In Kerala the growth rate of commodity producing sectors was lower and that of the services sector higher as compared with the economy as a whole. Kerala has alround development especially in the social sector. The sectoral balance in development is not maintained in Kerala (Hemalatha, 1985). We have a fast developing social sector with increasing quality of life but a rather static industrial sector and a rather negatively growing agricultural sector. We resorted to a planned economy for the last 42 years. But our planning did not take us anywhere near the objective. Heavy investment in social sector, even at the expense of primary and secondary sector (Table 2.1) has led to the emergence of sectoral imbalence in the state. At the same time Kerala economy could not attain the merits of unbalanced growth properly. This, along with other factors, has resulted in economic crisis leading to fiscal and financial crisis in the state.

Table 2.1

Cumulative Plan Expenditure from First Plan (1951-56) to Seventh Plan (1985-90)

(Rs. crores)

Sl. No.	Section	Actual expenditure from 1951 to 1990	Percentage
(1)	(2)	(3)	(4)
1.	Agriculture and Allied Services	667.19 2.24* 10.29**	11.4
2.	Rural Development	325.49 0.28*	5.5
3.	Special Area Programme	13.47 46.54*	0.2
4.	Irrigation and Flood Control	992.63 47.98* 1.00*	16.9
5.	Energy	1164.78 6.87*	19.8
6.	Industry and Minerals	619.30 1.89*	10.5
7.	Transport	509.91 0.02*	8.7

Table 2.1 (contd.)

(1)	(2)	(3)	(4)
8.	Science, Technology and Environment	55.80	1.0
9.	General Economic Services	46.48	0.8
10.	Social Services	1401.58 35.40* 31.33* 5.82@ 77.37 1.82*	23.9
	GRAND TOTAL	5874.00 143.04* 42.62** 5.82@	100.00

* Special Central Assistance
** Expenditure on drought relief during the Seventh Five Year Plan, the expenditure covered by Advance Plan Assistance.
@ Share of E.S.I.

Note: Sectoral Outlays and Expenditure rearranged in conformity with the Sectoral classification adopted from the Seventh Five Year Plan onwards.

Source: <u>State Plan Expenditure</u> (1951-1990), State Planning Board, Govt. of Kerala, Trivandrum.

The State of Kerala has entered upon a vicious circle of economic crises and fiscal and financial crises which reinforce each other. Due to paucity of investment funds, there has been a deceleration in the rate of growth of the state's plan expenditure, particularly developmental expenditure in recent years (George, 1990). This, along with other exogenous factors, has contributed to a slow expansion of the state's economy and its resource base. The resources of the state are inadequate, at present, to meet its current non-plan commitments. The absence of adequate fund for non-plan account has led to the reduction in the rate of growth of the plan size and target achievements of the state. Thus today, Kerala economy is caught in a trap of low resource, low investment, low development and low resource base.

This economic crisis of Kerala has its origin in the low level of development, both absolute and comparative. The long term average annual growth rate of Kerala economy as measured by state income in real terms was only 3 per cent during the period 1950-51 to 1975-76 as against 3.6 per cent in the national economy (Sankaranarayanan, 1985). This shows that the overall growth rate of Kerala economy was lagging behind the national economy during 1950-51 to 1975-76.

In terms of per capita net state domestic product at current prices during 1980-81, Kerala was above the all India level. Table 2.2 shows that during the period 1980-81 the per capita net state domestic product at current prices was Rs.1,644 whereas at the all India level it was only Rs.1,627; placing Kerala above the all India level by Rs.14. But the scene has changed by 1985-86. At the current prices in 1985-86, the per capita net state domestic product stood at Rs.2,152 whereas at the all India level it was Rs.2,734, placing Kerala below the all India level by Rs.582. During 1987-88 at current prices the per capita net state domestic product stood at Rs.2,598 in Kerala but it was Rs.3,284 at the all India level, thus Kerala was below the all India level in this respect by Rs.786. During 1985-86, it was only Rs.582 but the difference has increased to Rs.786 in 1987-88, which reveals that the rate of growth of Kerala economy was increasingly lagging behind the rather poor growth rate of all India level.

The Sarkaria Commission classified the Indian states into four groups: (a) advanced; (b) middle level; (c) backward and (d) special category (Sarkaria Commission Report, 1987). Kerala is placed 9th in the category of

Table 2.2

Per Capita Net State Domestic Product
(1980-81, 1985-86, 1987-88 -- New Series)

State	At Current Prices			
	1980-81	1985-86	1986-87	1987-88
Andhra Pradesh	1384	2313	2372	2653
Arunachal Pradesh	1525	3850	4087	--
Assam	1200	2313	2420	2583
Goa	3169	5360	5901	6284
Gujarat	1950	3037	3543	3592
Haryana	2353	3818	3947	4214
Himachal Pradesh	1662	2630	2955	3217
Kerala	1644	2152	2424	2598
Manipur	1564	2419	2575	2806
Meghalaya	1230	2037	2263	2371
Mizoram	1284	2788	--	--
Sikkim	--	3110	3471	--
Tamil Nadu	1498	2674	2921	3163
Uttar Pradesh	1332	2072	2269	2488
Pondicherry	3159	4541	4620	5142
All India	1627	2734	2974	3284

Source: Economic Review (1988), State Planning Board, Govt. of Kerala, Trivandrum.

middle level states, having its own peculiar problems of unemployment, industrial backwardness, and low productivity in agricultural sector. The Commissions' categorisation is presented in Table 2.3. So the Sarkaria Commission also found that the state's development is less and the problems like low productivity and unemployment are high in the state.

On the basis of per capita net domestic product, among the Indian states, Kerala had only eighth rank during 1970-71 but had gone down to nineth rank in 1977-88 and its position had further declined to tenth and eleventh during 1980-81 and 1984-85 respectively (Table 2.4). States like the Punjab and Haryana were maintaining their rank among Indian states in terms of per capita net domestic product and states like Andhra Pradesh and Tamil Nadu were improving their position. But Kerala's rank among Indian states in terms of per capita net domestic product was coming down over the years. This analysis also reveals that absolutely the level of economic development of Kerala was small and comparatively its economic performance was coming down over the years.

The level and rate of growth of the economy and the level and rate of growth of Governmental revenue and

Table 2.3

Categorisation of States by Sarkaria Commission

	Category	Name of States
1.	Advanced	Gujarat, Haryana, Maharashtra, Punjab, Tamil Nadu, West Bengal
2.	Middle level	Andhra Pradesh, Karnataka, Kerala
3.	Backward	Bihar, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh
4.	Special Category	Assam, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Sikkim, Tripura

Source: Sarkaria Commission Report, Sarkaria Commission on Central State Relations, Govt. of India, New Delhi.

Table 2.4

Per Capita Net Domestic Product
Among the Indian States

Sl. No.	States	Rank in the Year 1970-71	1977-78	1980-81	1984-85
1.	Andhra Pradesh	11	12	8	8
2.	Assam	12	13	12	12
3.	Bihar	17	17	17	17
4.	Gujarat	3	4	4	4
5.	Haryana	2	2	2	2
6.	Himachal Pradesh	6	6	7	10
7.	Jammu & Kashmir	13	10	9	9
8.	Karnataka	7	7	6	6
9.	Kerala	8	9	10	11
10.	Maharashtra	4	3	3	3
11.	Orissa	14	14	14	16
12.	Punjab	1	1	1	1
13.	Rajasthan	9	11	13	13
14.	Tamil Nadu	10	8	11	7
15.	Uttar Pradesh	15	15	15	14
16.	West Bengal	5	5	5	5

Source: State Income and Related Aggregates of Kerala (1985-86), Dept. of Economics and Statistics, Govt. of Kerala, Trivandrum.

the generation of financial surplus are directly related and these are the main sources of investment funds. So the poor growth rate of the economy generates only low volumes of investment funds and poor supply of resources for investment. This can restrict the absolute and comparative growth of Kerala economy.

The Revenue of the State

The state revenue consists of state taxes, non-tax revenue and transfer of funds from the centre in the form of divisible taxes and grants-in-aid and other forms of central assistance.

Tax Revenue

In a democratic state like Kerala, there exists a functional relationship between economic growth and taxable capacity and tax revenue of the economy. Since the growth rate of the economy is comparatively low, the rate of growth of tax revenue of the state is limited by the weak tax base of the state. Weaknesses in the implementation of individual tax and tax evasion keep rate of growth of tax revenue of the state at a low level, compared to the rate of growth of state expenditure.

The trends in percentage composition of state taxes over the years can be understood from Table 2.5. It clearly reveals that the percentage contribution of agricultural income tax to the state's taxes and duties declined from 13.77 per cent in 1957-58 to 3.01 per cent in 1984-85 and the land revenues declined from 9.10 per cent to 1.01 per cent. The percentage share from stamps and registration declined from 11.13 per cent to 6.92 per cent and the state excise duties declined from 16.26 per cent to 16.14 per cent during the same period. All taxes except sales tax show a declining trend. The contribution of sales tax to the state's total taxes and duties increased from 37.02 per cent in 1957-58 to 60.35 per cent in 1984-85.

Another major source of revenue to the Government is from the public sector undertakings. But the surplus generated by public sector is not promising. The working results of public sector manufacturing industries during and as on 1992-93 is given in Table 2.6. Out of the 38 manufacturing industries only 18 units earned profit amounting to Rs.3,117.32 lakhs. The remaining 20 industries showed a loss of Rs.7,822.15 lakhs during

Table 2.5

Percentage Composition of State Taxes in the Year 1957-58 and 1984-85

	1957-58	1984-85
Agricultural income tax	13.77	3.01
Land revenues	9.10	1.01
Stamps and registration	11.13	6.92
State excise duties	16.26	16.14
Sales tax	37.02	60.35
Taxes on vehicles	11.59	6.51
Taxes on goods and passengers, duties on electricity, other taxes and duties on commodities and services	1.13	6.08
Total	100.00	100.00

Source: Kerala Budget in Brief (1986-87), Govt. of Kerala, Trivandrum.

Table 2.6

Working Results of the Public Sector Undertakings

as on 31st March 1993

(Rs. in lakhs)

Sl. No.	Particulars	Total No. of units details of which are available	No. of units earned profit during 1992-93	Net profit earned during 1992-93	No. of units suffered loss during 1992-93	Net loss incurred during 1992-93	Net loss during 1992-93	Cumulative total accumulated loss as on 31-3-1993
1.	Manufacturing	38	18	3117.32	20	7822.15	4704.83	52740.86

Source: Economic Review (1993), State Planning Board, Govt. of Kerala, Trivandrum.

1992-93 alone. So the operation of the manufacturing industries of the government during 1992-93 resulted in a net loss of Rs.4,704.83 lakhs. The public sector undertakings have been a liability to the government. Out of the 38 manufacturing units, as on 31-3-1993, 33 units had an accumulated loss of Rs.52,740.86 lakhs. Thus the manufacturing industries are not a source of revenue to the government, but a liability. The surplus generating capacity of other public sector undertakings are also more or less of the same nature.

The public sector industrial enterprises in Kerala steadily show a higher capacity to incur loss. Table 2.7 shows that 18 manufacturing public sector industrial enterprises have accumulated a loss over the paidup capital. As on 31-3-1993, the total paid up capital of these 18 manufacturing industrial enterprises was Rs.19,974.35 lakhs. These 18 industries accumulated a loss of Rs.48,241.73 lakhs, which is more than double the paid up capital. Thus the public sector industries are not a source of surplus to the Government but a source of resource drain.

The above facts and figures point to the fact that the revenue generation of the state from its two major

Table 2.7

Public Sector Industrial Undertakings and the

Magnitude of Accumulated Loss

(Rs. in lakhs)

Number of Industrial Undertakings	Paid up capital	Accumulated loss as on 31-3-1993
18	19974.35	48241.73

Source: Economic Review (1993), State Planning Board, Govt. of Kerala, Trivandrum.

sources is low and is quite insufficient to meet the increasing revenue and capital expenditure of the state.

The Central Assistance to Kerala

The financial transfer from the centre to the state usually takes the form of statutory transfers, plan transfers, and non-plan non-statutory transfers. The central assistance plays a relatively smaller part in meeting the state's expenditure. Except during one year (1974-75) the proportion of expenditure financed by central assistance was lower in Kerala than in all states (George, 1990). This is true of aggregate expenditure as well as revenue expenditure. There is discretion even in the allotment of funds for special problem solving in the states. The eighth and ninth finance commissions have provided Rs.604 crores for this purpose. Kerala received no amount at all from this, though the problem of unemployment, educated unemployment and technically qualified persons' unemployment in the state is the highest in India.

The per capita central assistance received by Kerala and other states, during different plan periods clearly shows that the per capita central assistance received by Kerala is below the average of the other states since 1979-80 (Table 2.8).

Table 2.8

Annual Average Per Capita Central Transfers

	KERALA					ALL STATES				
	V Plan	Annual Plan	VI Plan	VII Plan	Total	V Plan	Annual Plan	VI Plan	VII Plan	Total
Statutory Transfer	50.6	64.1	75.0	117.7	307.4	40.2	67.7	72.9	135.2	248.3
Plan transfer	37.5	48.7	63.0	148.5	298.7	37.5	54.7	78.2	143.1	313.4
Non-plan non statutory transfer	9.5	5.3	26.3	70.4	111.5	15.7	28.3	34.0	71.0	145.0
Aggregate transfer	97.7	118.1	164.4	336.6	716.7	93.4	150.7	185.1	349.2	778.4

Notes: 1. Statutory transfers refer to devolution plus statutory grants
2. Plan transfer include transfer for state plan, central plan and centrally sponsored schemes.
3. Non-plans, non-statutory transfers include all other grants and loans.
4. A.P. Means annual plans.

Source: Compiled from George, K.K. (1990), "Kerala's Fiscal Crisis--A Diagnosis", Economic and Political Weekly, Vol.XXV, No.37.

Table 2.8 clearly shows that during the annual plan period of 1979-80 the average annual per capita central transfer to Kerala is only Rs.118.1 whereas it is Rs.150.7, the average figure of the states. There is a difference of Rs.32.6 against Kerala. During the seventh plan the annual average per capita transfer to Kerala is Rs.336.6 whereas the average of the states is Rs.349.2. This trend is continuously maintained since the annual plan of 1979-80. So the transfer of funds from the Centre to Kerala is lagging behind even the average for all states, though the development of Kerala is below the all India level and the problems like unemployment is the highest in the state.

The Central Sector Investments in Kerala

The central sector investment (percentage of the total) in Kerala is declining over the years (Table 2.9). Out of the total investments on public sector enterprises in 1975, Kerala got only 3.24 per cent, but that too declined to 1.3 per cent in 1992. The comparative share of central investments enjoyed by Kerala is rather low, though Kerala accommodates more than 3 per cent of Indian population.

Table 2.9

Central Sector Industrial Investment in Kerala

(Percentage of the total)

Year	Percentage
1970	2.99
1975	3.24
1980	2.33
1985	1.76
1986	1.62
1987	1.58
1988	1.59
1991	1.4
1992	1.3

Source: Economic Review (1990-92), State Planning Board, Govt. of Kerala, Trivandrum.

Institutional Finance and Kerala Economy

The institutional finance mainly originates from two sources--the non-banking financial institutions, and banking institutions. They have to play a major role in the provision of investment funds in the state. The size and trend in the availability of institutional finance in Kerala are to be analysed so that it can be made clear whether they are a sufficient source for solving the investment fund crises of the state.

The Non-banking Financial Institutions

In a developing economy like Kerala, where the budgetory resources are scarce and central assistance insufficient, institutional finance has to play a major role in the provision of investment funds in the state. The share of institutional finance made by IDBI, IFCI, ICICI, UTI, LIC, NABARD and NCDC to Kerala cumulative upto the end of March 1993 is given in Table 2.10. Table 2.10 reveals that out of the total financial assistance of Rs.110,235.3 crores by the non-banking financial institutions, Kerala received only Rs.2,463.6 crores, till March 1993. This share is one of the lowest among the Indian states. These facts and figures point out that the institutional finance provided by the all India non-banking

Table 2.10

State-wise Financial Assistance Disbursed by All India Financial Institutions as at the end of March 1993 (Cumulative)

(Rs. in crores)

State	Amount
Andhra Pradesh	9382.9
Assam	924.1
Bihar	3155.4
Gujarat	12370.6
Haryana	3309.5
Karnataka	6667.5
Kerala	2463.6
Madhya Pradesh	6115.8
Maharashtra	21887.5
Orissa	2782.1
Punjab	4094.8
Rajasthan	4811.6
Tamil Nadu	9348.8
Uttar Pradesh	10649.7
West Bengal	4656.10
All India	102620.0

Source: Report on Development of Banking in India (1992-93), IDBI, Bombay.

financial institutions to Kerala is comparatively less and absolutely quite insufficient to meet the mounting needs of the state.

The Public Sector Banks

The credit disbursement of the public sector banks in the state is not keeping pace with the increase in deposits in the state. In credit disbursement, there exist wide variations between states. Table 2.11 reveals these facts. The percentage credit deposit ratio of Kerala has been declining over the years. During 1969 the percentage credit deposit ratio of Kerala was 65.80 and declined to 58.7 per cent in 1991. In 1992 it further decreased to 50.9 per cent and in 1993 it reached a level of 47.2 per cent. The states like Andhra Pradesh, Karnataka and Tamil Nadu, enjoy a better share of credit disbursement of the public sector banks.

The Fiscal and Financial Crises in Kerala

Finance is the life-blood of all economic activities. Development schemes get stuck and achievements fall short of targets because of the non-availability of adequate finance in time. In Kerala, as stated earlier, the economic development is comparatively less and so the

Table 2.11

Credit Deposit Ratio (Percentage) of Public Sector Banks
(As at the end of March 1993)

	1969	1991	1992	1993
Andhra Pradesh	100.8	82.5	81.5	81.6
Assam	39.4	49.0	48.3	47.5
Bihar	30.8	39.5	38.2	37.3
Gujarat	48.6	61.1	53.6	52.5
Haryana	46.9	59.0	56.0	55.3
Karnataka	76.1	88.8	78.2	76.2
Kerala	65.8	58.7	50.9	47.2
Madhya Pradesh	100.1	80.0	64.4	68.5
Orissa	51.7	78.4	69.7	64.8
Punjab	27.0	44.0	42.1	42.5
Rajasthan	51.4	58.1	56.6	56.6
Tamil Nadu	133.5	98.5	97.1	87.4
Uttar Pradesh	45.7	47.7	44.1	42.1
West Bengal	115.4	32.2	48.4	50.1
Total for major states	79.2	66.3	59.8	59.8
All India	98.4	65.2	60.0	61.4

Source: <u>Economic Review</u> (1993), State Planning Board, Govt. of Kerala, Trivandrum.

resource base of the economy is poor. So the state's own resource generation, both from tax revenue and non-tax revenue is insufficient to meet the increasing state expenditure. The availability of central assistance and central investment in the state is comparatively low and also the share of institutional finance enjoyed by the state is comparatively low.

Ever since its formation, Kerala has been passing through a period of financial stringency characterised by successive budget deficits and continued depletion of cash balances (Sankaranarayanan, 1985). Over the years the fiscal crises of the state gathered momentum and came to a critical level in 1987. In December 1987, following the prolongation of the state's overdraft beyond the mandatory seven days limit, the Reserve Bank of India suspended treasury payments on behalf of the G overnment of Kerala. To avoid such suspension, which implies fiscal breakdown, the state government, on its own, has been imposing tight control on treasury payments. This process has led to the piling up of government dues to the public. After 1987, the treasury payments are frequently regulated, due to lack of finance. Thus the fiscal and financial crisis has grown to such a level that the government finds it difficult to meet the funds even for its daily expenditure. This situation definitely will influence the developmental expenditure of the state and the rate of growth of the economy. Thus the fiscal crisis is contributing to the states development crisis, which in turn is deepening the fiscal crisis of the state.

During the Fifth Five Year Plan period, Kerala had budgetory deficits in two years but the amount involved was also low. During the sixth five year plan period Kerala had deficits in four years. The number of years and the amount involved were getting higher over the fifth plan period. In the seventh five year plan, the state witnessed the biggest ever budgetory deficit of Rs.193 crores in 1986-87. Table 2.12 shows these facts clearly. The deficit of the state in 1991-92, according to the budget estimate (Revenue account), increased to 399.14 crores, ie., 12.92% of the revenue receipts of the state (Kerala Budget in Brief, 1991-92). The deficit of the state is increasing heavily over the years.

The Expenditure Pattern of Government of Kerala

A micro analysis of the expenditure pattern of Government of Kerala brings out a paradoxial situation of

Table 2.12

Kerala Budget - Surplus and Deficit
Over the Years

(Rs.in crores)

Year	Total
1974-75	6.8
1975-76	-12.6
1976-77	-13.8
1977-78	26.5
1978-79	58.1
1979-80	25.1
1980-81	-74.8
1981-82	-85.3
1982-83	0.5
1983-84	-70.4
1984-85	-124.1
1985-86	130.0
1986-87	-192.9
1987-88	-53.2

Source: Compiled from George, K.K. (1990), "Kerala's Fiscal Crisis--A Diagnosis", Economic and Political Weekly, Vol.XXV, No.37.

higher state expenditure accompanied by a lower rate of growth. The expenditure of the state, both in revenue account and capital account consists of plan expenditure, non-plan expenditure, developmental and non-developmental expenditure, budgetory and non-budgetory expenditure.

The ratio of budgetory expenditure to state domestic product in Kerala was higher than that of the states during ten out of the eleven year period ending 1984-85. The average annual per capita total expenditure of Kerala was higher than the average of all other states, but lower than some of the developed states during 1974-88 (Table 2.13). During the fifth, sixth and seventh plan periods, the total (plan and non-plan) annual average per capita expenditure in Kerala was Rs.237.8, Rs.457.6 and Rs.838.3 respectively whereas the same relating to the other states during the same period was only Rs.219.6, Rs.438.9, Rs.767.2 respectively. Thus during the fifth, sixth and seventh five year plan periods the state's total average annual per capita expenditure was higher than the average of all other states. The total annual average per capita expenditure of Kerala during the fifth, sixth and seventh plan was higher than the same for all the states by Rs.107.6.

Table 2.13

State-wise Per Capita Expenditure (1974-1988)

(Total of the Plan and Non-Plan)

Sl. No.	States	Total			
		V	VI	VII	Total
1.	Andhra Pradesh	214.2	412.3	753.1	1379.7
2.	Bihar	130.2	267.8	488.2	886.3
3.	Gujarat	262.7	550.2	986.0	1798.9
4.	Haryana	335.4	665.7	1179.8	2180.9
5.	Karnataka	244.0	485.1	855.3	1584.4
6.	Kerala	237.8	457.6	838.3	1533.4
7.	Madhya Pradesh	185.3	384.4	655.7	1225.7
8.	Maharashtra	302.2	591.0	1012.9	1906.2
9.	Orissa	198.6	390.6	658.8	1247.9
10.	Punjab	354.5	724.5	1280.3	2359.3
11.	Rajasthan	229.4	476.5	781.4	1437.3
12.	Tamil Nadu	209.4	472.5	753.6	1435.5
13.	Uttar Pradesh	168.0	326.7	547.4	1042.1
14.	West Bengal	200.6	379.9	644.3	1224.8
	Major States	213.2	425.3	738.6	1377.1
	Special Category States	342.9	679.6	1274.6	2296.7
	All States	219.6	438.9	767.2	1425.8

Source: Compiled from George, K.K. (1990), "Kerala's Fiscal Crisis--A Diagnosis", Economic and Political Weekly, Vol.XXV, No.37.

During the fifth plan period the annual average per capita expenditure of Kerala was above the annual average per capita expenditure of all other states by Rs.18.2 which increased to Rs.18.7 during the sixth plan period and during the seventh plan period the difference increased to Rs.71.1 which marked a sudden and rapid jump. All these facts and figures show that the total annual average per capita expenditure of Kerala state was above the per capita expenditure for all other states during 1974-88 and it also shows an increasing trend (Table 2.14).

But this higher annual average per capita expenditure of the state over the per capita expenditure of all other states in the economy has not contributed to a growth rate that is higher than the average growth rate of all the states (Nayanar, 1981). But the fact is that the average annual growth rate of Kerala lagged behind the annual average growth rate of all the states. A traditional explanation to this paradoxical situation can be found in the allocation of expenditure in the state.

Plan Expenditure and Non-Plan Expenditure

Though the annual average per capita expenditure of the state is higher than the per capita expenditure of

Table 2.14

State-wise Per Capita Expenditure (1974-1988)

(Annual averages)

Sl. No.	States	PLAN				NON-PLAN			
		V	VI	VII	Total	V	VI	VII	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Andhra Pradesh	73.7	130.8	239.0	443.6	140.5	281.5	514.0	936.1
2.	Bihar	42.4	82.3	192.0	316.8	87.8	185.5	296.3	569.5
3.	Gujarat	92.3	200.1	314.5	606.9	170.4	350.1	671.5	1192.0
4.	Haryana	122.9	240.8	409.2	772.9	212.5	424.9	770.6	1408.0
5.	Karnataka	65.6	153.8	281.7	501.1	178.4	331.3	573.6	1053.3
6.	Kerala	85.4	134.3	198.8	388.6	182.4	323.3	639.5	1145.2
7.	Madhya Pradesh	65.7	160.6	254.1	480.4	119.6	223.9	401.7	745.1
8.	Maharashtra	89.4	183.6	292.9	565.6	212.8	407.4	720.1	1340.3

Table 2.14 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
9.	Orissa	61.3	149.8	281.7	492.9	137.3	240.7	377.0	755.1
10.	Punjab	120.8	195.2	409.3	725.3	233.7	529.3	871.1	1634.1
11.	Rajasthan	70.1	139.2	213.5	386.9	165.2	343.3	540.1	1048.6
12.	Tamil Nadu	44.2	129.2	213.5	386.9	165.2	343.3	540.1	1048.6
13.	Uttar Pradesh	64.2	133.2	209.7	407.1	103.7	193.5	337.7	635.0
14.	West Bengal	53.5	93.5	165.8	312.8	147.1	286.4	478.5	912.0
	Major States	66.7	140.6	243.9	451.2	146.5	284.7	494.7	925.9
	Special Category States	126.2	259.0	502.1	887.4	216.7	420.5	772.1	1409.4
	All States	69.7	146.9	257.7	474.3	150.0	292.0	509.5	951.5

Source: Compiled from George, K.K. (1990), "Kerala's Fiscal Crisis--A Diagnosis", Economic and Political Weekly, Vol.XXV, No.37.

all other states, the per capita plan expenditure in Kerala in all the past five year plans had been much below the national average. In the sixth plan Kerala's per capita plan expenditure was Rs.726 which was lower than the state's average of Rs.873 (Gulati, 1988). Non-plan current expenditure grew at the rate of 15.2% per annum during the sixth plan outstripping its own performance in the previous plan and the growth of its own revenue income in the sixth plan by 3.6%. The trends in plan and non-plan expenditure are given in Table 2.15. The total annual average per capita expenditure in Kerala during the fifth plan period was Rs.237.8, out of which the plan expenditure was Rs.55.4 and non-plan expenditure Rs.182.4. So the non-plan average annual per capita expenditure in the state is higher by Rs.127 over plan expenditure of Rs.55.4.

During the Seventh Five Year plan the total average annual per capita expenditure was Rs.838.3, out of which the plan expenditure was only Rs.198.8 and non-plan expenditure Rs.639.5. Thus the non-plan average annual per capita expenditure was ahead of plan expenditure by Rs.639.5 during the seventh five year plan period (Table 2.14). The total average annual per capita expenditure in Kerala from 1974 to 1988 was Rs.1,533.4 of which the plan expenditure was only Rs.388.6 and non-plan expenditure Rs.1,145.2. These bring out the fact that in Kerala the average annual per capita plan expenditure was low compared to the non-plan expenditure and also that the non-plan expenditure was increasing steadily over the years. This negatively influenced the size of the plan, the plan targets and their achievement.

Developmental and Non-developmental Expenditure

Yet another notable feature of the expenditure pattern of Kerala state is the size and trend in developmental and non-developmental expenditure.

Out of the revenue expenditure during 1991-92, Rs.197,707 lakhs, or 63.99 per cent (B.E.) was for developmental purposes which is Rs.16,301 lakhs or 9% higher than the expenditure incurred in 1990-91 (R.E.). Non-developmental expenditure is estimated at Rs.111,243 lakhs ie., 36.01% of the revenue expenditure during 1991-92, which was Rs.10,169 lakhs or 10 per cent higher than that of 1990-91 (R.E.) (Kerala Budget in Brief, 1991-92). During 1990-91 and 1991-92 the developmental expenditure increased by 9 per cent and the non-developmental expenditure increased by 10 per cent. So the percentage of annual growth rate of non-developmental expenditure was higher than the percentage of the annual growth rate of developmental expenditure.

During the period 1983-84 to 1991-92 (B.E.) the developmental expenditure in Kerala increased only by 183% and non-developmental expenditure by 280% (Kerala Budge in Brief, 1991-92). Compared to the growth in developmental expenditure of Kerala economy, the non-developmental expenditure increased by 97% more. In other words, the growth of developmental expenditure lagged behind non-developmental expenditure by 97 per cent during the period 1983-84 to 1991-92 (Table 2.15). As per 1983-84 accounts, the development expenditure accounted for 70.48% of the total, but it decreased to 63.99% in 1991-92 (B.E.). At the same time the non-developmental expenditure was only 29.52 per cent of the total, but increased to 36.01 per cent in 1991-92 (B.E.). This increasing size and trend in non-developmental expenditure may make the availability of funds for developmental investments scarce.

The non-development expenditure of the state mainly consists of repaying of debts, pension payments and expenditure on government services. The share of the expenditure for debt repayment is increasing year after

Table 2.15

Trends in Revenue Expenditure

(1983-84 to 1991-92)

(Rs. in lakhs)

	1983-84 Accounts	1984-85 Accounts	1985-86 Accounts	1986-87 Accounts	1987-88 Accounts	1988-89 Accounts	1989-90 Accounts	1990-91 Revised estimate	1991-92 Budget estimate
1. Development expenditure	69948	79460	103634	111520	116293	135888	146031	181406	197707
Percentage to total	70.48	69.78	71.70	67.39	65.30	65.93	63.54	64.22	63.99
2. Non-development expenditure	29296	34406	40900	53957	61775	70212	83778	101074	111243
Percentage to total	29.52	30.22	28.30	32.61	34.70	34.07	36.46	35.78	36.01
Total	99244	113866	144534	165477	178063	206100	229809	282480	308950
Index	100	115	146	167	179	208	232	285	311

Source: Kerala Budget in Brief (1991-92), Govt. of Kerala, Trivandrum.

year (Table 2.16). Because of the scarcity of finance, it has to borrow not only for plan expenditure but also for making its daily treasury payments. The accounts of 1983-84 on non-developmental revenue expenditure show that the interest charges alone accounted for 31.23 per cent of the net domestic revenue expenditure (NDRE) and in the 1991-92 budget estimate the same had increased to 37.86 per cent of NDRE. Thus the share of interest charges was not only high but also showed an increasing trend (Kerala Budget in Brief, 1991-92). Since the life expectancy of the people is comparatively high in Kerala due to the heavy investment in public health and as the number of retirement is increasing, the pension payment also are very high and have to increase contributing further to increased non-development expenditure. Due to the proliferation of government's general services the expenditure in this area also has to increase. Hence it is evident that the non-development expenditure of Kerala is comparatively high and it will increase over the years steadily leaving less for developmental expenditure.

The Trends in the Allocation of Developmental Expenditure

In Kerala the share of developmental expenditure is very small and the trends in developmental expenditure

Table 2.16

Trends in Non-developmental Revenue Expenditure

	1983-84 Accounts	1984-85 Accounts	1985-86 Accounts	1986-87 Accounts	1987-88 Accounts	1988-89 Accounts	1989-90 Accounts	1990-91 Revised estimate	1991-92 Budget estimate
1. Interest charges	9149	12107	12715	17728	21317	24444	29300	34514	42118
Percentage to total	31.23	35.19	31.09	32.85	34.51	34.81	34.97	34.15	37.86
2. Territorial and political pensions, super-annuations, allowances etc.	6387	7604	10302	17221	18303	18632	20959	28634	30438
Percentage to total	21.80	22.10	25.19	31.92	29.23	26.54	25.02	28.33	27.36

Source: Kerala Budget in Brief (1991-92), Govt. of Kerala, Trivandrum.

are increasingly moving towards social infrastructure. The share on economic services particularly that of directly productive expenditure is less in Kerala (Table 2.17). Education and health absorb the lion's share of developmental expenditure leaving less for agricultural and industrial development. In the developmental expenditure accounts of 1983-84, education and health alone absorbed 53.82 per cent of the developmental expenditure and agriculture and industry together absorbed only 17.04% of the total during the same periods. So the share of developmental expenditure enjoyed by education and health is very high and that of agriculture and industry which is the directly productive sectors less.

The 1990-91 revised estimate shows that 57.21% of the developmental expenditure is consumed by education and public health. Industry and agriculture absorb only 13.09% of the same during this period.

The share of developmental expenditure on education and public health increased from 53.82% in 1983-84 to 57.21% in 1990-91 whereas the share of agriculture and industry decreased from 17.04% in 1983-84 to 13.09% in 1990-91. So the trends in developmental expenditure is moving favourably to education and public health and

Table 2.17

Trends in Developmental Expenditure (1983-84 to 1991-92)

(Rs. in lakhs)

Sl. No.		1983-84 Accounts	1984-85 Accounts	1985-86 Accounts	1986-87 Accounts	1987-88 Accounts	1988-89 Accounts	1989-90 Accounts	1990-91 Revised estimate	1991-92 Budget estimate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Education	30975	34897	41667	48126	51388	57945	63514	76221	79679
	Percentage to total	44.28	43.92	40.21	43.16	44.19	42.64	43.49	42.02	40.30
2.	Medical & Public Health Family Planning	6672	11132	12055	14375	16653	21420	23956	27557	31663
	Percentage to total	9.54	14.00	11.63	12.89	14.32	15.76	16.40	15.19	16.01

Table 2.17 (contd.)

(1) (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3. Agricultural Animal Husbandry, Co-operation and rural Development	8900	8562	8630	10834	11625	9346	11945	16045	19549
Percentage to total	12.72	10.78	8.33	9.71	10.00	6.88	8.18	8.84	9.89
4. Industries Labour & Employment	3025	3040	4110	4075	4688	6529	6851	7711	8268
Percentage to total	4.32	3.83	3.97	3.65	4.89	4.80	4.69	4.25	4.18

Source: <u>Kerala Budget in Brief</u> (1991-92), Govt. of Kerala, Trivandrum.

unfavourably to agriculture and industry which are the directly productive sectors. This reveals the trends in the allocation of developmental expenditure. So in the allocation of developmental expenditure the directly productive economic sectors could get only a minor portion and the social sectors like education and health absorb the larger portion.

The above analysis clearly reveals the fact that Kerala economy is caught in a maze of economic and financial crises. The resource base of the state is poor because of low growth. Owing to low growth, the internal resource generation of the state is low. The flow of funds from the centre to the state is comparatively low. The financial flow from the central financial institutions to Kerala is also comparatively low. On the other hand the non-developmental, non-plan expenditure of the government is increasing over the years. The lion's share of the developmental investments are on education and health, leaving less for agriculture and industry.

A considerable quantity of the megre funds allotted for agriculture, industry and infrastructure projects and programmes are wastefully consumed off by time-lag and cost overrun.

Chapter 3

THE TIME-LAG AND COST OVERRUN IN THE CENTRAL-SECTOR INVESTMENTS IN INDIA

The central sector investment occupies an important place in a federal economy. These public sector investments are mainly in the core sector and infrastructural areas. As such these investments are expected to produce certain pull and push effects in other sectors. The occurence of time lag and the consequent cost overrun in this sector will have certain damaging effects in the economy.

The study of time-lag and cost overrun in the central sector investment is based on all the 331 projects monitored by the Ministry of Programme Implementation (MPI), Government of India as on 1-1-1990.

The MPI has classified the central sector investments into the following three groups:

1. Mega projects - which have an investment of more than Rs.1000 crores

2. Major projects - which have an investment of more than Rs.100 crores

3. Medium projects - which have an investment of above Rs.20 crores.

The ongoing mega, major and medium projects in the central sector as on 1-12-1986, 30-9-1987, 1-1-1989 and 1-1-1990 are given in Table 3.1.

The central sector investments in the ongoing projects have increased from Rs.69,317 crores in 1-12-1986 to Rs.90,833 crores in 1-1-1990 (Table 3.1). This covers a good share of investments in India. The number of projects have also increased from 290 to 331 during the same period.

The number of mega projects have increased from 12 in 1986 to 25 in 1990 (Table 3.1). This increase in number of mega projects is not only due to the starting of new mega projects but also due to the convertion of major projects into mega projects due to heavy cost overrun. The time-lag has also contributed to the increase in mega projects over the years, since the projects are not completed in time and are spreading over years. This is the case with the major and medium projects too. So one cannot treat the

Table 3.1

Total No. of Projects and the Volume of Investments in Central Sector as on 1.2.1986, 30.9.1987, 1.1.1989, 1.1.1990 in the Monitoring System of MPI

GROUP	As on 1.12.1986			As on 30.9.1987			As on 1.1.1989			As on 1.1.1990		
	Nos.	Investment in crores	% of the total	Nos.	Investment in crores	% of the total	Nos.	Investment in crores	% of the total	Nos.	Investment in crores	% of the total
Mega Projects	12	25026	36	14	27699	36	19	36550	47	25	43520	48
Major Projects	108	35553	51	110	38560	52	94	32309	41	107	36896	41
Medium Projects	170	8738	13	187	9351	12	184	9667	12	199	10417	11
	290	69317	100	311	75610	100	297	78526	100	331	90833	100

Source: 1. Compiled from Jain, L.C. (1988), "Monitoring Public Investment -- A Creative Initiative", Economic and Political Weekly, Vol.XXIII, No.23.
2. Annual Reports (1987-1990), Ministry of Programme Implementation, Govt. of India, New Delhi.

increase in investment and number of projects as a measure of rapid economic prosperity on account of higher degree of time-lag and cost overrun.

Time-lag and Cost Overrun of Ongoing Projects in Central Sector: A General Analysis

Here, an attempt is made to ascertain the extent and pattern of time-lag and cost overrun of the central sector projects, ie., all the ongoing mega, major and medium projects in the central sector, which are in the list of the MPI, Government of India. As on January 1990, there were 331 ongoing mega, major and medium projects in the central sector, spreading over 13 sectors (Table 3.2). The difference between the latest approved cost of the project and the 1990 anticipated cost of the project is treated as cost overrun.

Table 3.2 reveals that as on 1-1-1990 the monitoring system of the MPI consists of 331 mega, major and medium projects with a total approved cost of Rs.75,840.1 crores which is anticipated to increase to Rs.90,833.5 crores at the time of completion. This involves a cost overrun to the tune of Rs.14,993.4 crores.

Table 3.2

Time and Cost Overrun: A Study of Central Sector Investments as on 1-1-1990

(Rs. in crores)

Sl. No.	Sector	TOTAL COST				PROJECTS WITH COST OVERRUN				PROJECT WITH TIME OVERRUN			Time lag Range (month)
		No.of project	Latest approved	Antici-pated	Cost over-run %	No.of project	Latest approved	Antici-pated	Percent-age increase	No.of project	Latest approved cost	Antici-pated cost of these	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	Atomic Energy	6	3108.7	3646.1	17.3	4	1716.4	2253.8	31.3	2	1061.2	1194.4	20-25
2.	Civil Aviation	3	2415.0	2732.1	13.1	2	2197.1	2514.3	14.4	0	00	00	---
3.	Coal	71	9918.4	12540.8	26.4	44	6184.7	8807.1	42.4	42	3962.4	5633.8	3-120
4.	Fertiliser	7	1175.9	1917.1	63.0	7	1175.9	1917.1	63	7	1175.9	1917.1	2-126
5.	Mines	3	3024.7	3156.8	4.4	3	3024.7	3156.8	4.4	1	2408.1	2476.9	2-24
6.	Steel & Iron Ore	11	13929.2	15430.3	10.8	10	13899.2	15400.3	10.8	7	13379.3	14604.3	5-60
7.	Chemicals & Petroleum	6	1693.9	1475.9	3.1	2	109.2	161.2	47.6	4	1569.9	1621.9	1-32
8.	Petroleum & Natural Gas	27	6581.2	6453.0	-1.9	5	1303.5	1564.9	20.1	21	5031.0	4891.7	2-56

Table 3.2 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
9.	Power	48	22474.2	28675.2	27.6	29	11186.9	17398.1	55.5	31	9378.8	14400.3	2-85
10.	Paper, Cement, Automobiles	12	1593.2	1853.2	16.3	6	753.5	1013.6	34.5	6	808.4	942.9	9-27
11.	Railways	89	6242.5	8669.5	38.9	53	4706.0	7197.1	52.9	16	1618.5	2498.7	3-36
12.	Surface Transport	31	2893.7	3176.1	9.8	17	979.5	1262.0	28.8	19	2060.8	2334.9	1-157
13.	Telecommunications	17	789.5	837.4	6.1	2	239.0	286.9	20.1	7	279.6	285.2	1-28
TOTAL		331	75840.1	90833.5	19.8	184	47475.7	62933.1	32.6	163	42734.0	52802.1	

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

Of these 331 projects, 184 projects resulted in cost overrun even after the latest approved cost (Table 3.2). The cost of these 184 projects increased from Rs.47,475.7 crores to Rs.62,933.1 crores, registering an increase of 32.6 per cent.

Out of the 331 mega, major and medium ongoing projects as on 1-1-1990, 163 projects have suffered time overrun. The cost of these projects also have increased from the latest revised cost of Rs.42,734 crores to Rs.52,802.1 crores. The extent of time overrun of these projects varies from one month to 157 months.

As seen earlier, in the central sector, out of 331 ongoing projects, 184 projects resulted in cost overrun. Thus 55.5 per cent of the ongoing central sector projects met with cost overrun as per the latest approved and anticipated cost as on 1-1-1990. If one estimates the cost overrun on the basis of the original estimated cost, definitely the increase would be much higher. Hence the calculation is rather an under estimated one. Moreover, of these 331 projects some relate to purchasing aeroplanes and the like schemes only, where chance of occurence of time-lag and cost overrun are expected to be nominal.

The cost overrun of these 184 ongoing projects amounted to Rs.15,457.4 crores, as on 1-1-1990. The comparitive magnitude of the cost overrun can be realised by having a simple comparison with the state plan expenditure of Kerala from 1951 to 1985; viz., Rs.3,501.58 crores (Statistics for Planning, 1986). The cost overrun amount of 184 ongoing projects was Rs.15,457.4 crores. Thus it is around 4.5 times higher than the total plan expenditure of Kerala State from 1951-85. If one takes into account the cost overrun of all the central sector projects from 1951 to 1992, the figure might be rather alarming. As seen earlier, out of the 331 ongoing projects in the central sector as on 1-1-1990, 163 projects resulted in time overrun ranging from one month to thirteen years. The consequent loss of output and income from these projects is of a high magnitude.

Of course, the above figures on time-lag and cost overrun in the central sector investments are alarming. But these figures are really under estimated ones and the actual figures must be far above these levels. This inference is based on the fact that the cost overrun is calculated on the basis of the revised cost and the anticipated cost. The original estimated cost of the projects must have been far below the revised costs. Furthermore, these figures are estimated according to the anticipated cost and time schedule of the ongoing projects. But since these projects are not yet completed there is every possibility of further time-lag and consequent cost revisions.

Inter-sectoral Comparison of Time-lag and Cost Overrun

As on January 1990, there are 331 ongoing mega, major and medium projects in the central sector, spreading over 13 sectors. The inter-sectoral comparitive analysis of time-lag and cost overrun takes into account all these projects and sectors (Table 3.2).

The extent of time-lag and cost overrun of the central sector project varies from sector to sector as revealed by Table 3.2. Among ongoing projects as on 1-1-1990, the highest percentage of cost overrun is found in fertilizer projects. There are seven ongoing projects in this sector as on 1-1-1990, and all these seven projects met with a total cost overrun of 63 per cent. All these seven projects also have time overrun of 2-126 months. The fertilizer sector is followed by the power sector ranking second in the level of cost overrun with a 55.5 per cent cost overrun. But the power sector has 48 ongoing projects out of which only 29 had cost overrun over the latest estimate and 31 have time overruns of 2 to 85 months. The lowest cost overrun and time-lag is found in civil aviation (Table 3.2).

Since the nature of the project varies from sector to sector, there is some reservation in arriving at this conclusion. For example, in civil aviation the project consists of buying of some aeroplanes only but in the case of fertilizer factory it is to be constructed.

Intra-sectoral Analysis of Time-lag and Cost Overrun in the Central Sector

The extent and magnitude of time-lag and cost overrun in the power sector at the project level are given in Table 3.3. As on 1-1-1990 there are 48 ongoing power projects in the monitoring system of MPI, with a cost of Rs.28,875 crores, of which the details of thirty one projects are included in Table 3.3. It includes 13 hydro electric projects (HEP) with a capacity ranging from 40 MW to 1500 MW, 11 Thermal Power Projects (TPP) with a capacity ranging from 600 MW to 1260 MW, three Atomic Power Projects (APP) and four Gas Power Projects (GPP). These 31 projects

Table 3.3

Time-Lag and Cost Overrun of Power Projects in the Central Sector as on 1-1-1990

(Rs. in crores)

Sl. No.	Project - State	Capacity	Date of Govt. approval original	DATE OF COMMISSIONING		COST			TIME	
				Original (RUSD)	Anticipated	Approved (Revised)	Anticipated	% cost over-run over the revised	Time over-run in month	Time over-run as % increase over original
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HYDROELECTRIC PROJECTS										
1.	Panchet Hill II HEP, Bihar	40 MW	Jan. 1978	Jan. 1983	Feb. 1990	16.03	54.35	239	85	141
2.	Doyang HEP, Nagaland	75 MW	Feb. 1983	June 1992	June 1994	96.31	166.65	73	24	21
3.	Kopili HEP, Assam	150 MW	Sept. 1985	Dec. 1982	Mar. 1988	56.77	241.10	0	63	67
4.	Ranganadi HEP, Arunachal Pradesh	405 MW	Apr. 1987	Aug. 1994	Mar. 1996	312.78	312.78	0	19	21
5.	Chamera HEP, Himachal Pradesh	540 MW	Apr. 1984	Apr. 1990	Dec. 1992	809.29	1419.66	75	32	44
6.	Dulhasti HEP, Jammu & Kashmir	390 MW	Nov. 1982	Nov. 1990	July 1994	183.45	1262.97	588	44	45
7.	Koel Karo HEP, Bihar	710 MW	June 1981	Dec. 1988	Mar. 1994	439.91	1107.49	151	63	70

Table 3.3 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
THERMAL POWER PROJECTS										
8.	Tanakpur HEP,	120 MW	Aug. 1984	Aug. 1988	Mar. 1992	178.75	367.25	105	43	89
9.	URI HEP,	480 MW	June 1989	June 1993	June 1993	1632.62	1632.62	0	0	0
10.	Salal HEP, Jammu & Kashmir	345 MW	Sept. 1989	Sept. 1993	Sept. 1993	303.78	303.78	0	0	0
11.	Nathpa Jhkri HEP, Himachal Pradesh	1500 MW	Apr. 1989	Apr. 1996	Apr. 1996	1678.02	1678.02	0	0	0
12.	Tanakpur HEP, Uttar Pradesh	120 MW	Aug. 1984	Aug. 1988	Mar. 1990	178.75	311.42	74	19	39
THERMAL POWER PROJECTS										
13.	Farakka STPP,West Bengal	600 MW	Mar. 1979	Mar. 1986	Aug. 1987	290.60	692.12	138	17	20
14.	Farakka STPP St.III, West Bengal	1000 MW	Sept. 1984	Mar. 1992	June 1992	868.48	1309.25	50	3	3
15.	Farakka STPP, III, West Bengal	500 MW	Sept. 1989	Dec. 1995	Dec. 1995	603.65	603.65	0	0	0
16.	Kahalgaon STPP, St.I, Bihar	840 MW	July 1985	July 1992	Jan. 1993	884.15	1484.00	67	6	7
17.	Korba STPP, St.II, Madhya Pradesh	1000 MW	Sept. 1981	Mar. 1989	Feb. 1989	457.98	811.65	77	-1	-1
18.	Ramagundam STPP St.II, Andhra Pradesh	1000 MW	Sept. 1981	Mar. 1990	Oct. 1989	501.89	735.03	46	-5	-4
19.	Rihand STPP St.I, Uttar Pradesh	1000 MW	June 1982	June 1988	July 1989	1033.00	1665.96	61	13	18

Table 3.3 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
20.	Vindhyachal STPP, St.I, Madhya Pradesh	1260 MW	June 1982	Feb. 1989	Dec. 1990	911.57	1335.25	46	12	13
21.	Farakka STPP St.I, West Bengal	600 MW	Mar. 1979	Mar. 1986	Aug. 1987	290.60	683.92	135	17	20
22.	Ramagundam STPP, St.I, Andhra Pradesh	1100 MW	Apr. 1978	Dec. 1984	June 1988	459.14	937.38	104	42	52
23.	Korba STPP St.II, Madhya Pradesh	1000 MW	Sept. 1981	Mar. 1989	Mar. 1989	457.98	493.80	73	0	0
DEPARTMENT OF ATOMIC ENERGY PROJECTS										
24.	Narora Atomic Power Uttar Pradesh	2x235 MW	Jan. 1974	Mar.1982	Aug.1990	209.89	532.85	153	101	103
25.	Kakrapar Atomic Power Gujarat	2x235 MW	Jul.1981	Dec.1991	Dec.1991	382.52	745	94	0	0
26.	Rajasthan Atomic Power Project, Rajasthan	2x235 MW	Nov.1986	Nov.1995	Nov.1995	711.56	711.56	0	0	0
27.	Kaiga Atomic Power Project, Karnataka	2x235 MW	June 1987	Dec.1995	Dec.1995	730.72	730.72	0	0	0

Table 3.3 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GASS POWER PROJECTS										
28.	Kawas GPP, Gujarat	600 MW	Oct. 1986	Apr.1991	Jan.1993	373.98	598.41	60	27	50
29.	Anta GPP, Rajasthan	430 MW	Oct.1986	Aug.1990	Aug.1990	265.03	372.99	40	0	0
30.	Auraiya GPP, Uttar Pradesh	600 MW	Oct.1986	Jan.1991	Sept.1990	371.67	571.09	53	-4	-7
31.	Malthon Gas Turbine Bihar	90 MW	Jan.1986	June 1987	Mar.1989	44.57	53.18	19	21	123
32.	Gas Turbine Assam	15 MW	Oct.1987	Apr.1989	Apr.1989	26.03	26.03	0	0	0

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

cover only generation schemes and avoid transmission schemes and as such they cover almost all the ongoing power generation projects in the central sector.

Since these projects were started in different periods, with different capacities with different gestation periods, and contructed under different social, geological contexts, it is rather difficult to compare and derive any specific conclusions on the extent and degree of cost overrun within the projects and in between the projects. But in general, the projects with greater time-lag have greater amount of cost overrun (Table 3.3).

The 12 hydro-electric projects given in Table 3.3, excluding the exceptional cases of the Dulhasti hydro-electric projects and Kopili hydro-electric project, the highest time-lag of 141 per cent and the highest cost overrun of 239 per cent are found in the case of Panchet Hill Hydro-electric Projects. It is seen from Table 3.3 that, in a good number of projects, the higher the extent of time-lag, the higher is the cost overrun in hydro-electric projects.

In thermal power projects too, this relationship is found to be true. Out of the 11 ongoing thermal projects as on 1-1-1990, the highest level of time-lag and cost overrun of 20 per cent and 138 per cent respectively is found in Farakka Super Thermal Power Project (STPP). In the case of atomic energy projects too there exists this relationship. Out of the three ongoing atomic power projects the Narora Atomic Power project has the highest amount of cost overrun and time overrun of 153 per cent and 103 per cent respectively. Thus in general it is found that the higher the time-lag, the higher the cost overrun.

But in the case of Dulhasti Hydro-electric Project, it is found that its cost overrun is very high (588%), but comparatively its time overrun is less (45%). Same is the case with Kopili HEP with a cost overrun of 324 per cent and a time overrun of 67 per cent (Table 3.3). It is evident from these that there are projects that have a comparatively low time-lag and very high level of cost overrun.

But in the case of Korba STPP II it has been completed before the stipulated period but has a cost overrun of 77 per cent. The Ramagundam STPP Stage II was also completed before the scheduled time but has a cost overrun of 46 per cent. So there are power projects which have cost overrun even without time overrun.

In the case of Ranganadi Hydro-electric Project, it has a time-lag of 21 per cent over the original estimate, but has only zero cost overrun. In the case of Korba STPP Stage II it has no time overrun but has a cost overrun of 73 per cent. This may be due to the crashing of the project.

From the above analysis it can be concluded that the emergence and extent of time-lag and cost overrun, vary from project to project, and depend on the project and its different facets. Therefore, time-lag and cost overrun is a phenomenon of the specific project in a specific way and it could be seen that to avoid or reduce it, micro level programmes are more effective than the programmes at the macro level.

The study also found that among the four types of power projects in the central sector--HEP, TPP, APP, GPP--the highest extent of time-lag and cost overrun is found in HEP (Table 3.3). It is in HEP that the highest extent of cost overrun amounting to 588 per cent is found. In TPP, APP and GPP the same was only 138 per cent, 153 per cent and 60 per cent respectively.

The highest extent of 141 per cent time-lag over the original is found in HEP followed by GPP (123 per cent). The same was 103 per cent and 52 per cent respectively in APP and TPP (Table 3.3).

Yet another fact that can be understood from the analysis of power projects is that the projects sanctioned in the 1970's have a higher cost and time overrun than the cost and time overrun of projects sanctioned in 1980's, with rare exceptions (Table 3.3). The Panchet Hill HEP II in Bihar sanctioned in 1978 with a capacity of 40 MW has time and cost overrun of 141 per cent and 239 per cent respectively over the original time and cost, whereas the Koel Karo HEP in the same state sanctioned in 1981 with a capacity of 710 MW has a comparatively less time and cost overrun of 70 per cent and 151 per cent respectively. The Tanakpur HEP sanctioned in 1984 with a capacity of 120 MW has a comparatively less time and cost overrun of 39 per cent and 74 per cent respectively. Thus over the years, in general, it is found that time and cost overrun in power projects in the central sector exhibit a downward trend.

Temporal Analysis of Time-lag and Cost Overrun of the Projects in the Central Sector

As seen, the monitoring system of the MPI, Government of India has grouped the mega, major and medium projects in the central sector into 13 sectors (Table 3.2). Among these 13 sectors, the highest percentage of cost overrun is in the fertilizer sector. This is followed by power and railways respectively (Table 3.2). In order to find out the trends in cost and time overrun in these three sectors at the micro level, a project-wise study is undertaken. The results of the study are presented in the following pages.

Trends in Time-lag and Cost Overrun in the Fertilizer Projects 1971-86

In the monitoring system of the MPI as on 1-1-1990, there are seven Fertilizer Projects. The extent of time and cost overrun of six projects, year-wise, are given in Table 3.4. The projects sanctioned during 1971 to 1986 are considered for the study.

Table 3.4 indicates that the Haldia Fertilizer Project, West Bengal, was approved by the Government in November, 1971, which is the earliest ongoing fertilizer project in the monitoring system of MPI as on 1-1-1990. This project has met with a cost overrun of 608 per cent over the original estimated cost and witnessed 325 per cent time lag over the original time schedule. The fertilizer project sanctioned in January 1982 has cost and time overrun of 243 per cent and 44 per cent respectively. The cost and time overrun of the project sanctioned in April 1982 has again declined to 112 per cent and 18 per cent respectively. The project sanctioned in March 1984 has witnessed a negative cost overrun of four per cent and time overrun of only four per cent. But with the project sanctioned in January 1986, the cost and time overrun has increased slightly to 26 per cent and 19 per cent respectively. The other project sanctioned in October, 1986 has a cost overrun of 52 per cent, but has no time overrun.

The above analysis clearly shows that the extent of cost overrun and time-lag of fertilizer industry has declined over the years, though not steadily (see Table 3.4). In some cases the extent of time-lag and cost overrun has become zero and even negative over the years. The projects started in the earlier years are nearing completion, but the projects started in the later years are in the initial stages of work. When the work advances, it may give birth to further time-lag and cost overrun. Still one can observe a downward trend in time-lag and cost overrun.

Table 3.4

Time and Cost Overrun of the Ongoing Fertiliser Projects -- A Temporal Analysis at the Project Level as on 1.1.1990

Year of Govt. approval	Project - State	Cost overrun as % over the original	Time overrun as % over the original	Latest anticipated year of commissioning	Size of the project
Nov.1971	Haldia Fertilizer Project, West Bengal	608	325	Oct.1992	151 THMT
Jan.1982	Pradeep Fertilizer Project II Orissa	243	44	June 1990	720 THMTPA
Apr.1982	Caprolactum - FACT, Kerala	112	18	Sept.1980	-50/225 THMTPA
Mar.1984	Aonla Fertilizer Project, Uttar Pradesh	-4	4	June 1988	-726 THMTPA
Oct.1986	Rehab of AMM Plant, Maharashtra	26	19	May 1990	40 THMT
Oct.1986	Amzhore Phosphate Fertilizer Project, Bihar	52	0	Nov.1989	40 THMT

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

The Trends in Time-lag and Cost Overrun of the Railway Projects

The trends in time-lag and cost overrun of railway projects (railway lines only) on year basis, from 1972 to 1987, are given in Table 3.5. The projects sanctioned after 1987 are not considered because, since they are in the initial stages of implementation, there is no meaning in quantifying the extent of time and cost overrun. The projects included in Table 3.5 are selected on a random basis; of course, deliberate consideration is given to the year. As on 1-1-1990 there are 89 ongoing railway projects out of which a good number are not railway lines. Here we are considering only railway line construction.

The Calcutta underground railway project in West Bengal, sanctioned in April 1972, has the highest cost overrun of 842 per cent. The projects undertaken during the successive years have cost overrun but in terms of percentage over the original estimate it shows a downward trend, though not steady (Table 3.5).

Similarly time-lag in the railway projects is also showing a downward trend, though not regular (Table 3.5).

Table 3.5

Time and Cost Overrun Trends of the Ongoing and Completed Railway Projects

As on 1-1-1990

Sl. No.	Date of Govt. approval	Project - State	Cost over-run as % over the original	Time over-run as % over the original	Latest anti-cipated year of commission-ing	Size of the project
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Apr. 1972	Calcutta Underground, West Bengal	842	187	June 1991	16.43 KM
2.	Mar. 1974	Manmad-Parli	45	--	--	
3.	Mar. 1979	Itarsi-Amla	121	8	Dec. 1988	81 KM
4.	Mar. 1980	Kiul-Jamalpur	57	0	Mar. 1990	75.85 KM
5.	Mar. 1981	Rohtak-Jakhal, Haryana	160	12	Mar. 1990	76 KM
6.	Jul. 1981	Jhansi-Bina, UP	129	3	Mar. 1989	381 KM
7.	Mar. 1982	Koraput-Rayagada, Tamil Nadu	187	80	Mar. 1991	164 KM
8.	Mar. 1983	Itarsi-Amalanag, PH II	55	14	Mar. 1989	39 KM

Table 3.5 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
9.	Mar. 1985	Kumedpur-Jalpaigari I	70	0	Mar. 1990	80 KM
10.	Mar. 1985	Tandur-Malkhaid	56	50	Mar. 1990	46 KM
11.	Mar. 1987	Vikrabad-Tadur	13	0	Mar. 1990	41 RKM
12.	Mar. 1987	Jaikwara-Manikpur	0	75	June 1992	58 KM

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

The time-overrun of the project sanctioned in April 1972 is 187 per cent over the original schedule of completion. The same has come down to eight in the case of project sanctioned in March 1979 (Table 3.5).

From the above analysis it is inferred that, in general, the extent of time-lag and cost overrun shows a declining trend in the case of railway projects sanctioned between 1972 to 1985.

The Trends in the Time-lag and Cost Overrun of Power Projects Started During 1974-87

For the study of the trends in time-lag and cost overrun in the power sector 27 power projects are taken as sample, on a random basis, out of 48 ongoing of projects in the central sector. Out of these 48 power projects, a good number are in the transmission area, which are not considered. Out of the 27 power projects selected, ten are hydro power projects, seven thermal power projects, five gas power projects and four atomic power projects. Table 3.6 reveals that, in general, the extent of time-lag and cost overrun shows a downward trend over the years. Finally in some cases it comes to zero and in some cases it shows negative trend.

Table 3.6

The time and cost overrun trends of the ongoing power projects--

A Temporal study at the project level (as on 1-1-1990)

Sl. No.	Date of Govt. approval	Project - State	Cost over-run as % of original	Time over-run as % of the original	Latest anti-cipated year of commission-ing	Size of the project
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hydro Power Projects						
1.	Mar.1975	Kopili HEP, Assam	324	67	March 1988	150 MW
2.	Jan. 1978	Panchet Hill II HEP, Bihar	239	141	Feb. 1990	40 MW
3.	Jan. 1978	Panchet Hill I HEP, Bihar	192	131	Aug. 1989	
4.	June 1981	Koel Karo HEP, Bihar	151	70	Mar. 1994	710 MW
5.	Nov. 1982	Dulhasti HEP, Jammu & Kashmir	588	45	July 1974	390 MW
6.	Feb. 1983	Doyang HEP, Nagaland	73	21	June 1994	75 MW

Table 3.6 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
7.	Apr. 1984	Chamera HEP, Himachal Pradesh	75	44	Dec. 1992	540 MW
8.	Aug. 1984	Tanakpur HEP, Uttar Pradesh	74	39	Mar. 1990	120 MW
9.	Apr. 1987	Ranganadi HEP, Arunachal Pradesh	0	21	Mar. 1996	405 MW
Thermal Power Projects						
10.	Apr. 1978	Ramagundam STPP Stage I Andhra Pradesh	104	52	June 1988	1000 MW
11.	Mar. 1979	Farakka STPP Stage I, West Bengal	138	20	Aug. 1987	600 MW
12.	Sept. 1981	Korba STPP Stage II, Himachal Pradesh	77	-1	Feb. 1989	1000 MW
13.	Sept. 1981	Ramagundam STPP Stage II, Andhra Pradesh	46	-5	Oct. 1989	1000 MW
14.	June 1982	Rihand STPP Stage I, Uttar Pradesh	61	18	Jul. 1989	1000 MW
15.	June 1982	Vindhyachall STPP Stage I, Madhya Pradesh	46	13	Dec. 1990	1260 MW

Table 3.6 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
16.	Sept. 1984	Farakka STPP Stage II, West Bengal	50	3	June 1992	1000 MW
Gas Power Projects						
17.	Jan. 1986	Malthon Gas Turbine Project, Bihar	19	123	Mar. 1989	90 MW
18.	Oct. 1986	Kawar GPP, Gujarat	60	50	Jan. 1993	600 MW
19.	Oct. 1986	Auraiya GPP, Uttar Pradesh	53	-7	Sept. 1990	600 MW
20.	Oct. 1986	Anta GPP, Rajasthan	40	0	Aug. 1990	430 MW
21.	Oct. 1987	Gass Turbine	0	0	Apr. 1989	15 MW
Atomic Power Projects						
22.	Jan. 1974	Narora Atomic Power Project, Uttar Pradesh	153	103	Aug. 1990	2x235 MW
23.	Jul. 1981	Kakrapar Atomic Power Project, Gujarat	94	0	Dec. 1991	2x235 MW

Table 3.6 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
24.	Nov. 1986	Rajasthan Atomic Power Project 3&4, Rajasthan	0	0	Nov. 1995	2x235 MW
25.	June 1987	Kaiga Atomic Power Project, Karnataka	0	0	Dec. 1995	2x235 MW

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

The hydro power projects sanctioned in March 1978 has a cost overrun of 239 per cent and a time-lag of 141 per cent (Table 3.6). The project started in 1981 has only a cost and time overrun of 192 per cent and 131 per cent respectively. Thus time-lag and cost overrun of the projects started after 1978 shows a declining trend (Table 3.6). Same is the case with the thermal power projects. The thermal power project sanctioned in April 1978 has a cost overrun and time-lag of 104 per cent and 52 per cent respectively. But the same has come down to 77 per cent and zero per cent respectively in the case of the project sanctioned in September 1981. So over the years from 1978 to 1984, the cost overrun and time-lag of the thermal power projects have declined (Table 3.6).

In the case of the Gas Power Projects, the fall in time-lag and cost overrun was quick and sudden. The project sanctioned in October 1986 has a cost and time overrun of 60 per cent and 50 per cent respectively, whereas the project sanctioned in October 1987 has no time and cost overrun (Table 3.6). The department was able to control fully the occurrence of time-lag and cost overrun.

More or less the same declining trend, over the years, in time-lag and cost overrun is found in the Atomic Power Projects too. The atomic power project sanctioned in 1974 has a time and cost overrun of 103 per cent and 153 per cent respectively (Table 3.6). By 1986, the Department was able to avoid time-lag and cost overrun in the Atomic Power Projects.

The above analysis of time-lag and cost overrun of power projects--Hydel, Thermal, Gas and Atomic--in the central sector in general exhibits a declining trend over the years. The technological development, improvement, in management and co-ordination and the experience gathered from implementing the projects, all should have contributed to this phenomenon.

The Nature and Capacity of the Project and Time-lag and Cost Overrun

The feasibility report and the detailed project report of the projects are worked out, by taking into account of the nature and capacity of the project. The complexity of the project, and the size and capacity of the project are considered properly in fixing the cost and the time schedule of the project work. As such there could not be a direct relationship between time-lag and cost overrun, and nature and capacity of the project.

Table 3.6 consists of nine ongoing hydro-electric projects with installed capacity ranging from 40 MW to 710 MW. The Panchat Hill II HEP which has a capacity of 40 MW has met with a cost overrun of 239 per cent and a time overrun of 141 per cent whereas Doyang HEP with a capacity of 75 MW has only a cost overrun of 73 per cent and time-lag of 21 per cent (Table 3.6). So in the case of two hydro-electric projects the capacity of which is below 75 MW, one has high time-lag and cost overrun and the other has only low time-lag and cost overrun.

The hydro-electric project with a capacity of 150 MW has a cost overrun of 324 per cent and a time-lag of 67 per cent whereas the project with 540 MW has only comparatively low cost and time overrun of 75 per cent and 44 per cent respectively. In the case of thermal projects, gaspower projects and atomic power projects same is the situation as in HEP projects (Table 3.6). So in the case of power projects there is no such strong relationship between the capacity of the project and time-lag and cost overrun.

The above analysis and conclusion are also true in the case of fertilizer projects. Table 3.4 reveals this. The Halida Project with a capacity of 151 THMT has a cost and time overrun of 608 per cent and 325 per cent respectively. Whereas the Aonala Fertilizer Project having a much higher capacity of 720 THMTPA, has a negative cost overrun and very low time-lag of four per cent. So in the fertilizer project too, the study cannot identify any direct relationship between the size of the project and time and cost overrun.

In the case of Railway projects also, one cannot find an exact relationship between the size of the project and the extent of time and cost overrun (Table 3.5). It varies from project to project irrespective of the size of the project.

Time-lag and Cost Overrun in the Central Sector Investment: A Temporal Analysis at the Sectoral Level

Here an analysis is made on the extent and trends of time-lag and cost overrun of central sector projects scheduled for commission during 1987-88, 1988-89, 1989-90 and 1990-91. Almost all the mega, major and medium projects scheduled for commission during these years are considered. In the central sector there were 39 projects scheduled for commissioning during 1987-88, 24 projects during 1988-89, 66 projects in 1989-90 and 36 projects in 1990-91. The extent and trends in time-lag and cost overrun of these projects are given in Table 3.7. The percentage time overrun over the original and the percentage cost overrun over the original cost are worked out at the sectoral level for comparison.

The sectoral level analysis is a good indicator to find out the trends in time-lag and cost overrun because it will not be determined by abnormal or extreme cases as in the case of project level analysis.

In the department of coal, there are eight projects scheduled for commissioning during April 1987 to March 1988, which resulted in a cost overrun of 136.3 per cent (Table 3.7). But as for the projects scheduled for commissioning during April 1988 to September 1989, the same has increased to 322.4 per cent, more than double the percentage cost overrun over the previous year. The cost overrun of five coal projects scheduled for commissioning during 1990 comes down sharply to 76.45 per cent over the original estimate but in the case of nine coal projects

Table 3.7

The Trends in Cost and Time Overrun of the Central Sectoral Projects which are Scheduled to be Completed/Completed during 1987-88, 1988-89, 1990, 1991

Sl. No.	SECTOR	April 1987 to March 1988			April 1988 to Sept.1989			1990			1991		
		No. of projects completed	Cost overrun in % over the original	Time overrun in %	No. of projects	Cost overrun in %	Time overrun in %	No. of projects	Cost overrun % over the original	Time overrun % over the original	No. of projects	Cost overrun % over the original	Time overrun % over the original
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	Mines	1	82.0	43.9	2	77.1	13.9	1	99	42			
2.	Coal	8	136.3	68.5	2	322.4	100.0	5	76.45	280.43	9	94.96	83.24
3.	Petroleum and Natural Gas	6	19.5	39.9	4	9.7	74.7	10	-37.18	46.17	2	0	7
4.	Steel	2	69.7	73.4	3	115.5	89.7	3	15.41	34.16	2	14.61	-15.4
5.	Fertilisers	2	17.5	48.9	1	0	4.1	3	175.60	32.59	1	5	0
6.	Petrochemicals & Chemicals	4	33.2	41.0	3	18.18	31.03	4	20.49	12.32			
7.	Surface Transport	7	59.0	195.0	3	66.8	65.8	10	12.19	8.42	5	7	6

Table 3.7 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
8.	Railways	6	81.0	13.5	2	44.1	60.0	10	64.91	7.75	8	29.50	10.11
9.	Civil Aviation	1	—	20.8	1	—	0.0	1	16.6	0			
10.	Power	6	116.5	58.8	1	226.0	92.3	2	41.16	45.45	2	58.33	84.11
11.	Telecommunications	1	0	—	1	10.0	8.0	8	0	0	4	0	0.7
12.	Public Enterprises (Industrial)	1	0	22.0	1	237.0	133.3	6	91.60	58.57	2	52.32	15.38
13.	Atomic Energy	—	—	—	—	—	—	3	57.27	70.78	1	94	0
TOTAL		39			24			66			36		

Source: 1. Compiled and calculated from <u>Annual Reports</u> (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

2. Roy S.K. et al. (1960), "Industrial Projects, Time and Cost Overrun", <u>Encyclopaedia of Economic Development</u>, Vol.20, Akashdeep Publishing Company, New Delhi.

scheduled to be commissioned during 1991 it has shown a slight increase to 94.96 per cent. The percentage cost overrun of coal projects during 1987 to 1991 shows an irregular trend, ie., in 1987 it was only 136.3 per cent but it had increased to 322.4 per cent in 1988-89, declined sharply to 76.45 per cent in 1990 and made a slight increase to 94.96 per cent in 1991. But it shows a declining trend in general, ie., 136.3 per cent in 1987-88 to 94.96 per cent in 1991 (Table 3.7).

The percentage time overrun of the coal projects scheduled for commissioning during the same period, ie., 1987-91, is also given in the Table 3.7. It is 68.5 per cent in 1987-88 which increased to 100 per cent in 1988-89 and then declined to 76.45 per cent in 1990 but again had increased slightly to 83.24 per cent in 1991. Thus an irregular trend is found in the case of time overrun of coal projects scheduled to be commissioned during 1987 to 1991. The time overrun has made a slight increase from 68.5 per cent in 1987-88 to 83.24 per cent in 1991, but declined from 100 per cent in 1988-89 to 83.24 per cent in 1991. So, in general, the time overrun of coal projects also exhibits a downward trend (Table 3.7).

In the case of petroleum and natural gas projects this downward trend of time and cost overrun is more sharp and comparatively steady (Table 3.7). The six petroleum and natural gas projects scheduled to be commissioned in 1987-88 have a cost overrun of 19.5 per cent over the original cost. But the same has declined to 9.7 per cent in 1988-89. The petroleum and natural gas projects scheduled to be commissioned in 1990 have a 'negative' cost overrun of 37.18 per cent. The projects in the Department of Petroleum and Natural Gas scheduled to be commissioned in 1991 have no cost overrun. So projects in the department of petroleum and natural gas have attained a laudable stage where they have zero and even negative cost overrun.

The time overrun of the projects in the petroleum and natural gas shows the same declining trend, though not as sharp as in the case of cost (Table 3.7). The percentage time overrun of these projects was only 39.9 per cent in 1987-88 which increased to 74.7 per cent in 1988-89, then declined to 46.17 per cent in 1990 and again had further declined to seven per cent in 1991 (Table 3.7).

The cost overrun of power projects scheduled to be completed in 1987-88 was 116.5 per cent which increased to 226 per cent in 1988-89, and declined to 41.16 per cent in 1990, but again had increased to 58.33 per cent in 1991

(Table 3.7). Though there was an increase in cost overrun of power projects declined from 116.5 per cent in 1987-88 to 58.33 per cent in 1991. But in the case of time overrun of power projects in the central sector during the same period increased from 58.8 per cent in 1987-88 to 84.11 per cent in 1991. But a closer analysis shows that the time overrun declined from 92.3 per cent in 1988-89 to 45.45 per cent in the case of projects scheduled for completion in 1990 (Table 3.7).

The general trend in time and cost overrun of projects in these 13 sectors in the central sector scheduled to be commissioned during 1987-88 to 1990-91 shows different degrees and intensities (See Table 3.7). Inter-sectoral differences are clearly revealed in Table 3.7. In most sectors there is also no regular trend in time and cost overrun. But, in general, the projects in these 13 sectors, scheduled to be commissioned during 1987-88 to 1991 show a clear downward trend and in certain projects have attained zero and even negative time and cost overrun.

Time-lag and Cost Overrun in the Central Sector Investments A Cross Section Analysis

As on 1-1-1990, the monitoring system of the MPI had 38 projects to be commissioned in 1991 which is given in Table 3.8. Here an attempt is made to analyse time-lag and cost overrun of the projects which were scheduled to be commissioned in 1991, as on 1-1-1990. In this cross-section analysis 38 projects covering 10 sectors are taken into account. Table 3.8 provides the details of the projects scheduled to be commissioned in 1991, and the extent of time-lag and cost overrun.

In the atomic energy department one project was scheduled to be commissioned by December 1991, which had no time overrun and as scheduled it took ten years to complete the work, but the project had a cost overrun of 94 per cent over the original estimated cost.

In the department of coal, there were nine projects, spreading over four states, scheduled to be commissioned during March 1991 to June 1991. All the nine projects resulted in time overrun range from 32 per cent to 234 per cent over the original. Out of the nine projects one project had no cost overrun and all the other eight projects met with cost overrun ranging from 30 per cent to 237 per cent over the original estimate. So all the projects had different degrees of time and cost overruns, though they were scheduled to be commissioned in the same year.

Table 3.8

Time and Cost Overrun of Projects Scheduled for Completion in 1991

(Rs. in crores)

Sl. No.	PROJECT - STATE	Capacity	Date of Govt. approval	Date of Commissioning		Time overrun month	Time overrun as % over the original	Cost of the Project		Cost overrun as % increase over the original
				Original	Anticipated			Approved	Anticipated	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DEPARTMENT OF ATOMIC ENERGY										
1.	Kakrapar Atomic Power Gujarat	2x235 MW	Jul.1981	Feb.1991	Dec.1991	0	0	382.52	745.00	94
DEPARTMENT OF COAL										
2.	Damodar OC, Bihar	1.00 MTY	Mar. 1984	Mar.1988	Mar.1991	36	75	57.04	57.04	0
3.	Jharia, Block II OC, Bihar	2.50 MTY	Jun. 1982	Mar.1987	Mar.1991	48	84	112.05	173.82	55
4.	Katrasug, Bihar	0.90 MTY	Oct.1979	Sept.1983	Mar.1991	96	234	26.04	87.88	237
5.	Madhubandu Washery, Bihar	1.13 MTY	Mar.1985	Mar.1989	Jun.1991	27	56	71.90	93.54	30
6.	Karkatta, OC, Bihar	1.00 MTY	Jun.1982	Mar.1985	Mar.1991	72	218	29.60	63.90	115
7.	Bina OC, Uttar Pradesh	4.50 MTY	May 1979	Mar.1986	Mar.1991	60	73	56.91	168.64	196
8.	Kakri OC, Uttar Pradesh	2.50 MTY	Oct.1980	Mar.1987	Mar.1991	48	62	50.54	137.80	172

Table 3.8 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
9.	Belpahar OC, Orissa	2.00 MTY	Dec.1982	Mar.1989	Mar.1991	24	32	57.38	99.95	74
10.	Sasti OC, Maharashtra	1.00 MTY	Nov.1981	Mar.1988	Mar.1991	36	47	25.15	66.71	165
DEPARTMENT OF FERTILISER										
11.	Rampura AUGC, Rajasthan	--	Nov.1988	May 1991	May 1991	0	0	585.33	617.20	5
DEPARTMENT OF STEEL										
12.	Salem Exp.PH, Tamil Nadu	1000 tonnes	Mar.1988	Sept.1991	Jun.1991	-3	-7	69.37	72.27	4
13.	Durgapur Steel Plant Rebuild Co.BI, West Bengal	----	Jun.1988	May 1991	Mar.1991	-2	-5	33.06	45.13	36
DEPARTMENT OF PETROLEUM AND NATURAL GAS										
14.	New Oil Terminal, Cochin	KLM 000015	Aug.1988	Aug.1991	Aug.1991	0	0	65.21	65.21	0
15.	Gandhar Development Ph.I	5.55 MT	Mar.1988	Dec.1990	Jun.1991	6	18	326.68	326.68	0
POWER										
16.	Bokaro B.II, TPP, Bihar	420 MW	Jul.1981	Oct.1985	Dec.1991	74	145	186.93	356.25	90
17.	Kahalgaon TR, Line I	809 CKM	Jul.1985	Mar.1990	Jul.1991	16	26	174.48	216.00	23

Table 3.8 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DEPARTMENT OF INDUSTRY										
18.	MANF, X-ray & Graphic Film, Tamil Nadu.	12 MSQM	Mar.1986	Oct.1991	Oct.1991	0	0	168.12	291.0	73
19.	MOD. of Tyre Corporation, West Bengal	5 lakhs	Feb.1988	Mar.1991	Dec.1991	9	24	66.71	66.71	0
DEPARTMENT OF RAILWAYS										
20.	SHG-Link, E.R.	50 RKM	Mar.1986	Mar.1991	Mar.1991	0	0	29.81	38.70	29
21.	GARHWA RD N.E.R., Bihar	79 KMS	Mar.1987	Mar.1991	Mar.1991	0	0	48.89	51.02	4
22.	Moradabad-Rampur, Uttar Pradesh	27 KMS	Mar.1987	Mar.1991	Mar.1991	0	0	20.72	20.27	-2
23.	Raipur-Vijanagaram	100 KMS	Mar.1987	Mar.1991	Mar.1991	0	0	62.60	67.57	7
24.	Calcutta Underground, West Bengal	16.43 KMS	Apr.1972	Dec.1978	Jun.1991	150	187	140.30	1323.00	842
25.	Mankhurd-Belapur, Maharashtra	18 KMS	Feb.1986	Oct.1990	Mar.1991	5	8	120.00	153.04	27
26.	Koraput-Rayagada	164 KMS	Mar.1982	Mar.1987	Mar.1991	48	80	112.10	322.00	187
27.	Alleppey-Kayamkulam, Kerala	43 KMS	Mar.1982	Mar.1991	Mar.1991	0	0	11.10	35.58	220
28.	Bhopal-Nagda, Madhya Pradesh	239 KMS	Mar.1983	Mar.1991	Mar.1991	0	0	53.24	53.24	0

Table 3.8 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DEPARTMENT OF SURFACE TRANSPORTS										
29.	ACQ Vessels, CIWTC, West Bengal	63 Nos.	Feb.1987	Mar.1991	Mar.1991	0	0	63.80	63.80	0
30.	Cochin Container Handling, Kerala	1 No.	Feb.1988	Jan.1991	Jan.1991	0	0	53.11	53.11	0
31.	Procurement of DREG II DCI, Tamil Nadu	1 No.	Feb.1988	Jan.1991	Mar.1991	2	5	28.20	33.22	17
32.	CAL-PALSIT Section, West Bengal	64.5 KMS	Jan.1986	Jun.1990	Feb.1991	8	15	48.60	58.00	7
33.	Murthal-Kars, NH 1, Haryana	80 KSM	Jan.1986	Dec.1990	Apr.1991	4	6	42.50	46	8
34.	Second Hoogly Bridge, West Bengal	822.96 M	Jan.1977	Dec.1983	Aug.1991	92	110	57.00	340.00	126
DEPARTMENT OF COMMUNICATIONS										
35.	Vasna II Exp, EIOB,EX&BDG, Gujarat	Line 10000	Jul.1988	Jan.1991	Jan.1991	0	0	20.01	20.01	0
36.	RGHZM/W Cal, West Bengal	140 MB/S	Sept.1987	Mar.1990	Mar.1991	12	37	20.47	20.47	0
37.	EIOB EXCH.,TE&Building,	12 KM	Apr.1989	Dec.1991	Jan.1991	-11	-34	22.07	22.07	0
38.	EIVB EXCH., Punjab	15 KM	Jan.1988	Dec.1991	Dec.1991	0	0	26.52	26.52	0

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

In the monitoring system of MPI, therewas only one fertilizer project scheduled to be commissioned in May 1991, which had no time overrun but had a nominal cost overrun of five per cent over the original estimate (Table 3.8).

In the steel department two projects were scheduled to be commissioned in May 1991 and September 1991; both of them were expected to be commissioned before the scheduled period by seven per cent and five per cent of the original planned schedule. But these two projects had a cost overrun of four per cent and 36 per cent over the original cost (Table 3.8).

In the petroleum and natural gas department there were two projects expecting to get commissioned in June 1991 and August 1991 and both of them had no cost overrun and one project had no time overrun also. But the other project, though it had no cost overrun, met with a time overrun of 18 per cent.

The study reveals that all the 38 projects, though they were scheduled to be commissioned in 1991, had no uniformity in the emergence and extent of time and cost overrun. Even within each department, having more or less the same type of implementation, there is no uniformity in the matter of time-lag and cost overrun. The projects in the same department sanctioned in the same year and month and scheduled to be commissioned in the same year and month have different cost and time overruns (Table 3.8). Thus time-lag and cost overrun in the central sector projects scheduled to be commissioned in 1991, varied from project to project without any uniformity.

Out of these 38 projects scheduled to be completed in 1991, 14 projects have no time-lag and three projects were completed before the planned schedule. Thus 44 per cent of the projects have no time overrun. Eleven projects out of 38 have no cost overrun and one project is getting completed at a cost which is lower than the original estimated cost. Thus 31 per cent of the projects have no cost overrun. But it is seen that 56 per cent of the projects have time overrun and 69 per cent of the projects have cost overrun (Table 3.8).

Out of the 38 projects only one project has no cost overrun and a negative time overrun; and one project has a negative cost overrun and no time-lag. These are in the Department of Railways and Communication. Six projects have no time-lag and cost overrun. Thus a total of eight projects are free from time-lag and cost overrun which come about 21 per cent of the total and the rest 79 per cent of the projects scheduled to be commissioned in 1991 are not free from either time-lag or cost overrun or both of them.

A Causative Analysis of Time-lag and Cost Overrun in the Central Sector Projects

As stated earlier, out of the 331 ongoing projects in the central sector on 1-1-1990, 163 projects resulted in time overrun and 184 projects resulted in cost overrun. The extent of time-lag and cost overrun varies from project to project. The reasons for time-lag and cost overrun in different projects are listed in Table 3.9.

The most frequently arising reasons for time-lag and cost overrun are the problem related to land acquisition, forest clearence, evacuation and rehabilitation. Out of 163 projects 45 projects are delayed due to these reasons, and 24 projects are affected by contract related issues.

One important factor that can be noted from Table 3.9 is that only 11 projects are delayed due to unforeseen

Table 3.9

The Causative Factors of Time and Cost Overrun of 163 Projects in the Central Sector as on 1.1.1990

Sl. No.	Reasons/Factors	No. of projects affected
1.	Land acquisition/Forest clearance/ evacuation/rehabilitation	45
2.	Contract defects/failure/cancellation/poor work by contractor/late contract awarding	24
3.	Funds/Materials constraints	17
4.	Machinery/equipment delay	16
5.	Technology/consultants/collaboration/ bilateral agreement/import	15
6.	Poor/delayed/insufficient infrastructure	14
7.	Modification/changes in scope/design	12
8.	Unforeseen/failed to forsee factors	11
9.	Delay in completion of critical stages/ works	11
10.	Delay in/faults in planning/engineering/ design	8
11.	Labour strike/public agitation/law and order	6
12.	Delay in approval/sanction	2
13.	Project site change	1

Source: Compiled and calculated from Annual Reports (1987-90), Ministry of Programme Implementation, Govt. of India, New Delhi.

reasons like geological and climatic factors, Of course, these are in most cases, beyond control. But all other reasons and factors that have contributed to time-lag and cost overrun are man made and the effect of these can be avoided or reduced.

Chapter 4

TIME-LAG AND COST OVERRUN OF INVESTMENTS IN KERALA: AN ECONOMIC ANALYSIS

The sectoral allocation of plan expenditure during the first to the eighth plan reveals that around 38 per cent of the total expenditure of the state is spent on irrigation and power projects. A study on time-lag and cost overrun of the investment in these two sectors is expected to represent clearly the nature and trends in time-lag and cost overrun of Governmental investment. Hence a census study with reference to time-lag and cost overrun of governmental investments relating to all the completed and ongoing HEPs and irrigation projects is undertaken here. Along with the census study of HEPs and irrigation projects a sample study of the time-lag and cost overrun of industries is also worked out.

Time-lag and Cost Overrun of Irrigation Projects

In Kerala there exist 28 irrigation projects - 10 completed and 18 ongoing. The time-lag and cost overrun of the completed and the ongoing projects are studied here separately.

Time-lag and Cost Overrun of Completed Irrigation Projects

There are 10 completed irrigation projects in Kerala. The details of the extent of time-lag and cost overrun of these projects are given in Table 4.1.

The original estimated cost of these 10 projects was Rs.1,849 lakhs. The actual cost of these projects has increased to Rs.2,353.83 lakhs. The extent of cost overrun is Rs.505.49 lakhs. The cost overrun comes to about 27.33 per cent over the original estimated cost.

Out of the 10 completed irrigation projects only two have negative cost overrun and the other two have only nominal increase in cost over the original estimate. The other six projects resulted in considerable extent of cost overrun, ranging from 43.10 per cent to 135.55 per cent over the original estimated cost.

All the 10 completed irrigation projects resulted in time-lag (Table 4.1) ranging from three years to 17 years. Time-lag over the original estimated period fluctuates between 60 per cent to 500 per cent. The total gestation period of all these 10 projects are 48 years. But this has increased to 92 years which shows 191.66 per cent increase over the original estimated period.

Table 4.1

Time-Lag and Cost Overrun of Completed Irrigation Projects in Kerala

(Rs. in lakhs)

Sl. No.	Project	Year of commence-ment	Year of comple-tion	Years taken for completion	Original anticipa-ted year of completion	Original years for completion	Time-lag in years	Time-lag as % increase over the original	Original estimated cost	Latest estimated cost	Cost over-run in Rs.	Cost over-run as % increase over the original
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1.	Peechi	1947	1959	12	1952	5	7	140	235	235	0	0
2.	Chalakudy	1949	1966	17	1954	5	12	240	188	188.25	0.25	0
3.	Malampuzha	1949	1966	17	1954	5	12	240	388	580	192	49.48
4.	Neyyar	1951	1973	22	1956	5	17	500	248	461	213	85.88
5.	Vazhani	1951	1962	11	1956	5	6	120	108	107.57	-0.43	-0.39
6.	Mangalam	1953	1966	13	1957	4	9	225	45	106	61	135.55
7.	Walayar	1953	1964	11	1957	4	7	175	92	131	39.66	43.10
8.	Meenbara	1956	1964	8	1961	5	3	60	220	220	0	0
9.	Chunukuzhy	1957	1973	16	1962	5	11	220	91	90.76	-0.24	-0.00026
10.	Pothundy	1958	1971	13	1963	5	8	160	234	234.25	0.25	0.0010
TOTAL						48	92	191.66	1849	2353.83	505.49	27.33

Source: 1. Working Committee Reports on Industry, Power and Irrigation (1984-1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Report of the High Level Committee on Social Infrastructure and Services (1984), State Planning Board, Govt. of Kerala, Trivandrum
3. Economic Review (1960-1991), State Planning Board, Govt. of Kerala, Trivandrum.
4. Five Year Plan Documents (1957-1990), State Planning Board, Govt. of Kerala, Trivandrum.

Out of the 10 completed irrigation projects four have a time lag of more than 10 years. Out of the 10 completed irrigation projects nine projects have a time-lag of more than six years. Table 4.1 clearly brings out the fact that time lag and cost overrun in the implementation of commissioned irrigation projects are a common feature of almost all projects.

Time-lag and Cost Overrun of Ongoing Irrigation Projects

There are 18 ongoing irrigation projects in Kerala. The time-lag and cost overrun of these 18 projects are given in Table 4.2. The original estimated cost of these 17 projects (excluding sl.no.17) is Rs.17,661 lakh. The latest estimated cost of (1991) these 17 projects is (excluding sl.no.17) Rs.1,11,731 lakhs. The cost overrun of these 17 projects amounts to Rs.94,070 lakhs (estimated). Thus there is 671.55 per cent increase over the original estimated cost (Table 4.2). As per 1991 estimate the Kallada project has the highest amount of cost overrun of Rs.30,021 lakh showing 2,260 per cent increase over the original estimated cost.

Time-lag of the Ongoing Irrigation Projects

The extent of time lag of the ongoing irrigation project is presented in Table 4.2. The Periyar irrigation

Table 4.2

Time-lag and Cost Overrun of Ongoing Irrigation Projects in Kerala as on 1992

(Rs.in lakhs)

Sl. No.	PROJECT	Year of starting	Original expected date of commissioning	Original estimated years of commission-ing	Time over-run in years over the original	Time over-run as % increase over the original	Original estimated cost	Latest estimated cost as on March 1992	Cost over-run in Rs.	Cost over-run as % in-crease over the original
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Periyar	1956	1961	5	31	620	348	6304('89E)	5956	1711.49
2.	Kallada	1961	1967	6	25	417	1328	45780('92)	44452	3347.28
3.	Kanhirappuzha	1961	1968	7	24	343	365	7500('92)	7135	1954.79
4.	Chitturpuzha	1961	1967	6	25	417	106	2080('89)	1974	1862.26
5.	Kuttiadi	1962	1968	6	24	400	496	5500('89)	5004	1008.87
6.	Pamba	1964	1968	4	24	600	383	6341 ('89)	5958	1555.61
7.	Pazhassi	1964	1967	3	25	800	442	7736('89)	7294	1650.22
8.	Leenapuzha (Karapuzha)	1975	(1980-81) VI Plan	5	11	220	760	4066('89)	3306	435.00
9.	Attapady	1975	(1980-81) VI Plan	5	11	220	760	5000('89)	4524	950.42

Table 4.2 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
10.	Chimoni Mulpi	1975	1979	4	13	310	633	3615('92)	2982	471.09
11.	Muvattupuzha	1976	(1980-81) VI Plan	4	11	270	2086	8925('92)	6839	327.85
12.	Kuriarkutty-Karapara	1978	(1982-83) VI Plan	4	10	250	1036	6018('92)	4982	480.88
13.	Banasurasagar	1979	(1983-84) VI Plan	4	9	220	800	1798('89)	998	124.75
14.	Kakkadavu	1979	(1983-84) VI Plan	4	9	220	1335	9885('92)	8550	640.4
15.	Meenachil	1980	(1983-84) VI Plan	3	9	300	3300	4956('89)	1656	50.18
16.	Idamalayar	1981	(1984-85) VI Plan	3	7	270	1785	7121('92)	5336	298.93
17.	Beypore puzha (Chaliar)	1981	(1984-85) VI Plan	3	7	--	--	--	--	--
18.	Vamanapuram	1981	1984	3	9	300	1982	3640('89)	1658	83.65
	TOTAL			79	284	359	17661	136265	118604	671.55

Note: Sl.No.17 excluded.

Source: 1. Working Committee Reports on Industry, Power and Irrigation (1984-1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Report of the High Level Committee on Social Infrastructure and Services (1984), State Planning Board, Govt. of Kerala, Trivandrum
3. Economic Review (1960-1991), State Planning Board, Govt. of Kerala, Trivandrum.
4. Five Year Plan Documents (1957-1990), State Planning Board, Govt. of Kerala, Trivandrum.

project started in 1956 with a gestation period of 5 years. It was originally planned to get it commissioned in 1961. But even today it is not yet commissioned. Todate it has registered a time-lag of 32 years. There is 620 per cent increase over the original estimated period of completion. All the ongoing projects have experienced a terrible extent of time-lag and cost overrun (Table 4.2). When compared with the completed irrigation projects the extent of time-lag and cost overrun is very high in the case of ongoing irrigation projects.

Since all these 18 irrigation projects are in the implementing stage, if this trend of time-lag and cost overrun continues the magnitude of time-lag and cost overrun will increase further. Thus the extent of time-lag and cost overrun of the irrigation projects is not only high but also of an increasing trend.

These 17 ongoing projects have an original estimated cost of Rs.17,661 lakhs. But a total expenditure of Rs.65,226.25 lakhs have gone into these 17 projects so far, but no project is completed yet.

Time-lag and Cost Overrun of Hydro-electric Projects in Kerala

In Kerala there exist 28 hydro-electric projects of which 12 projects are completed and 16 projects still under construction.

Time-lag and Cost Overrun of Completed Hydro-electric Project

The extent of time-lag and cost overrun of completed hydro-electric projects is given in Table 4.3.

The original estimated cost of the 12 commissioned hydro-electric projects is Rs.17,476.01 lakhs. But the actual cost of these has increased to Rs.37,730.54 lakhs incurring a cost overrun of Rs.20,254.53 lakhs. Thus there is an increase in cost of 115.89 per cent over the original estimated amount. These figures reveal that cost overrun amount is even higher than the original estimated cost of these 12 projects. This means that the excess expenditure, in the form of cost overrun on these 12 hydro-electric projects is even sufficient enough to construct an equal number of additional projects.

The Idamalayar HEP started in 1973 has an original estimated cost of Rs.2,340 lakhs. But the cost of the project has increased to Rs.9,003 lakhs, causing a cost overun of Rs.6,663 lakhs. This comes to be about 284.74 per cent increase over the original estimated cost.

Table 4.3

Time-Lag and Cost Overrun of Completed Hydro-electric Projects in Kerala

Sl. No.	PROJECT	Capacity installed	Year of of sanction/ starting	Original expected date of commi- ssioning	Original years for commiss- ioning	Actual date of commi- ssioning	Actual years taken for commiss- ioning	Time over- run in year	Time over- run as % increase over the original	Original cost (Rs.lakhs)	Actual cost	Cost overrun in Rs. lakhs	Cost over- run as % increase over the original
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	Pallivasal	37.5 MW	1933	--	--	1940-41	8	--	--	70.76	136.2	65.44	92.48
2.	Sengulam	48 MW	1944-45	--	--	1954	10	--	--	364.73	399.11	34.38	9.42
3.	Peringalkuthu	32 MW	1946	1955-56	9	1957-58	11	3	30	306.27	340.23	33.96	11.08
4.	Neriamangalam	45 MW	1955	1958-59	4	1963-64	9	5	125	290.00	360.33	70.00	24.13
5.	Panniar	30 MW	1956	1960-61	5	1963	7	2	40	280.25	630.00	349.75	124.79
6.	Sholayar	54 MW	1958-59	1964-65	6	1968	10	4	66.6	391.00	668.00	277.00	70.84

Table 4.3 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
7.	Sabarigiri	300 MW	Mar. 1961	1964	3.5	1967-68	7	3	85.71	3640.00	4283.00	643.00	17.66
8.	Idukki Stage I	390 MW	1963	1973	10	1976	13	3	30	6265.00	11500.00	5235.00	74.70
9.	Kuttiady	75 MW	1964-65	1968-69	5	1972	8	3	60	700.00	900.00	200.00	28.5
10.	Idamalayar	75 MW	1973	1982	9	1987	14	5	55.5	2340.00	9003.00	6663.00	284.74
11.	Idukki Stage III	390 MW	1975	1979-80	5	1989-90	15	10	200	410.00	1511.00	1101.00	268.5
12.	Idukki Stage II	390 MW	1979	1985	6	1987	8	2	33	2418.00	8000.00	5582.00	230.85
		TOTAL			62.5		120	40	61.27	17476.01	37730.54	20254.53	115.89

Source: 1. Working Committee Reports on Industry, Power and Irrigation (1984-1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Report of the High Level Committee on Social Infrastructure and Services (1984), State Planning Board, Govt. of Kerala, Trivandrum
3. Economic Review (1960-1991), State Planning Board, Govt. of Kerala, Trivandrum.
4. Five Year Plan Documents (1957-1990), State Planning Board, Govt. of Kerala, Trivandrum.
5. Kerala State Electricity Board, Planning Cell, Trivandrum.

All the completed hydro-electric projects of the state resulted in cost overrun and the extent of the same is very high (Table 4.3).

Out of the nine completed hydro-electric projects all the projects met with time-lag. The extent of time-lag veries from 2 years to 10 years (Table 4.3). In the case of Idukki Stage III, the extent of time-lag is 10 years. This is 200 per cent increase over the original estimated period for completion. The total gestation period of these nine projects are 62.5 years which has increased to 102 years causing a time-lag of 40 years which comes to be about 61.27 per cent over the original estimated period.

Time-lag and Cost Overrun of the Ongoing HEPs

There are 15 ongoing HEPs in Kerala, started during the period 1972 to 1989. The latest cost estimates of these projects show that all these projects resulted in cost overrun (Table 4.4). The original estimated cost of these projects is Rs.16,079 lakhs. As per the latest estimate this has increased to Rs.25,689 lakhs, resulting in a cost overrun of Rs.13,741 lakhs. This shows an increase of 85.46 per cent in cost over the original estimated amount.

The extent of cost overrun is very high in the case of ongoing HEPs. In the case of Lower Periyar Hydro-Electric Project, the original estimated cost of the project is Rs.8,843 lakhs. As per 1990 revised estimate this has increased to Rs.14,500 lakhs. Thus a sum of Rs.5,657 lakhs in addition has to be spent on the project to meet the cost overrun (Table 4.4).

Since these are ongoing projects, and if this trend in cost overrun is maintained, the extent of cost overrun will increase further.

Even before reaching the commissioning stage, all the projects resulted in time-lag. The extent of time-lag varies from 2 to 10 years as per the 1990 revised estimate (Table 4.4). And if this trend of time-lag is maintained, the extent of time-lag will increase further. The projects started in 1972 with a gestation period of 9 years remain incomplete even today after 20 years of project work. The extent of time-lag of the ongoing projects is very high. According to the original time schedule the total period for the completion of these 15 projects is 58 years. As per the 1990 time schedule it will take 129 years to

Table 4.4

Time-lag and Cost Overrun of Ongoing Hydroelectric Projects of Kerala as on March 1992

(Rs. in lakhs)

Sl. No.	PROJECT	Energy potential	Year of sanction/ starting	Original expected date of commissioning	Original years for commissioning	Anticipated date of commissioning	Anticipated years for commissioning	Time overrun in years	Time overrun as % increase over the original	Original estimated cost	Latest estimated cost (3/92)	Cost overrun in Rs.	Cost overrun as % increase over the original	Expenditure on 3/92
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1.	Sabarigiri Augmentation	125 Mu	1972	Jan.1981	9	1994	22	13	144.4	127	1200	1073	844	
2.	Kakkad HEP	262 Mu	Sept.1976	Mar.1984	8	1995-96	19	11	137.5	1860	8800	6940	373.1	6224
3.	Kallada HEP	65 Mu	Sept.1981	1984-85	4	1993-94	12	8	200	1180	1437	257	21.7	1161
4.	Lover Periyar HEP	493 Mu	Apr.1983	1989	6	1994-95	11	5	83.3	8843	18000	9157	103.5	10759
5.	Madupatty HEP	6 Mu	Dec.1985	1987-88	3	1993-94	8	5	166.6	292	365	73	25	181
6.	Malampuzha HEP	5.6 Mu	Dec.1985	1987-88	3	1993-94	8	5	166.6	295	425	130	44.06	188
7.	Azhutha Diversion	57 Mu	Jun.1986	Aug.1991	5	1994-95	8	3	60	248	420	172	69.35	242
8.	Malankara HEP	42 Mu	Aug.1986	1987-88	2	1995-96	9	7	450	750	1600	850	113.33	89
9.	Pooyamkutty HEP Stage I	645 Mu	Aug.1986	--	--	--	--	--	--	25000	--	--	--	450

Table 4.4 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
10.	Peppara HEP	11.5 Mu	Aug.1986	1987-88	2	1993-94	7	5	250	392	580	188	47.95	213
11.	Chimmini HEP	6.5 Mu	Aug.1986	1987-88	2	1994-95	8	6	300	316	425	109	34.4	54
12.	Vadakkepuzha Diversion	12 Mu	Oct.1988	1990-91	3	1994-95	6	3	100	131	160	29	22.13	--
13.	Kuttiar Diversion	36.6 Mu	Feb.1989	1990-91	2	1994-95	5	3	150	131	254	123	93.89	64
14.	Peringalkuthu L.B. HEP	38 Mu	May 1989	1992	3	1995-96	6	3	100	902	2192	1290	143.01	609
15.	Kuttiady Tail Race Scheme	15 Mu	Jun.1989	1992	3	1994-95	5	2	66.6	397	450	53	13.35	--
16.	Vazhikkadavu Diversion	24 Mu	Jun.1989	1992	3	1995-96	6	3	100	185	200	15	108	--
	TOTAL				58		140	82	141.37	16049	36508	20459	127.47	20314

Note: Sl.No.9 excluded.

Source:
1. Working Committee Reports on Industry, Power and Irrigation (1984-1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Report of the High Level Committee on Social Infrastructure and Services (1984), State Planning Board, Govt. of Kerala, Trivandrum
3. Economic Review (1960-1991), State Planning Board, Govt. of Kerala, Trivandrum.
4. Five Year Plan Documents (1957-1990), State Planning Board, Govt. of Kerala, Trivandrum.
5. Kerala State Electricity Board, Planning Cell, Trivandrum.

complete the work. This shows a time-lag of 71 years which is 122.41 per cent increase over the original estimate.

The Extent of Time-lag and Cost Overrun

As mentioned earlier there are 10 completed irrigation projects in Kerala. These 10 projects have an estimated cost of Rs.1,849 lakhs. But the actual cost of the project is Rs.2,353.83 lakhs. The cost overrun is Rs.505 lakhs.

There are 12 completed HEPs in Kerala. The estimated cost of these projects is Rs.17,476.01 lakhs. But as seen earlier (Table 4.3) the actual cost has increased to Rs.37,730.54 lakhs. The cost overrun is Rs.20,254.53 lakhs.

The total expenditure on completed irrigation projects and hydro-electric projects is Rs.40,084.37 lakhs. The total amount of cost overrun is Rs.20,760 lakhs. Out of the total investment of Rs.40,084 lakhs on completed irrigation and HEPs, Rs.20,760 lakhs, just about half of the total, is consumed away by cost overrun. As per the original estimate, the project could have been commissioned without this additional amount of investment. As such the amount of Rs.20,760 lakhs brings out zero output. This shows that cost overrun contributes to capital wastage.

Again the 12 completed hydro-electric projects have a total time-lag of 37 years. This means that these 12 HEPs of the state could have been completed without this additional time, had it been completed as per original schedule. This implies that the employment, output, and income that could have been generated by these projects in these 37 year's are lost.

Tables 4.2 and 4.4 reveal the very large extent of time lag and cost overrun that has led to capital wastage and capital loss in the ongoing hydro-electric and irrigation projects of Kerala.

Time-lag and Cost Overrun: A Study of Industries in Kerala State

In Kerala, the phenomenon of time-lag and cost overrun is not only confined to projects in the primary and infrastructural sectors but is also found in the case of projects in the secondary sector. To analyse and identify the extent of time-lag and cost overrun in the projects of secondary sector, a sample study of the time-lag and cost overrun of five public sector industrial undertakings is carried out. The samples are selected on the basis of the year of starting. The other criteria of selecting the samples are spatial consideration and the availability and accessibility of data. A sample study of time-lag and cost overrun of two private sector industrial undertakings is also carried out alongwith the five public sector industries.

Data relating to time-lag and cost overrun of seven industries are given in Table 4.5. Kerala Metals and Minerals Ltd., a public sector industrial project, started in 1978 with a gestation period of four years resulted in a time-lag of about 3 years making 72.34 per cent increase over the original scheduled period. This project with an original estimated cost of Rs.6,499.88 lakhs resulted in a cost overrun of Rs.3,340 lakhs. Here is a 51.38 per cent increase in cost over the original estimate (Table 4.5).

Out of the five public sector industrial units studied, four resulted in considerable extent of time-lag and cost overrun. But only one unit ie., the KSWIL unit was completed without any time-lag and cost overrun. This has happened so because its work has the technical and

Table 4.5

Time Lag and Cost Overrun of Industries in Kerala

Sl. No.	PROJECT	Year of project sanction/ fund sanction	Original year of completion	Gestation period original (month)	Actual year of completion	Time over-run in months	Time over-run as % over the original	Original cost Rs.	Actual cost	Cost over-run in Rs.	Cost over-run as % over the original
1.	Kerala Minerals and Metals Ltd. (KMML)	Apr.1978	Mar.1982	47	Jan.1985	34	72.34	6499.88	9840.00	3340	51.38
2.	Kerala State Drugs and Pharmaceuticals Ltd. (KSDP)	Mar.1979	Jan.1981	24	Oct.1983	33	137.5	500.00	943.62	443.62	88.72
3.	Malabar Cements Ltd. (MCL)	Apr.1980	Apr.1982	24	Oct.1984	30	125	3350.00	5400.00	2050	61.19
4.	Carbon and Chemicals India Ltd. (CACIL)	Mar.1981	Oct.1982	20	Jan.1984	15	75	1250.00	1774.00	524	41.92
5.	Kerala State Wood Industries Ltd. (KSWIL)	Apr.1982	Apr.1983	12	Apr.1983	0	0	555.00	555	0	0
6.	Malabar Building Products Ltd. (MBPL)	1984-85	Apr.1986	16	Apr.1986	0	0	575	575	0	0
7.	Masoneilan India Ltd. (MIL)	1984-85	May 1985	12	Apr.1985	-2	0	475	520	45	9.47
	TOTAL					112	88.1	13204.88	19607.62	6402.62	49.15
	Total Sl.No.1-5 (Govt. Companies)							12154.88	18512.62	6357	52.30
	Total Sl.No.6 and 7 (Private Projects)							1050	1095	45	0.428

Source: Compiled from the Company documents.

managerial advice from a private sector unit of similar nature.

The extent of time-lag is high in the case of public sector industries. The overall time overrun of the five projects as percentage increase over the original is 88.1 per cent.

An analysis of the two private sector industries reveals that one project has no time lag and cost overrun while the other unit has a negative time-lag and no cost overrun (Table 4.5). Though one cannot generalise the findings by studying just two samples, this points to the fact that time-lag and cost overrun in project implementation in the private sector is generally very negligible and sometimes even negative.

The five industrial undertakings of Government of Kerala have an estimated cost of Rs.12,154.88 lakhs. But the actual cost has increased to Rs.18,512.62 lakhs. The cost overrun over the estimated expenditure of Rs.12,154.88 lakhs amounted to Rs.6,357 lakhs making an increase of 52.30 per cent over the original estimated amount (Table 4.5).

The cost overrun as percentage increase over the original estimated cost of all the completed HEPs comes to 115 per cent (Table 4.3), and that of all the completed irrigation projects to 27.33 per cent, and that of the five completed public sector industries to 52.30 per cent, and that of the two completed private sector industries to only 0.428 per cent (Table 4.6).

Table 4.6

Time Lag and Cost Overrun of Completed Projects in Kerala

(Time lag and cost overrun as percentage increase over the original estimated amount)

Sl. No.	Particulars	Time-lag	Cost overrun
1.	12 Completed hydroelectric projects of Kerala	62.71%	115.89%
2.	10 Completed irrigation projects	191.66%	27.33%
3.	5 Industries (Public Sector)	88.1%	52.30
4.	2 Industries (Private Sector)	20%	0.428
5.	15 Ongoing hydroelectric projects	127.47	85.46
6.	17 Ongoing irrigation projects	359	532.64

Source: Compiled from Tables 4.1, 4.3 and 4.5.

The item-wise split-up of cost overrun of industries (Table 4.7) reveals that the pre-operative expenses is the single largest contributor of cost overrun in most of the industries studied.

Time-lag and Cost Overrun--A Comparative Analysis

Time-lag of the 10 completed irrigation projects shows 191.66 per cent increase over the original schedule (Table 4.1). Time-lag of the 12 completed hydroelectric projects amounts to 62.71 per cent increase over the original scheduled period (Table 4.3). The 15 ongoing hydroelectric projects resulted in a cost overrun of 127.47 per cent of the original estimate (Table 4.4). The four industrial units also have an 88.1 per cent increase in time over the original time schedule.

A comparative study of time-lag of completed HEP and ongoing HEP shows that time-lag is very high in the case of ongoing HEP and it increased from 62.71 per cent to 127.47 per cent (Table 4.6) and is expected to increase further since the projects are not yet completed. So a project wise study of time-lag and cost overrun of HEP is carried out in chapter five.

Table 4.7

The Item-wise Project Cost Overrun of Industries in Kerala

(Rs. in lakhs)

Sl. No.	PROJECT Particulars	KMML		KSDP		MCL		CACIL		MIL	
		Rs.	Percent-age over the original	Rs.	Percent-age over the original	Rs.	Percent-age over the original	Rs.	Percent-age over the original	Rs.	Percent-age over the original
1.	Land and site development	54.78	52.74	13.67	210.63	2.84	31.98	6.72	36.09	6.94	31.83
2.	Building	481.41	104.06	109.93	190.28	533.09	118.96	53.61	143.3	39.8	92.12
3.	Plant and Machinery	869.00	31.45	80.96	47.11	427.29	25.79	197.19	40.32	59.2	39.46
4.	Technical know-how for Engineers	159.79	19.86	19.89	45.20	12.97	35.82	19.08	17.46	-43.38	-133.36
5.	Miscellaneous Fixed Assets	773.42	75.92	83.10	73.89	225.51	52.44	88.44	41.38	4.11	9.13
6.	Preliminary expenses	1.25	21.73	-0.20	-0.4	-12.00	-66.6	5.92	34.37	-26.87	-76.77
7.	Pre-operative expenses	1417.75	206.48	168.08	310.39	916.10	161.78	217.59	122.58	--	--
8.	Provision for contingencies	-514.22	-100	-39.50	-100	-138.38	-100	-154.13	-100	--	--
9.	Margin money for working capital	9.7	97.97	17.69	75.89	47.58	100.33	89.58	270.71	5.20	10.4
10.	Commissioning expenses	--	--	--	--	35	100	--	--	--	--
	Total	3340.18	51.38	443.62	88.72	2050.00	61.19	524.00	41.92	45	9.47

KMML - Kerala Metals and Minerals Ltd., KSDP - Kerala State Drugs and Pharmaceuticals Ltd., MCL - Malabar Cements Ltd., CACIL - Carbon and Chemicals India Ltd., MIL - Masoneilan India Ltd.

Source: Collected from Project Documents.

Chapter 5

TIME-LAG AND COST OVERRUN OF HYDROELECTRIC PROJECTS OF KERALA--A PROJECTWISE STUDY

There are 12 completed hydroelectric projects and 16 ongoing hydroelectric projects in Kerala. A project based microlevel study of time-lag and cost overrun of these projects is carried out here.

I. Time-lag and cost overrun of completed hydroelectric projects

Project No.1: Pallivasal Hydroelectric Project

This is the first public sector hydroelectric project in Kerala. The first stage of the Pallivasal hydroelectric scheme included the construction of the dam, water tunnel of about 10,000 feet long, one penstock, two generating sets of 5000 KVA each, two step-up transformers of 2500 KW each and 95 miles of transmission lines (Kerala Five Year Plan 1958).

The project which started in 1933 had an original estimated cost of Rs.70.76 lakh which included interest charges for the period of construction of the project. The itemwise estimated cost of the project is given in Table

5.1. The first stage of the project was completed in 1940-41 at a cost of Rs.136.2 lakhs (Mathew, 1977). The cost overrun of Pallivasal hydroelectric project is given in Table 5.2. The project resulted in a cost overrun of Rs.65.44 lakhs.

The later stages of Pallivasal project were completed during 1942, 1948, 1949 and 1951 with a total installed capacity of 37.5 MW and a firm capacity of 32.5 MW. During 1940-49 a sum of Rs.570.41 lakhs was invested on the project.

Project No.2: Sengulam Hydroelectric Project

This is a tail water development of the existing Pallivasal scheme. The project work started in 1944-45 (Mathew, 1977). The execution of the project started in 1947 (Kerala Five Year Plan, 1958). The installed capacity of the project is 48,000 KW. Before the first five year plan an amount of Rs.140 lakhs had been spent on the scheme. The total expenditure on the project during the first five year plan was Rs.257.28 lakhs. The total cost of the project is Rs.399.11 lakhs. All the finishing works of the project was completed only by 1957-58, though power generation was started in 1954. The details of time-lag and cost overrun of Sengulam project is presented in Table 5.3.

Table 5.1

Item-wise Details of the Original Estimated Cost of Pallivasal Project Stage I

(Rs. in lakhs)

Sl.No.	Particulars	Amount
1.	Dam work	31.73
2.	Transmission	20.07
3.	Distribution	5.96
4.	Supervision	3.00
5.	Contingencies	2.50
6.	Miscellaneous + Interest on Capital Outlay	5.50
	Total	70.76

Source: 1. Mathew, E.T. "Power Development in Kerala", Social Scientist, Vol.6, No.2.

Table 5.2

Time-lag and Cost Overrun of Pallivasal Hydroelectric Project Stage I

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1933
2.	Year of completion	1940-41
3.	Total period for completion	8 years
4.	Original estimated cost of the scheme	Rs.70.76
5.	Actual cost of the scheme	Rs.136.2
6.	Cost overrun in Rs.	Rs.65.44
7.	Cost overrun as percentage increase over the original	92.48%

Source:1. Kerala Five Year Plans (1958-59), Irrigation and Power, Dept. of Public Relations, Govt. of Kerala, Trivandrum.
2. Annual Reports (1976-80), KESB, Trivandrum.

Table 5.3

Time and Cost Overrun of Sengulam Hydroelectric Project

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1944-45
2.	Year of completion	1954
3.	Gestation period of of the project	10 years
4.	Estimated cost of the project	364.73 lakhs
5.	Final cost of the project	399.11 lakhs
6.	Cost overrun in Rs.	34.38 lakhs
7.	Cost overrun as a percentage increase over the original	9.42%

Source: 1. Kerala Five Year Plan (1957-59), Irrigation and Power, Dept. of Public Relations, Govt. of Kerala, Trivandrum.

Project No.3: Neriamangalam Hydroelectric Project

The Neriamangalam scheme contemplates the diversion of the Mudirapuzha river at Kallarkutty where the river Kallar joins Mudira Puzha, at about three miles down stream of the Vellathuval power house of the Sengulam project. The tail water of the Sengulam hydroelectric power station together with the run off from 191 sq. miles of catchment below Munnar is proposed to be utilised in the scheme. The power house is located just below the Panamkutty junction. Three generating sets each of 15000 KW are installed. The cost of the scheme was estimated to be Rs.290 lakhs and an amount of Rs.274 lakhs was provided in the second plan (Kerala Five Year Plan 1958). The project was expected to be completed by 1958-59. But the 3rd unit was commissioned only by the 3rd plan ie., in 1963-64. But the first two generation units were commissioned in 1960-61.

The commissioning of the third unit was delayed because of the damage caused to it and it was returned to Switzerland and got repaired only by 1963 (Govt. of Kerala, Report 1963-64). The extent of time-lag and cost overrun of the project is given in Table 5.4. The Neriamangalam hydroelectric project has resulted in a time-lag and cost overrun of 125 per cent and 24.13 per cent over the original estimated level, respectively.

Table 5.4

Time-Lag and Cost Overrun of Neriamangalam Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1955
2.	Scheduled date of commissioning	1958-59
3.	Actual period of completion	1963-64
4.	No. of years taken for completion	9
5.	Scheduled No. of years for completion	4
6.	Time overrun in years	5
7.	Time overrun as % increase over the original	125%
8.	Initial estimated cost of the project	290
9.	Actual cost of the project	360
10.	Cost overrun of the project	70
11.	Percentage increase in cost over the original estimated amount	24.13%

Source: 1. Third Five Year Plan (1963-64), Third Year's Progress Report, State Planning Board, Govt. of Kerala, Trivandrum
2. Krishna Aiyer, S. (1975), Keralathinte Sampath Vyavastha, Bhasha Institute, Trivandrum.

Project No.4: The Panniar Hydroelectric Project

The scheme envisages the construction of two dams, one at Anayirikal and the other at Ponmudi and a water conductor system (tunnel) and penstock. The power house is constructed in the left bank of Mudirapuzha river almost opposite to be Sengulam power house, consisting of two generating units of 30,000 KW, 15,000 units each. Both the units were planned to be commissioned by 1960-61 but were completed only by 1963 (Third Five Year Plan a Review 1964). The total cost of the project comes to Rs.280.25 lakhs (Five Year Plan,1958). The extent of time-lag and cost overrun of Panniar hydroelectric project is given in Table 5.5. The project had a cost overrun of 124.79 per cent over the original cost and a time-lag of 40 per cent over the original time schedule.

Project No.5: Peringalkuthu Hydroelectric Project

The scheme is meant for the development of power from the Chalakudy river by creating a reservoir of 1200 m.c.ft. storage capacity in the Chalakudy river basin where it is joined by Anakkayam stream (Kerala Five Year Plan, 1958). The power house has an installed capacity of 24,000 KW, and is located down stream at the foot of the Peringalkuthu falls.

Table 5.5

Time-Lag and Cost Overrun of Panniar Hydroelectric Project

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1956
2.	Expected year of commissioning	1960-61
3.	Actual year of commissioning	1963
4.	Gestation period of the project	7 years
5.	Original scheduled period of commissioning	5 years
6.	Time overrun in years	2
7.	Percentage increase over the original	40
8.	Original cost of the project	280.25 lakhs
9.	Actual cost of the project	630 lakhs
10.	Cost overrun in Rs.	349.75 lakhs
11.	Cost overrun as percentage increase over the original	124.79%

Source:
1. Third Five Year Plan (1964)--A Review, Planning Department, Govt. of Kerala, Trivandrum.
2. Kerala Five Year Plan II Irrigation and Power (1958), Dept. of Public Relations, Govt. of Kerala, Trivandrum.
3. Krishna Aiyer, S. (1975), Keralathinte Sampath Vyavastha, Bhasha Institute, Trivandrum.

Table 5.6

Time-Lag and Cost Overrun of Peringalkuthu Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1946
2.	Expected year of commissioning	1955-56
3.	Actual date of completion	1957-58
4.	Total period taken for commissioning	12 years
5.	Total period as per original scheduling	9
6.	Time overrun in years	3
7.	Percentage increase over the original	30%
8.	Estimated cost	306.27
9.	Actual cost of the scheme	340.23
10.	Cost overrun in Rs.	33.96
11.	Percentage increase over the original	11.08%

Source: 1. <u>Report of the High Level Committee on Industry, Trade and Power</u> (1984), Vol.III, Govt. of Kerala, Trivandrum.
2. Krishna Aiyer, S. (1975), <u>Keralathinte Sampath Vyavastha</u>, Bhasha Institute, Trivandrum.

The scheme was taken up for execution in 1946 at an estimated cost of Rs.306.27 lakhs. The expenditure prior to the commencement of the first five year plan amounted to Rs.125 lakhs and the expenditure during the first five year plan was Rs.175.23 lakhs. Including the provision in the second plan an amount of Rs.340.28 lakhs was spent on the project. The project was originally programmed to be completed by the end of the first five year plan. But due to delay in the supply of penstock and generating plant, the commissioning of the project was delayed until the beginning of the second plan. A provision of Rs.40 lakhs was made in the second plan.

All the three generating sets, each of 800 KW, were commissioned during the first quarter of 1957-58. The first generating unit was commissioned on 6th March 1957. The other units were commissioned in the first half of the second plan, i.e., by 1957-58 (Govt. of Kerala, Report of the High Level Committee, 1984).

Project No.6: Sabarigiri Hydroelectric Project

This is the first hydroelectric project in the Pamba basin. The project consists of two dams, one across the Pamba and the other across the Kakki, a tunnel inter-connecting the Pamba and the Kakki reservoirs, a power tunnel taking off water from the Kakki reservoir into the penstocks and a power house with an installed capacity of 300,000 KW from 6 generating units of 50,000 KW each (Fourth Five Year Plan, 1966-71). The power house is located on the bank of Moozhiar.

The preliminary works on the first stage of the project were started in the second plan. The scheme was sanctioned in August 1960 and works were started in full swing in March 1961 and commissioned on 28th August 1967. The first unit was commissioned in April 1966, the second unit was completed in 1967-68.

The extent of time-lag and cost overrun of the project is worked out in Table 5.7.

Project No.7: Sholayar Hydroelectric Project

The project consists of a dam across Sholayar, diverting water to drop down to a power house located on the right bank of Anakkayam stream. The power station has an installed capacity of 54,000 KW with three generating sets of 18,000 KW each. The first unit of the project was

Table 5.7

Time-Lag and Cost Overrun of Sabarigiri Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1960-61
2.	Scheduled year of commissioning	1963-64
3.	Actual year of commissioning	28-8-1967
4.	Years of construction	6
5.	Time lag as percentage increase over the original	100%
6.	Original estimated cost	2491
7.	Revised cost	4283
8.	Cost overrun in Rs.	1792
9.	Cost overrun as percentage over the original	71.94%

Source:
1. Sabarigiri Hydroelectric Project (1977), Technical Completion Report, Vol.I, KSEB, Trivandrum.
2. Sabarigiri Hydroelectric Project (1960), Project Report, KSEB, Trivandrum.

commissioned in May 1966 and second unit in 1968.

The cost of the project was estimated to be Rs.391 lakhs (Kerala Five Year Plan II, 1958). But the total cost of the project has increased to Rs.668 lakhs.

The construction was started during the second plan, i.e., 1958-59, but the work gathered momentum only during the third plan after the settlement of the question of sharing the water in the catchment area with Tamil Nadu (Govt. of Kerala Draft IV Five Year Plan, 1966-71). The time-lag and cost overrun of the project is presented in Table 5.8.

Project No.8: Kuttiadi Hydroelectric Project

This project envisages the development of power from the Kuttiadi river in Malabar. Under this scheme a reservoir would be formed in the Kuttiadi river and the water would be diverted through a tunnel and pipeline to a power house to be located on the banks of Kakkayam stream, a tributory of Kuttiadi river. The power house has an installed capacity of 75,000 KW from three generators of 25,000 KW each (Fourth Five Year Plan - A Draft Outline, 1966-71).

Table 5.8

Time-Lag and Cost Overrun of Sholayar Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of starting the scheme	1958-59
2.	Originally planned year of commissioning	1964-65
3.	Actual year of commissioning	5-6-1968
4.	Total period of commissioning	
5.	Time overrun	4 years
6.	Percentage increase over the original	66.6
7.	Original cost of the project	391
8.	Expenditure upto 1965-66	668
9.	Cost overrun in Rs.	277
10.	Percentage increase over the original	70.84

Source:
1. Kerala Five Year Plan II (1958), Irrigation and Power, Dept. of Public Relations, Govt. of Kerala, Trivandrum.
2. Economic Review (1959), Govt. of Kerala, Trivandrum.
3. Fourth Five Year Plan (1966-71) A Draft Outline, Planning Department, Govt. of Kerala, Trivandrum.

The work on the project was started in 1964-65 and the first unit was expected to be commissioned in 1967-68. The project was scheduled to be completed in all respects by 1968-69. But actually the commissioning of the project took place in September 1972 (Economic Review, 1972).

The Kuttiadi hydroelectric project had a time-lag of 60 per cent over the original time schedule and had a cost overrun of 28.5 per cent over the original estimate (Table 5.9).

Project No.9: Idukki Hydroelectric Project Stage I

This project envisages the construction of three dams, one across the Periyar at Idukki, the other across the Cheruthoni river and the third at Kulamavu to form a single reservoir. The water would be diverted through a tunnel and pressure shaft to an underground power house at Moolamattom. The power house will have an installed capacity of 390,000 KW in three generating units in the first stage. The sanction for the first stage of the project was granted in January 1963 (Fourth Five Year Plan, 1966-71). The revised scheme contemplates an underground power station with three units of 130 MW in the first

Table 5.9

Time-Lag and Cost Overrun of Kuttiady Hydroelectic Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1964-65
2.	Expected year of commissioning	1968-69
3.	Original expected years for commissioning	5
4.	Actual period of commissioning	1972 Sept.
5.	Actual years for commissioning	8 years
6.	Time overrun in years	3 years
7.	Percentage increase over the original	60
8.	Estimated cost of the project	700
9.	Actual cost of the project	900
10.	Cost overrun in Rs.	200
11.	Cost overrun as percentage of the original	28.5

Source: 1. Economic Review (1976), State Planning Board, Govt. of Kerala, Trivandrum.
2. Planning Cell, KSEB, Trivandrum.

stage.

The time-lag and cost overrun of the project is presented in Table 5.10. The project resulted in a time-lag of 30% and a cost overrun of 74.70% over the original estimated level.

Project No.10: Idukki Hydroelectric Project Stage II

The project envisages the installation of additional three units of 130 MW each in the existing Idukki power station. All three power generating units had to be imported from Canada. The project was aided by the Government of Canada and the aid agreement between the Government of India and the Government of Canada had been signed. Foreign consultants had also been appointed.

During the first stage itself most of the civil works for the second stage were also completed. The project was sanctioned in 1979 (Economic Review, 1981). The sixth plan envisaged to commission the Idukki Stage II in 1984-85 (Report of the High Level Committee, 1984).

The original cost of the project was estimated to be Rs.2,418 lakhs (Economic Review, 1979). This went up to Rs.3,168 lakhs in 1980 and Rs.8,000 lakhs in 1982 (Economic

Table 5.10

Time-Lag and Cost Overrun of Idukki Hydro-electric Project Stage I

Sl.No.	Particulars	Year/Amount
1.	Year of starting (sanctioning)	1963
2.	Expected year of commissioning	1973
3.	Year of commissioning	12-2-1976
4.	Estimated period for completion	10 years
5.	Actual period for commissioning	13 years
6.	Time overrun	3 years
7.	Percentage increase over the original	30
8.	Estimated cost	Rs.6265 lakhs
9.	Revised cost (1965-66)	Rs.6820 lakhs
10.	Refixed cost	Rs.9000 lakhs
11.	Expenditure upto 31-3-1976	Rs.9169.51 lakhs
12.	Latest estimated amount	Rs.11500 lakhs
13.	Cost overrun in Rs.	Rs.4680 lakhs
14.	Percentage cost overrun over the original	74.70%

Source:
1. Annual Report (1975-77), KSEB, Trivandrum.
2. Fourth Five Year Plan (1966-71) A Draft Outline, Planning Department, Govt. of Kerala, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.
4. Krishna Aiyer, S. (1975), Keralathinte Sampath Vyavastha, Bhasha Institute, Trivandrum.

Review, 1982). By 1982 contracts were made for construction. Machinery parts reached the site from Canada in the same year itself.

It was expected that the fourth unit could be commissioned in December 1984, fifth unit in March 1985 and the sixth unit in June 1985. But in reality the fourth and fifth units could be commissioned only in 1986 and the sixth unit in 1987.

The time-lag and cost overrun of the project are presented in Table 5.11.

Project No.11: Idukki Hydroelectric Project Stage III

This scheme envisaged the augmentation of the Idukki reservoir by diversion of water from Kallar and Erattayar streams to yield additional power of 376 Mu annually at the Idukki power station.

This scheme consisted of constructing two dams--Erattayar diversion dam and Kallar diversion dam and construction of two tunnels (diversion system) - Kallar Idukki tunnel (2.96 km) and the Erattayar tunnel (diversion system) (3803 m long) (Planning Cell, KSEB, Trivandrum).

Table 5.11

Time-Lag and Cost Overrun of Idukki Hydro-electric Project Stage II

Sl.No.	Particulars	Year/Amount
1.	Year of starting	1979
2.	Expected year of commissioning 1982 based expectation	1985
3,	Actual year of commissioning	1987
4.	Gestation period of the project	8 years
5.	Gestation period as per the 1982 schedule	6 years
6.	Time overrun in years	2 years
7.	Percentage increase over the original	33%
8.	Original cost of the project	Rs.2418/-
9.	Actual cost of the project(1982 revision)	Rs.8,000/-
10.	Cost overrun in Rs.	Rs.5,582/-
11.	Percentage increase over the original estimated cost	230.85%

Source:
1. Project Report (1978), Idukki Hydroelectric Project Stage II, KSEB, Trivandrum.
2. Economic Review (1975-1978), State Planning Board, Govt. of Kerala, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.

The Kallar diversion system mainly consisted of a masonry gravity dam 12.2 m high across Kallar and an unlined tunnel 2.96 km long and 5 m diameter to divert water from Kallar to Erattayar.

The Erattayar diversion system comprised of a masonry gravity dam 19.8 m high across Erattayar and an unlined tunnel (3.8 km long and 6 m dia) to divert water from Erattayar to Idukki reservoir.

The Idukki Stage III scheme was approved by the Planning Commission at an estimated cost of Rs.410 lakhs in 1975. The preliminary work on the project was started in 1975-76 (KSEB Annual Report, 1976-77). But the major work was started only in 1976-77. The project was originally planned to be completed in 1979-80. But possession of land for most of the work sites was obtained only by the end of 1976-77 (Economic Review, 1977).

In respect of the Erattayar-Idukki tunnel the progress of work as on December 1979 was 3760 m as against the total length of 3803 m. In Erattayar dam by 1979 only 10942 m^3 of earth work excavation and 8061 m^3 of rock excavation were done. In Kallar-Erattayar tunnel, only 488 m length was driven out of a total length of 2965 m. The land required for the Kallar dam was taken possession of only by 1979. This is the position of the scheme at the time when it ought to have already been commissioned according to the original schedule.

Labour problems, termination of existing contract and delay related to retendering and awarding the contract, the delayed transfer of forest land etc. are the contributory factors to this state of affairs.

By 1981, the revised time schedule for completion of the Erattayar diversion system (the 3803 m long tunnel) had been over. But only 27% of the construction work of the dam could be completed by 1981. This was due to labour trouble, and the problems connected with rehabilitation of the evicted people. In respect of Kallar diversion system, the tunnel work had progressed and 2499 m had been completed out of 2960 m by 1981. The construction of Kallar diversion dam was also behind schedule (Economic Review, 1981). So in 1981 the schedule of commissioning was again revised and rescheduled to complete the work by 1982-83 at a revised cost of Rs.1,055 lakhs (Table 5.12).

Table 5.12

Cost and Time Revisions of Idukki Stage III

Year	Cost revision	Time revision for completion
1975	410	1979-80
1977	875	1980-81
1981	1055	1983-84
1982	1176	1983-84
1985	1300	3/1987
1987	1459	3/1988
1989	1511	1989-90

Source: 1. Economic Review (1985-1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Annual Reports (1976-1990), KSEB, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.

Even this revised project commissioning schedule could not be kept because of several reasons. The construction of Kallar dam was commenced only during 1981-82 and about 40% of the work was completed by August 1982. The work was even abandoned by the contractor demanding higher revised rates.

The 2905 m long Kallar tunnel is more or less completed except for a length of 60 m, which would have been completed by June 1982, had it not been delayed due to labour strike (Economic Review, 1982).

The 3803 m Erattayar tunnel was completed in 1979-80 and the diversion was effected during the monsoon of 1979-80. But in February 1981 the Erattayar dam work was stopped due to labour strike, at a time when 27% of the work was over (Economic Review, 1982).

By 1983 about 56% of the Kallar diversion dam work was over. The 1983 revised commissioning date of the project was April 1984.

By the end of March 1984, the diversion tunnel works were completed and 75 per cent of Kallar and 25 per cent of Erattayar dam work was over (Economic Review, 1984). This is the picture of the project at the revised date for commissioning, i.e., in March 1984.

With effect from August 1984, partial diversion of water to Idukki reservoir was effected by providing bunds across the streams and the power content of this diverted water is 175 Mu. By 1984, most of work of the Kallar diversion dam was completed, but Erattayar dam works were held up from August 1981. The work had again to be retendered and completed.

The Time-lag and Cost Overrun of Idukki Stage III

Idukki Stage III suffered seven cost revisions during 1975 to 1989 (Table 5.12). The project had six time revisions also during the same period (Table 5.12). The year-wise time and cost revisions of the project is presented in Table 5.12. This table reveals that compared to the number of time revisions, the number of cost revisions are higher.

The Expenditure on Idukki Stage III

The cumulative expenditure on the project is given in Table 5.13. It can be seen that the annual allotment of funds to the project during some years was comparatively

Table 5.13

Cumulative Expenditure on Idukki Stage III

Year	Cumulative Expenditure
1976-77	312
1977-78	359
1978-79	585
1979-80	752
1980-81	814
1982-83	1055
1983-84	1068
1989-90	1511

Source:
1. Economic Review (1978-81), State Planning Board, Govt. of Kerala, Trivandrum.
2. Planning Cell, KSEB, Trivandrum.
3. Seventh Plan Draft (1980), State Planning Board, Govt. of Kerala, Trivandrum.

low. It is also found that in certain years the funds provided for the project are not fully utilised, for example, during the year 1978-79, an amount of Rs.350 lakhs was provided for the project, but it actually utilised only Rs.226 lakhs.

The Time-lag and Cost Overrun of Idukki Stage III

The original estimated cost of the project was Rs.410 lakhs, but it has increased to Rs.1,511 lakhs causing a cost overrun of Rs.1,101 lakhs (268.5 per cent increase over the original). The initial gestation period of the project was five years, but the same has increased to 15 years, resulting in a time-lag of 10 years. This comes to be about 200% increase over the original schedule (Table 5.14).

Project No.12: Idamalayar Hydroelectric Project

Idamalayar project is a low head hydroelectric scheme taken up in Idukki district of Kerala. The project, in brief, comprises of creation of a reservoir of 1153 million cum. capacity by construction of a 91 M high concrete dam across Idamalayar river and diversion of this water through a water conductor system consisting of 1741 M long tunnel and 151.5 M long penstocks to the 75 MW

Table 5.14

Time-Lag and Cost Overrun of Idukki Stage III

Sl.No.	Particulars	
1.	Year of sanctioning	1975
2.	Commencement of work	1975-76
3.	Originally planned year of commission	1979-80
4.	Actual year of commissioning	1989-90
5.	Total period taken for commissioning	15 years
6.	Original planned year of commissioning	5 years
7.	Extent of time-lag in years	10 years
8.	Percentage increase over the original	200%
9.	Original estimated cost of the project	410
10.	Actual cost of the project	1511
11.	Extent of cost overrun	1101
12.	Percentage increase over the original cost	268.5%

Source:
1. Economic Review (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
2. Annual Reports (1976-82), KSEB, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.

generating station located on the left bank of Idamalayar to produce 331 Mu of power per annum (Idamalayar Project Fact Sheet, 1987).

Idamalayar hydroelectric project resulted in five time revisions and five cost revisions leading to heavy time-lag and cost overrun (Table 5.15).

The project was originally scheduled to complete in 1982, but was completed only in 1987, resulting in a time overrun of 55.5 per cent over the original (Table 5.15). The original estimated cost of the project was Rs.2,340 lakhs but has increased to Rs.9,003 lakhs resulting in a cost overrun of 284.74 per cent over the original estimate (Table 5.16).

Table 5.15

Time-Lag and Cost Revisions of Idamalayar Hydro-electric Project

Sl.No.	Particulars	Year
1.	1975 estimated date of completion	1982
2.	1977 revised date of completion	1982-83
3.	1981 revised date of completion	1983-84
4.	1985 revised date of completion	1986
5.	1987 revised date of completion	1987
6.	1973 original estimated cost of the project	2340
7.	1982 revised cost	4850
8.	1983 revised cost	5640
9.	1985 revised cost	8900
10.	1987 revised cost	9003

Source: 1. KSEB Idamalayar Project Office, Kothamangalam.
2. Planning Cell, KSEB, Trivandrum.
3. Economic Review (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.16

Time-lag and Cost Overrun of Idamalayar Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	1973
2.	Commencement of main work	1975-76
3.	Scheduled year of completion planned in 1975-76	1982
4.	Actual date of completion	Feb. 1987
5.	Time overrun as % increase over the original	55.5%
6.	Original estimated cost (as in 1973)	2340
7.	Actual cost	9003
8.	Cost overrun	6663
9.	Cost overrun as percentage increase over the original	284.74%

Source:
1. KSEB Idamalayar Project Office, Kothamangalam.
2. Planning Cell, KSEB, Trivandrum.
3. Economic Review (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.

II. The Time-lag and Cost Overrun of Ongoing Hydroelectric Projects -- Kerala State

Sabarigiri Augmentation

This is a diversion scheme which envisages the diversion of water of the Kullar, Gaviar and Meenar rivers into the existing Pamba reservoir and diversion of water from upper Moozhiyar stream in to the existing Kakki reservoir. The augmented storage available by this diversion will enable additional power generation to the tune of 125 Mu per annum at the existing Sabarigiri power station (Economic Review, 1980). The scheme involves the construction of four dams and two tunnels.

The diversion of water to Kakki reservoir commenced in May 1979 (Economic Review 1979). But the works relating to the Pamba diversion scheme were affected very badly due to labour problems, contract failures, non-availability of forest land for work site etc. This caused slippages in the completion schedule (Economic Review, 1982). The 2104 m long Gaviar Meenar diversion tunnel is the critical part of the work of this scheme. After failure of an earlier contract, a new contract had been arranged in 1981-82 at a time when the project was scheduled to be completed. Though the main works of the Gaviar dam had been completed during 1981-82, works on Kullar, Meenar I and Meenar II dams were still in various stages of construction.

Time-lag and Cost Overrun of Sabarigiri Augmentation Scheme

The original estimated cost of the project was Rs.129 lakhs. As per the latest (1988) estimate the cost of the project has increased to Rs.1,122 lakhs which results in a cost overrun of Rs.993 lakhs. This comes to about 769.77 per cent increase in cost over the original estimate (Table 5.17).

The project was started in 1972 and was scheduled to be completed in 1981. The 1989 revised date of completion of the project is December 1991, which brings in a time-lag of about 10 years (Table 5.17).

The Time and Cost Overrun of Sabarigiri Augmentation

The time and cost revisions of the project are furnished in Table 5.18, which show that compared to time revisions, cost revisions are more frequent. Further, it can be noticed that there were cost revisions in every year except during 1984 and 1985.

Table 5.17

Time-lag and Cost Overrun of Sabarigiri Augmentation Scheme

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	1972
2.	Year of starting preliminary works	1972
3.	Year of starting major works	1976-77
4.	Original expected year of commissioning	--
5.	1979 Expected year of commissioning	Jan. 1981
6.	1989 Expected year of commissioning	Dec. 1991
7.	Total years taken for commissioning as per 1989 estimation	19 years
8.	Expected period of commissioning as per 1979 estimation	9 years
9.	Time-lag in years	10 years
10.	Time overrun as % increase over the original	111%
11.	Original cost of the project	Rs.129.00
12.	1988 estimated cost of the project	Rs.1122.00
13.	Extent of cost overrun in Rs.	Rs.993.00
14.	Cost overrun as % increase over the original	769.77%

Source:
1. Annual Reports (1973-78), KSEB, Trivandrum.
2. Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
3. Economic Review (1988-90), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.18

Time and Cost Revisions of Sabarigiri Augmentation Scheme

(Rs. in lakhs)

Year	Cost revision	Time revision for commission
1979	127	1981
1980	313	--
1981	450	1983-84
1982	614	--
1983	634	1985-86
1986	856	--
1987	966	--
1988	1122	1990
1989	--	1991

Source: 1. Economic Review (1980-90), State Planning Board, Govt. of Kerala, Trivandrum.
2. Annual Plan (1993-94), KSEB, Trivandrum.
3. Draft Eighth Plan (1985), State Planning Board, Govt. of Kerala, Trivandrum.

The Cash Flow to Sabarigiri Augmentation Scheme

A study of the cash flow to the Sabarigiri project during the 1979-84 period shows that,it was insufficient to meet the scheduled rate of progress of the project, particularly in the context of annual cost revisions. Further it is seen that wide variations exist in the annual allotment of funds to the project (Table 5.19).

Kakkad Hydroelectric Project

The Kakkad hydroelectric scheme is a tail race development of the existing Sabarigiri hydroelectric project. The scheme envisages construction of a 7512 m long power tunnel, a 3036 m long interconnecting tunnel, a diversion dam about 30 m high at Moozhiyar, a small forebay dam at Veluthodu, an underground pressure shaft, and a surface power house, housing two units of 25 MW each at Seethathodu. The installed capacity of the project is 50 MW and the annual generating capacity is 262 Mu (Seventh Five Year Plan 1985-90, SPB). The net annual revenue from the project is worked out to be 13.9 per cent (Fourth Five Year Plan Draft 1970-75).

Table 5.19

Cash Flow to the Sabarigiri Augmentation Scheme

Year	Rs. in lakhs
1979-80 (November 1980)	33
1980-81	61
1981-82	112
1982-83	29
1983-84	72

Source: Economic Review (1980-85), State Planning Board, Govt. of Kerala, Trivandrum.

The project was sanctioned in September 1976 and the work commenced in April 1978.

By 1981 major portion of the construction of the infrastructure work was over. Though the contract for the construction of the 3 km long interconnecting tunnel and the 7.5 km long power tunnel was awarded in October 1979 and works commenced; these contracts had to be terminated in June 1981 due to contract failure (Economic Review, 1981). Fresh contracts were arranged and the work was in full swing by July 1983 (Economic Review, 1983).

By the end of March 1984, nearly 75 per cent of the tunnel work and 90 per cent of the power house and site levelling works were completed.

There was also contract failure in respect of power tunnel and interconnecting tunnel work. So the works were slowed down. Further the Moozhiar dam had to be tendered thrice for want of acceptable tenders.

By 1989 the dam was almost completed, 74 per cent of the interconnecting tunnel driving was completed, the power house structure was almost made over, the erection of

EOT crane was completed and the erection of generating machinery started.

In 1990 the works on dams and power tunnel were completed. But the interconnecting tunnel work and the erection of generating machinery were not completed.

Out of the 3160 m, 3112 m length of interconnecting tunnel had been driven by August 1991. Tunnelling works were held up from September 1990 to September 1991 due to labour strike and so the concrete lining works were also not started till September 1991. Out of the total 7707 m, 7688 m length of power tunnel had been driven and tunnelling was held up from September 1990 due to labour strike. The driving of surge and pressure shaft have been completed. Concrete lining/steel lining works have been awarded on contract and works were on hand by September 1991 (Eighth Plan Proposals, KSEB, 1992-97). All these show that there is lack of co-ordination in project work resulting in unbalanced progress of the same.

Time-lag and Cost Overrun of Kakkad Hydroelectric Project

Time-lag and cost overrun of Kakkad hydroelectric project is given in Table 5.20. As per 1990 estimate the

Table 5.20

Time-lag and Cost Overrun of Kakkad Hydro-electric Project

(Rs. in lakhs)

Year	Particulars	Year/Amount
1.	Year of sanctioning	Sept. 1976
2.	Commencement of work	Apr. 1978
3.	Original year of commissioning	Mar. 1984
4.	1990 anticipated period of commissioning	Mar. 1994
5.	Extent of time-lag in years	10 years
6.	% increase in time	125%
7.	1990 estimated total years for commissioning	18 years
8.	Total years as per original schedule	8 years
9.	Original cost	Rs.1860.00
10.	1990 estimated revised cost	Rs.7100.00
11.	Extent of cost overrun as per 1990 estimate	Rs.5240.00
12.	% increase in cost	281.72%

Source:
1. Economic Review (1977), State Planning Board, Govt. of Kerala, Trivandrum.
2. Annual Plan (1992-93), KSEB, Trivandrum.
3. Draft Eighth Five Year Plan (1992-97), State Planning Board, Govt. of Kerala, Trivandrum.
4. Eighth Plan Proposals (1992-97), KSEB, Trivandrum.

project met with 125 per cent increase in time over the original schedule and 281.72 per cent increase in cost over the original estimated level.

The item-wise extent of cost overrun of the project is presented in Table 5.21. The power house construction resulted in the highest cost overrun of 802 per cent increase over the original.

The Time and Cost Revisions of Kakkad Hydroelectric Project

The year based time and cost overrun of Kakkad hydroelectric project are given in Table 5.22. There are six time revisions and eight cost revisions. This shows that cost revisions are more frequent than time revisions. Further, annual revisions of cost are found to exist except in a few years.

The annual and cumulative expenditure on Kakkad hydroelectric project is given in Table 5.23 which shows wide variations in the allotment of funds.

The Outlay and Expenditure of Kakkad Hydroelectric Project

The plan outlay and actual expenditure on Kakkad project during Sixth and Seventh Plans are given in Table

Table 5.21

Detailed Presentation of Cost Overrun of Kakkad Hydroelectric Project

Sl. No.	Description of activity/ contract	Approved cost	1991 anti-cipated cost	Delivery / complet-tion	Amount and % increase over the original
(1)	(2)	(3)	(4)	(5)	(6)
1.	Moozhiar Dam - concrete	131	673	completed except plugg- of construct-ion	413.7% (542 lakhs)
2.	Veluthode (Fore bay dam - concrete	68	196		188.2% (128 lakhs)
3.	Power Tunnel (Head race tunnel)				
	Excavation Concreting overt & invert Grouting, cleaning, plugging adit etc.	252	1407	Dec. 1993	458.3% (1155 lakhs)
4.	I.C. Tunnel				
	Excavation, concreting overt and invert, grouting, plugging adit etc.	128	483	Oct. 1993	277.3% (355 lakhs)

Table 5.21(contd.)

(1)	(2)	(3)	(4)	(5)	(6)
5.	Surge Shaft (Tank)				
	Excavation, concreting, steel liner etc. steel gate with hoist	39	133	Dec.1992	241% (94 lakhs)
6.	Pressure Shaft				
	Excavation, concret lining,plugging adit, steel lining	23	200	Dec. 1992	769.5% (177 lakhs)
7.	Power House				
	Excavation, concrete and masonry, finishing work	41	370	Dec.1992	802.4% (329 lakhs)
8.	Switch Yard	3	20	Dec.1992	566.6% (17 lakhs)
9.	PH Electrical Works				
	Generating unit and other electrical works	825	2104	Mar.1994	155% (1279 lakhs)

Table 5.21 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)
10.	Other Works - Building, communication, T&P, land, establishment etc.	384.5	1150	Mar. 1994	199% (765.5 lakhs)
11.	R & R Suspense etc.	(-)34.5	(-)36		
		1860	7100		281.7% (5240 lakhs)

Source: <u>Eighth Plan Proposals</u> (1992-97), KSEB, Trivandrum.

Table 5.22

The Time and Cost Revisions of Kakkad Hydroelectric Project

(Rs. in lakhs).

Year	Time revision	Cost revision
1978	Mar. 1984	Rs.1860.00
1980	--	Rs.2050.00
1981	--	Rs.2920.00
1982	1987	--
1983	--	Rs.3760.00
1984	May 1989 (I unit) 1989-90 (II unit)	--
1985	--	Rs.5000.00
1987	Sept. 1991	Rs.6948.00
1988	--	Rs.7012.00
1989	June 1992 Sept. 1992	--
1990	1992-93	Rs.7100.00

Source: 1. Economic Review (1979-1991), State Planning Board, Govt. of Kerala, Trivandrum.
2. Sixth Five Year Plan (1980-85), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.23

The Outlay and Expenditure on Kakkad Hydroelectric Project Over Plans

(Rs. in lakhs)

Plan	Agreed outlay	Actual expenditure
Sixth Five Year Plan	1500.00	1062.18
Seventh Five Year Plan	2822.00	2822.00

Source: Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.

5.23. It is found that during Sixth Plan period the actual expenditure on the project was less than the Plan outlay.

Kallada Hydroelectric Project

The Kallada hydroelectric project is a low head hydel scheme at the dam toe power station in the ongoing Kallada irrigation scheme for utilising the irrigation release for power generation. The scheme envisages the installation of a small length penstock and a power house at the toe of the dam with two units of 7.5 MW each to generate 65 Mu of energy per year (Seventh Five Year Plan, 1985-90).

The Kallada hydroelectric project was sanctioned by the Planning Commission in September 1981. During 1983-84 the preliminary and enabling works were in progress and contract had been given to BHEL for the erection of the generating machinery.

Time-lag and Cost Overrun of Kallada Hydroelectric Project

The extent of time-lag and cost overrun of Kallada hydroelectric project is given in Table 5.24. The project has a time-lag of 200 per cent and a cost overrun of 17.7 per cent over the original time and cost estimates, as per 1990 revised estimate.

Table 5.24

The Time-lag and Cost Overrun of Kallada Hydroelectric Project

(Rs. in lakhs).

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	1981
2.	Preliminary work started	1982
3.	Commencement of major work	1984
4.	Original year of commissioning	1984-85
5.	Total years for commissioning as per original schedule	4 years
6.	1990 Expected year of commissioning	1992-93
7.	Total years required for commissioning as per 1990 estimate	12 years
8.	Extent of time-lag (years)	8
9.	% increase over the original schedule	200%
10.	Original estimated cost	Rs.1180.00
11.	1990 Estimated cost	Rs.1389.00
12.	Cost overrun in Rs. as per 1990 estimate	209
13.	Cost overrun as % increase over original cost	17.71%

Source: 1. Annual Plan Proposals (1992-93), KSEB, Trivandrum.
2. Economic Review (1982-1990), State Planning Board, Govt. of Kerala, Trivandrum.

The item-wise extent of cost overrun of Kallada project is given in Table 5.25. As in the case of Kakkad project, the highest extent of cost overrun of 282.1 per cent is found in the works related to the power house.

The Cost and Time Revisions of Kallada Hydroelectric Project

The project met with five time revisions and three cost revisions till 1990 (Table 5.26). Unlike some of the earlier projects studied, the cost revisions are less compared to time revision.

The year-wise expenditure on the project is presented in Table 5.27, which exhibits fluctuations in the use of amounts.

Lower Periyar Hydroelectric Project

This scheme was sanctioned by the Planning Commission in 1983 and the work started in April 1983 at an estimated cost of Rs.8,843 lakhs. The project was originally scheduled to be commissioned in 1989.

This scheme was conceived as a tail race cum run off river scheme in the lower reaches of Periyar, just below

Table 5.25

The Split-up Cost Overrun of Kallada Hydroelectric Project

(Rs. in lakhs)

Sl. No.	Description of activity/ contract	Approved cost estimate	Now anticipated cost	Cost overrun in Rs. and as % increase over the original
(1)	(2)	(3)	(4)	(5)
I.	PENSTOCK			
A.	Cost of pipeline fixed by PWD	15	15	
B.	Extension of pipe	11.54	22.47	94.7% (10.93)
II.	Supply, erection and testing, concreting and grouting	10.96	30.53	178.5% (19.59)
		37.5	68.0	81% (30.5)
III.	Power House Building & Tail Race			
	Excavation	1.82	12.89	608.2% (11.07)
	Concreting, masonry etc.	38.87	155.63	300.3% (116.76)
	Stop log gate etc.	9.31	22.68	143.6% (13.37)
		50.00	191.2	282.4% (141.2)

Table 5.25 (contd.)

(1)	(2)	(3)	(4)	(5)
IV.	Switch Yard			
	Excavation	--	2.7	
	Concrete etc.	--	5.3	
			8.0	
V.	Power House, Electrical Works Generating Units and other electrical works	952	952	
	Other Works: Building, Road, T&P, Establishment etc.	143.45	2.95	19.86% (28.5)
	R & R	(-) 2.95	(-) 2.95	17.7% (209)
	Net Total	1180	1389	

Source: <u>Annual Plan Proposals</u> (1992-93), KSEB, Trivandrum.

Table 5.26

Cost Revision and Time Revision of Kallada

Hydroelectric Project

(Rs. in lakhs)

Year	Revised time	Revised cost
1984	1984-85	1180
1985	1987-88	1389
1987	1988-89	1389
1988	Dec.1990	1389
1990	1992-93	1389

Source: 1. Planning Cell, KSEB, Trivandrum.
2. Economic Review (1985-91), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.27

Annual Cumulative Spending on Kallada Hydroelectric Project

(Rs. in lakhs)

Year	Expenditure
1983-84	Rs.54.00
1984-85	--
1985-86	Rs.399.00
1986-87	Rs.521.63
1987-88	Rs.654.00
1988-89	--
1989-90	Rs.914.00

Source: 1. Planning Cell, KSEB, Trivandrum.
2. Economic Review (1985-91), State Planning Board, Govt. of Kerala, Trivandrum.

the Neriamangalam power station. The installed capacity, firm power and the annual power generation of the scheme are 180 MW, 56.3 MW and 493 Mu respectively (Economic Review, 1982).

The Techno-Economic clearance for the scheme from Central Electricity Authority (CEA) and environmental clearance from the Department of Science and Technology, Government of India had been received during 1982.

The scheme envisages construction of a 32 m high diversion dam across Periyar, a 12.78 km long power tunnel with associated surge shaft and pressure shaft and a power station with three units of 60 MW each (Eighth Plan Proposals, 1992-97). The scheme was partly financed by World Bank as per IBRD Loan Agreement, No.2582, signed in December 1985 (Eighth Plan Proposals, KSEB, 1992-97).

The work on the 12.78 km long power tunnel was started in 1984. Because of the strike by the labourers the works were held up from April 1985 to August 1985.

Tunnel driving was over and concrete lining had been done for a length of 9776 m by September 1991. The tunnel works were expected to be completed by April 1993.

Generating equipments were ordered with M/s.BHEL and supply of the same was in good progress. EOT crane and 3 Nos. generator transformers had already been supplied. Erection contracts were settled by September 1991.

The dam, surge shaft, pressure shaft and power house works were given on contract to M/s.NPCC in 1987. But the contractors failed to achieve any substantial progress in the execution of these works. They could not even complete the excavation works till the first half of 1991. So the contracts entrusted with M/s.NPCC had been terminated in September 1991 (Annual Plan, KSEB, 1993-94). Interim arrangements are being made to carry out the balance excavation works of dam, pressure shaft and power house on piece rate basis, till fresh contracts are settled for balance work, so as to complete it by December 1994.

Time-lag and Cost Overrun of Lower Periyar Hydroelectric project

The detailed presentation of time-lag and cost overrun of the project is made in Table 5.28. There was a 100 per cent increase in time and 63.97 per cent increase in cost over the original estimated level.

Table 5.28

Time-lag and Cost Overrun of Lower Periyar Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	1983
2.	Commencement of work	Apr. 1983
3.	Original year of commissioning	1989
4.	1991-92 Revised year of commissioning	1994-95
5.	Time-lag in years	6
6.	Time lag as % increase over the original schedule	100%
7.	Original estimated cost	Rs.8843.00
8.	1990 Estimated cost	Rs.14500.00
9.	Cost overrun in Rs.	Rs.5657.00
10.	Cost overrun as % increase over the original cost	Rs.63.97%

Source: 1. Eighth Plan Proposals (1992-97), KSEB, Trivandrum.
2. Economic Review (1983-1988), State Planning Board, Govt. of Kerala, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.

The Time and Cost Revisions of Lower Periyar Hydroelectric Project

The various time and cost revisions of Lower Periyar hydroelectric project is given in Table 5.29. Compared to cost revisions, time revisions are found to be higher in Lower Periyar hydroelectric project.

The annual cumulative expenditure on Lower Periyar project is presented in Table 5.30. In certain years very high volume of investment was made on the project, but in some other years, the same was very low.

Mattupetty Small Hydroelectric Project

The project aims at constructing a dam toe power station at the existing Mattupetty dam and utilising the water release to Munnar head works (Pallivasal power station) for power generation. The generation capacity of the project is 6 Mu annually.

The project costing Rs.292 lakhs was approved by Planning Commission in December 1985. The latest estimated cost is Rs.332 lakhs (1988). The expenditure on the project till the end of March 1991 is Rs.70 lakhs. Orders have been placed for the generating equipment. The excavation for

Table 5.29

Time Revisions and Cost Revisions of Lower Periyar Hydroelectric Project

(Rs. in lakhs)

Year	Time Revision of commissioning	Cost Revision
1983	1989	Rs.8843.00
1985	1990	Rs.10050.00
1986	1990	Rs.14500.00
1988	Sept.1991	Rs.14500.00
1989	Mar. 1992 June 1992 Sept.1992	Rs.14500.00
1990	1992-93	14500.00
1991	1994-95	14500.00

Source: 1. Eighth Plan Proposals (1992-97), KSEB, Trivandrum.
2. Economic Review (1983-1988), State Planning Board, Govt. of Kerala, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.

Table 5.30

Cumulative Annual Expenditure on the Lower Periyar Hydroelectric Project

(Rs. in lakhs)

Year	Expenditure
Till 1983-84	Rs.128
Till Mar. 1985	Rs.539
Till March 1986	Rs.758
Till March 1987	Rs.1344
Till March 1988	Rs.2910
Till March 1989	Rs.5122
Till March 1990	--
Till March 1991	Rs.8652
Till Sept. 1991	Rs.8742

Source: 1. Economic Review (1988-1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Eighth Plan Proposals (1988-1990), State Planning Board, Govt. of Kerala, Trivandrum.
3. Planning Cell, KSEB, Trivandrum.

power house building is almost over (Draft Eighth Five Year Plan, 1992-97).

The extent of time-lag and cost overrun of the project is provided in Table 5.31. As per 1988 revised estimate the project has a time-lag of 100 per cent and a cost overrun of 136 per cent over the original estimates

The various time and cost revisions of Mattupetty hydroelectric project is presented in Table 5.32. There are five time revisions and two cost revisions in the scheme.

Malampuzha Hydroelectric Project

The irrigation releases from the existing Malampuzha dam through the left bank canal is supposed to be utilised for power generation in this scheme by constructing a power house at the toe of the Malampuzha dam. The project has an annual generating capacity of 5.6 Mu.

Planning Commission accorded sanction for the scheme in December 1985. The estimated cost of the project was Rs.295 lakhs (1985) and the project was scheduled to get completed by 1987-88 (Five Year Plan, 1985-90).

Table 5.31

Time-lag and Cost Overrun of Mattupetty Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Sept.1985
2.	Year of work commencement	Nov.1986
3.	Original estimated year of completion	1987-88
4.	Sept.1991 Estimated year of commissioning	Jan. 1993
5.	Extent of time lag in years	3
6.	Time lag as % increase over the original schedule	100%
7.	Total years taken for commissioning as on Sept.1991	6
8.	Total years for commissioning as per original schedule	3
9.	Original estimated cost	Rs.292
10.	1988 Estimated cost	Rs.332
11.	Extent of cost overrun in Rs. as per 1988 estimate	Rs.40
12.	Cost overrun as % increase over the original cost	136%

Source: 1. Draft Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
2. Draft Eighth Five Year Plan (1992-97), KSEB, Trivandrum.

Table 5.32

Time Revisions and Cost Revisions of Mattupetty Hydroelectric Project

(Rs. in lakhs)

Year	Time revision	Cost revision
1985	1987-88	Rs.292
1988	Nov. 1990	Rs.332
1989	March 1991	Rs.332
1990	1991-92	Rs.332
1991	1992-93	Rs.332

Source: 1. Draft Eighth Five Year Plan (1992-97) and Annual Plan (1992-93), State Planning Board, Govt. of Kerala, Trivandrum.
2. Draft Seventh Plan (1985-90), Fifth Year Programme 1989-90, State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Eighth Five Year Plan (1992-97), KSEB, Trivandrum.

The details of time-lag and cost overrun of Malampuzha hydroelectric project are given in Table 5.33. The project has a time-lag of 133.3 per cent and a cost overrun of 16.9 per cent over the original estimated schedules.

The year-wise time and cost revisions of Malampuzha hydroelectric project is presented in Table 5.34. It shows that the project resulted in four cost revisions and five time revisions.

Azhutha Diversion

This scheme taken up as part of Idukki Stage II, envisages the construction of a small weir and diversion tunnel to divert the water of Azhutha river to Idukki reservoir to generate 57 Mu of power. The project was sanctioned in June 1986 and the work on the project started in April 1987. By 1990 the works had commenced and have been gaining momentum. Out of the 4000 m tunnel driving required 1802 m has already been completed. It is programmed to complete the works on the scheme by middle of 1993-94 (Eighth Plan Proposals, KSEB, 1992-97).

Table 5.33

Time-lag and Cost Overrun of Malampuzha Hydroelectric Project

(Rs. in lakhs).

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Dec. 1985
2.	Plan to start the work	1985-86
3.	Actual starting of the work	Apr. 1987
4.	Original schedule of project completion	1987-88
5.	1990 Expected year of completion	Sept. 1992
6.	Time-lag in years	4
7.	Time lag as % increase over the original time	133.3%
8.	1990 Based total years of completion	7 years
9.	Total years for commissioning as per original schedule	3
10.	Original estimated cost of the projects	Rs.295
11.	1988 Estimated cost	Rs.345
12.	Extent of cost overrun in Rs.	Rs.50
13.	Cost overrun as % increase over the original cost	16.9%

Source: 1. Draft Eighth Five Year Plan (1992-97), KSEB, Trivandrum.
2. Draft Seventh Five Year Plan (1985-90) Fifth Year Programme (1989-90), State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Eighth Five Year Plan (1992-97), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.34

Time Revision and Cost Revision of Malampuzha Hydroelectric Project

(Rs. in lakhs)

Year	Time Revision	Cost Revision
1985	1987-88	295
1987	1989	305
1988	Nov. 1990	345
1989	Dec. 1990	345
1990	1991-92	345

Source:
1. Draft Eighth Five Year Plan (1992-97), KSEB, Trivandrum.
2. Economic Review (1989-92), State Planning Board, Govt. of Kerala, Trivandrum.
3. Seventh Five Year Plan (1985-90) Fifth Year Programme, Govt. of Kerala, Trivandrum.

The time-lag and cost overrun of the project is presented in Table 5.35. The project has 60 per cent time-lag and 49.19 per cent cost overrun over the original. The various cost and time revisions of the project is given in Table 5.36.

Malankara Hydroelectric Project

This scheme is also known as power generation scheme under Muvattupuzha valley irrigation project. The scheme envisages the utilisation of the tail race releases from the Idukki power house and the inflow from 153 sq. kms catchment of Thodupuzha river.

The scheme envisages the generation of 42 Mu of power. The project was sanctioned in August 1986 at an estimated cost of Rs.780 lakhs. By 1990-91 the dam construction was completed and other works are now in progress (Draft Eighth Five Year Plan, 1992-97).

By 1990 the excavation for power house was completed. Tenders for power house building were invited. Also tenders have been received for supply and erection of generating equipment in 1990 (Economic Review, 1990).

Table 5.35

Time-lag and Cost Overrun of Azhutha Diversion Scheme

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning the project	June 1986
2.	Commencement of work	Apr. 1987
3.	Aug. 1938 based year of commissioning	Aug. 1991
4.	1990-91 estimated year of commissioning	1993-94
5.	Extent of time-lag in years	3
6.	Time lag as % increase over the original period	60%
7.	Total years for commissioning the scheme as per 1990-91 estimate	8 years
8.	Original cost of the project	Rs.248
9.	Latest estimated cost of the project	Rs.370
10.	Extent of cost overrun	Rs.122
11.	Cost overrun as % increase over the original	49.19%

Source: 1. Eighth Plan Proposals (1992-97) and Annual Plan (1992-93), KSEB, Trivandrum.
2. Economic Review (1987-90), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.36

Time and Cost Revisions of Azhutha Diversion Scheme

(Rs. in lakhs)

Year	Time revision	Cost revision
1987	Aug. 1991	248
1988	Aug. 1991	370
1989	Oct. 1991	370
1991-92	1993-94	370

Source: 1. Economic Review (1988-1992), State Planning Board, Govt. of Kerala, Trivandrum.
2. Draft Eighth Plan Proposals (1992-97), KSEB, Trivandrum.

The project resulted in a time-lag of 300 per cent over the original schedule, and has a cost overrun of 41.02 per cent over the original estimated amount (Table 5.37). The various time and cost revisions of the project are given in Table 5.38. There are four time revisions and three cost revisions. The time revisions are higher than the cost revisions. The cumulative expenditure on the project reveals that in certain years the allotment of funds were insufficient (Table 5.41).

Pooyankutty Hydroelectric Project

The scheme envisages the construction of a 148 m high concrete dam across Pooyankutty river and a 50 m high saddle dam to create a reservoir with an effective storage capacity of 1021 mm^3, and water conductor system comprising of 2.8 km long head race tunnel and associated surge shaft, low pressure pipe (LPP), and surface pen stocks of length 516 m and surface power station with two units of 120 MW each. The project has an annual generating capacity of 645 Mu.

Planning Commission approved the scheme in September 1986 at an estimated cost of Rs.25,000 lakhs. The expenditure on the project till the end of March 1988 was Rs.29 lakhs.

Table 5.37

Time-lag and Cost Overrun of Malankara Hydroelectric Project

(Rs. in lakhs)

1.	Date of sanctioning the project	Aug. 1986
2.	The proposed date of the work to start	1986
3.	Commencement of work	Jan. 1987
4.	Original year of commissioning	1987-88
5.	1991 Anticipated year of commissioning	Mar. 1994
6.	Extent of time-lag in years	6
7.	Time-las as % increase over the original period	300%
8.	Total years for commissioning as per 1991 expectation	8 years
9.	Total years required for commissioning as per original schedule	2 years
10.	Originally estimated cost of the project	Rs.780
11.	1990-91 Estimated cost of the project	Rs.1100
12.	Extent of cost overrun in Rs. as per 1990-91 estimate	Rs.320
13.	Time-lag as % increase over the original	41.02%

Source: 1. Draft Eighth Plan (1992-97), KSEB, Trivandrum.
2. Draft Eighth Five Year Plan (1990-95), Vol.1, State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Seventh Five Year Plan (1985-90), Annual Plan (1985-86), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.38

Time and Cost Revisions of Malankara Hydroelectric Project

(Rs. in lakhs)

Year	Time revision	Cost revision
1986-87	May 1990	780
1988	1991-92	780
1989	1992-93	997
1991-92	1993-94	1100

Source:
1. Draft Seventh Plan (1985-90), Fifth Year Programme, 1989-90, State Planning Board, Govt. of Kerala, Trivandrum.
2. Economic Review (1990), State Planning Board, Govt. of Kerala, Trivandrum.
3. Annual Plan Proposals (1992), KSEB, Trivandrum.
4. Draft Eighth Five Year Plan, annual Plan (1992-93), State Planning Board, Govt. of Kerala, Trivandrum.

The major works of the project have not been commenced for want of sanction from Government of India for the forest clearance required for the project (Seventh Five Year Plan, 1985-90).

All the formalities including proposal for compensatory afforestation as required under the Forest Conservation Act of 1980 have been promised to be fulfilled by the Board and State Government (Report, KSEB, 1991).

The cost overrun of Pooyankutty project is presented in Table 5.39.

Peppara Hydroelectric Project

The project envisages the utilisation of the drinking water supply release and the surplus yield from the existing Peppara dam for power generation. The storage reservoir at Peppara is intended for Trivandrum water supply. The project was approved by the Planning Commission in August 1986 at a cost of Rs.393 lakhs. The installed capacity of the project is 3 MW and the annual generation capacity is 11.5 Mu. The construction of the dam toe power house is in progress. EOT crane has been erected and the erection of the generating machinery is in progress (Draft Eighth Five Year Plan, 1992-97).

Table 5.39

Time-lag and Cost Overrun of Pooyankutty Hydroelectirc Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Aug. 1986
2.	Original estimated cost	Rs.25000
3.	1991-92 price level cost	Rs.35000
4.	Spill over beyond 31 March 1990	34559
5.	Cost overrun as per 199-91 estimate	10000
6.	Cost overrun as % cost over the original	40%

Source: 1. Annual Plan (1991), KSEB, Trivandrum.
2. Economic Review (1992), State Planning Board, Govt. of Kerala, Trivandrum.

The time-lag and cost overrun of Peppara project is furnished in Table 5.40. It resulted in a time-lag and cost overrun of 200 per cent and 44.64 per cent respectively over the original estimate.

The project has four time revisions and two cost revisions (Table 5.41). The cumulative expenditure on the project during 1989-91 was only Rs.12 lakhs. This is too low for a project with an estimated cost of Rs.567 lakhs expected to complete within three years.

Chimini Hydroelectric Project

The project envisages the utilisation of the regulated release from Chimini irrigation project by constructing a dam toe power station. The project was approved by the Planning Commission in August 1986 at a cost of Rs.314 lakhs. The installed capacity of the project is 2.5 MW and the annual generation capacity is 6.5 Mu. Contract has been awarded for the construction of power house building and civil works. Orders are also placed for the supply and erection of generation equipment (Draft Eighth Plan, 1992-97).

Table 5.40

Time-lag and Cost Overrun of Peppara Hydroelectric Project

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Aug. 1986
2.	Proposed date of starting	1985-86
3.	Commencement of ongoing work	Jan. 1987
4.	Original estimated year of completion	1987-88
5.	1990-91 Estimated year of completion	Mar. 1993
6.	Extent of time-lag in years	4
7.	Time-lag as % increase over the original	200%
8.	Total years for commissioning as as per Sept. 1991 estimate	6
9.	Total years for commissioning as per original schedule	2
10.	Original estimated cost (1986)	Rs.392
11.	Latest estimated cost (1985)	Rs.567
12.	Extent of cost overrun	Rs.175
13.	Time-lag as % increase over the original	44.64%

Source: 1. Draft Eighth Five Year Plan (1992-97), State Planning Board, Govt. of Kerala, Trivandrum.
2. Draft Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala Trivandrum.
3. Annual Plan Proposals (1992), KSEB, Trivandrum.
4. Economic Review (1987), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.41

Time and Cost Revisions of Peppara Hydroelectric Project

(Rs. in lakhs)

Year	Time revision	Cost revision
1986	1987-88	392
1987	1990	392
1988	1991-92	567
1989	1991-92	567
1990-91	1992-93	567

Source:
1. Economic Review (1987-90), State Planning Board, Govt. of Kerala, Trivandrum.
2. Draft Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Eighth Five Year Plan (1992-97), State Planning Board, Govt. of Kerala, Trivandrum.

The time-lag and cost overrun of Chimini hydroelectric project are worked out in Table 5.42. The project resulted in a time-lag and cost overrun of 250 per cent and 13.92 per cent respectively.

The project has witnessed four time revisions and three cost revisions (Table 5.43). The annual cumulative expenditure on the project shows that expenditure on the project during the initial periods was small.

Vadakkepuzha Diversion Scheme

The scheme envisages diversion of water of Vadakkepuzha river by providing a small weir and pumping over 12 m height into Idukki reservoir. The project is proposed to be completed by 1990-91 (Seventh Five Year Plan 1985-90). The expenditure on the schemes upto March 1991 was negligible. By 1990-92, the preliminary and enabling works and land acquisition were in progress (Economic Review, 1991).

The project resulted in a time-lag of 100 per cent, but has not witnessed any cost overrun (Table 5.44). The project has three time revisions but has no cost revision (Table 5.45).

Table 5.42

Time-lag and Cost Overrun of Chimmini Hydroelectric Project

(Rs. in lakhs).

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Aug. 1986
2.	Proposed date of starting	1985-86
3.	Commencement of major works	Apr. 1987
4.	Original schedule of completion	1987-88
5.	1990-91 Revised year of commissioning	Mar. 1993
6.	Extent of time-lag in years	5
7.	Time-lag as % increase over the original period	250%
8.	As per 1991 estimate total years required for commissioning	7
9.	As per original schedule the years for commissioning	2
10.	Original estimated cost	Rs.316
11.	1988 Revised cost	Rs.360
12.	Extent of cost overrun as per 1988 estimate	Rs.44
13.	Cost overrun as % increase over the original	13.92%

Source: 1. Annual Plan Proposals (1992), KSEB, Trivandrum.
2. Draft Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Eighth Five Year Plan (1992-97), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.43

Time and Cost Revisions of Chimmini Hydroelectric Project

(Rs. in lakhs)

Year	Time revision	Cost revision
1985-86	1987-88	316
1987	1989-90	320
1988	1991-92	360
1989	1991-92	360
1990-91	1992-93	360

Source:
1. Draft Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
2. Economic Review (1987-88), State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Eighth Five Year Plan (1992-97), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.44

Time-lag and Cost Overrun of Vadakkepuzha Diversion Scheme

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Oct. 1988
2.	Commencement of work	Apr. 1989
3.	Year of completion	1990-91
4.	Revised year of completion	1993-94
5.	Extent of time-lag in years	3
6.	Time-lag as % increase over the original	100%
7.	Sept.1991 based estimated years for commissioning	6
8.	Original estimated years for commissioning	3
9.	Cost (1988 based)	Rs.131

Source: 1. Draft Eighth Plan (1992-97), KSEB, Trivandrum.
2. Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.
3. Economic Review (1989), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.45

Time and Cost Revisions of Vadakkepuzha Diversion Scheme

(Rs. in lakhs)

Year	Time revision	Cost revision
1988	1990-91	131
1989	1991-92	131
1991	1993-94	131

Source: 1. Economic Review (1990-1992), State Planning Board, Govt. of Kerala, Trivandrum.
2. Annual Plan Proposal (1992), KSEB, Trivandrum.

Kuttiar Diversion

This scheme envisages diversion of water from Kuttiar of Muvattupuzha basin to Idukki reservoir by constructing small weir and diversion tunnel at an estimated cost of Rs.131 lakhs (1987) to generate 36.6 Mu of power. The time-lag and cost overrun of the project are furnished in Table 5.46.

The project has three time revisions and three cost revisions.

Poringalkuthu Hydroelectric Project

The project envisages the installation of an additional pipeline of 790 m long from the tunnel exit of the existing Peringalkuthu Left Bank (PLB) project and a power station with an installed capacity of 1x16 MW for better utilisation of the inflow of the existing scheme. Planning Commission accorded sanction for this scheme in May 1989. The estimated cost of the project is Rs.902 lakhs. Preliminary and enabling works and land acquisition are in progress (Draft Eighth Five Year Plan, 1992-97). Orders have already been placed for the generating equipment with M/s.BHEL. Other works were also commenced by September

Table 5.46

Time-lag and Cost Overrun of Kuttiar Diversion Scheme

(Rs. in lakhs).

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	Feb. 1989
2.	Commencement of work	Apr. 1989
3.	Original estimated date of commissioning	1990-91
4.	Sept.1991 estimated year of commissioning	Mar. 1994
5.	Extent of time-lag in years	3
6.	Time-lag as % increase over the original	150%
7.	Total years required for commissioning as per 1991 estimate	5
8.	Total years required for commissioning as per original schedule	2
9.	Original estimated cost (1987)	Rs.131
10.	1991-92 Estimated cost	Rs.254
11.	Extent of cost overrun	Rs.123
12.	Time-lag as % increase over the original	93.89%

Source: 1. Annual Plan Proposals (1992), KSEB, Trivandrum.
2. Seventh Five Year Plan (1985-90), State Planning Board, Govt. of Kerala, Trivandrum.

1991. Due to eviction problems at work sites, civil works could not be started as programmed. By September 1991, this was almost settled and fresh tenders were invited for the various civil works. As per the 1991 programme the scheme could be commissioned by the end of 1993-94.

The time-lag and cost overrun of Peringalkuthu hydroelectric project is presented in Table 5.47. The project has a time-lag and cost overrun of 66 per cent and 77 per cent respectively over the original.

Kuttiady Tail Race Scheme

The project envisages the utilisation of regulated discharges from the existing Kakkayam power station of Kuttiady hydel project for power generation in the power station to be installed further down stream. The tail water of Kakkayam power station will be diverted to the proposed Kuttiady tail race power station by constructing a diversion dam across the tail race channel of the Kakkayam power station. The installed capacity of the project is 2.5 MW and has an annual generating capacity of 15 Mu (Draft, Eighth Five Year Plan, 1992-97).

The Kuttiady tail race scheme resulted in a time-lag of 66.6 per cent over the original, but has only a cost

Table 5.47

Time-lag and Cost Overrun of Peringalkuthu Hydroelectric Project

(Rs. in lakhs).

Sl.No.	Particulars	Year/Amount
1.	Date of sanctioning	May 1989
2.	Commencement of work	Sept. 1989
3.	Original estimated year of commissioning	1992
4.	Jan.1991 estimated year of commissioning	Mar. 1994
5.	Extent of time-lag in years	2
6.	Time-lag as % increase over the original	66%
7.	Total years for commissioning as per 1991 estimate	5
8.	Total years for commissioning as per original schedule	3
9.	Original estimated cost	Rs.902
10.	Sept.1991 Revised estimated cost	Rs.1600
11.	Extent of cost overrun as per 1991 estimate	Rs.698
12.	Cost overrun as % increase over the original	77%

Source: 1. Draft Eighth Plan (1992-97), KSEB, Trivandrum.
2. Economic Review (1991-92), State Planning Board, Govt. of Kerala, Trivandrum.

overrun of 13.55 per cent over the original estimates (Table 5.48). The project resulted in two time and cost revisions.

Vazhikkadavu Diversion Scheme

The project envisages diversion of the water from the upstream catchment of the Meenachil river to Idukki reservoir by constructing a small diversion weir and a diversion tunnel of 2900 m long. Preliminary and enabling works and land acquisition works are in progress. The generation capacity of the scheme is 24 Mu. (Draft Eighth Five Year Plan, 1992-97).

The project has one cost and time revision respectively, over the original (Table 5.49).

Chembukadavu Stage I Mini Hydroelectric Project

The project envisages the development of power in Chalipuzha river by a mini hydel project. The State Government accorded sanction for the scheme in October 1989. The cost of the project is estimated to be Rs. 425 lakhs. By 1992-93 preliminary works had been commenced and the project was expected to be completed by 1993-94. The latest (1991-92 price level) cost of the project is Rs.450 lakhs.

Table 5.48

Time-lag and Cost Overrun of Kuttiady Tail Race Scheme

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	June 1989
2.	Commencement of work	Sept. 1989
3.	Originally expected year of commissioning	1992-93
4.	1991 Anticipated year of commissioning	Mar. 1994
5.	Extent of time-lag in years	2
6.	Time-lag as % increase over the original	66.6%
7.	Total years for commissioning as per 1991 estimate	5
8.	Total years for commissioning as per original schedule	3
9.	Original cost of the project	Rs.397
10.	1991 Revised cost	Rs.450
11.	Extent of cost overrun in Rs. as per 1991 estimate	Rs.53
12.	Cost overrun as % increase over the original cost	13.35%

Source: 1. Draft Eighth Plan (1992-97), KSEB, Trivandrum.
2. Economic Review (1992), State Planning Board, Govt. of Kerala, Trivandrum.

Table 5.49

Time-lag and Cost Overrun of Vazhikadavu Diversion Scheme

(Rs. in lakhs)

Sl.No.	Particulars	Year/Amount
1.	Year of sanctioning	June 1989
2.	Commencement of work	Sept. 1989
3.	Originally planned year of completion	1992-93
4.	1990-91 Revised year of completion	Mar. 1994
5.	Extent of time-lag in years	2
6.	Time-lag as % increase over the original	66%
7.	Total years for commissioning as per 1991 estimate	5
8.	Total years for commissioning as per original schedule	3
9.	Original estimated cost of the scheme	Rs.185
10.	1991-92 Revised cost	Rs.200
11.	Extent of cost overrun in Rs. as per 1991-92 estimate	Rs.15
12.	Cost overrun as % increase over the original	8.1%

Source: 1. Economic Review (1989), State Planning Board, Govt. of Kerala, Trivandrum.
2. Eighth Five Year Plan (1992-97) and Annual Plan (1992-93), State Planning Board, Govt. of Kerala, Trivandrum.
3. Draft Eighth Plan Proposals (1992-97), KSEB, Trivandrum.

Athirappally Hydroelectric Project

This is mainly a tail race development scheme in the Chalakudy river below the Peringalkuthu left bank and right bank schemes. The scheme envisages the creation of a fore bay in Chalakudy river with the 23 m high diversion dam located about 3 km down stream of the Peringalkuthu left bank power station to pick up the tail waters of the Peringalkuthu left bank and right bank power stations and also the yield from its own catchment and to utilise the water for power generation at a power station located on the left bank of the Kunnamkuzhi Thodu, a tributary of Chalakudy river (Draft, Seventh Five Year Plan, 1985-90). The water is diverted through a 4500 m long tunnel and 200 m long pipeline. The power house contains two units of 80 MW each.

The project is expected to generate 331 Mu of power. The estimated cost of the project is Rs.5,400 lakhs. The project is expected to be commissioned by 1989-90. The scheme has the techno-economic clearance by the Central Electricity Authority (CEA). But the Department of Environment and Forests, Government of India denied sanction to the scheme on environmental grounds. The main objection was about drying up of the existing water falls in the river. A modified proposal with an additional upper power station with two units of 7.5 MW each to retain the existing water falls had been submitted to CEA in October 1990.

The preceding project level study of time-lag and cost overrun of hydroelectric projects reveals that, in general, time revisions are higher than cost revisions. As seen in certain projects, even after four time revisions, there is no cost revision. Where there is a direct relationship between time-lag and cost overrun, time schedule revisions should result in cost revisions also. In certain projects higher time-lag is followed by low cost overrun and higher cost overrun exists in certain hydroelectric projects which have only low time-lag.

The study also found that time-lag emerges in all the three major stages of hydroelectric project implementation--time-lag in sanctioning the project, delay in starting the work and time-lag in the implementing stage. But the highest extent of time-lag is found in the implementing stage, followed by the delay in sanctioning the project.

The study also found that there exists a considerable extent of lack of co-ordination in certain hydroelectric projects. Certain schemes of the project get completed while other schemes of the same project heavily slip away from the time schedule.

Further it is seen that a good number of labour strikes in various schemes of the project emerges at a time when most of the works of the schemes are about to complete.

The analysis of the annual expenditure on the project found that, particularly in the initial years of work, the expenditure on the scheme is quite insufficient when the estimated cost and the time schedule of completion of the project is considered. Also it is found that in certain years, in the case of certain projects, there exists under-utilisation of even the alloted funds.

Chapter 6

TIME-LAG AND COST OVERRUN OF HYDROELECTRIC PROJECTS-- AN ECONOMIC ANALYSIS

In the preceding chapter an attempt was made to highlight the extent of time-lag and cost overrun in the case of hydroelectric projects in the state. Attempt was also made to highlight time-lag and cost overrun with reference to five public sector and three private sector industries in Kerala. The study reveals that all the hydroelectric projects and almost all the irrigation projects, both ongoing and completed, resulted in considerable amount of time-lag and cost overrun. The same is also true in the case of public sector industrial units studied.

The total original estimated cost of all the twelve completed hydroelectric projects is Rs.17,476.01 lakhs. But the actual cost of these projects has increased from Rs.17,476.01 lakh to Rs.37,730.54 lakhs. This shows that the cost overrun went up by 115.89 per cent over the original estimate (Table 6.1).

Table 6.1

A Project-wise Presentation of Time-Lag and Cost Overrun of Completed Hydroelectric Projects

(Rs. in lakhs)

Sl. No.	PROJECTS	Cost over-run in Rs.	Cost over-run as % increase over the original	Time overrun in years	Time over-run as % increase over the original
1.	Pallivasal	65.44	92.48	--	--
2.	Sengulam	34.38	9.42	--	--
3.	Peringalkuthu	33.96	11.08	3	30
4.	Neriamangalam	70	24.13	5	125
5.	Panniar	349.75	124.79	2	40
6.	Sholayar	277.00	70.84	4	66.6
7.	Sabarigiri	643.00	17.66	3	85.71
8.	Idukki Stage I	5235.00	74.70	3	30
9.	Kuttiady	200.00	28.5	3	60
10.	Idamalayar	6663.00	284.75	5	55.5
11.	Idukki Stage II	5582.00	230.85	2	33
12.	Idukki Stage III	1101.00	268.5	2	33
	Total	20254.53	115.89	40	60.5

Source: Compiled from Table 4.3.

The time overrun of the 10 completed hydroelectric projects is also given in Table 6.1. Out of the 12 completed hydroelectric projects, 10 projects have a total time overrun of 40 years. The cumulative total years for the completion of the 10 projects have increased from 62.5 years to 102 years, causing a time overrun of 40 years. This accounts an increase of 60.5 per cent over the original estimated years of project completion. Along with other factors, a time-lag of 60.5 per cent over the original period has resulted in cost overrun to the tune of 115.89 per cent. This clearly shows that time-lag and cost overrun are high in the case of all the completed hydroelectric projects in Kerala.

The extent of cost overrun spreads over a range of Rs.33.96 to Rs.6,663 lakhs (Table 6.1). Cost overrun in terms of percentage over the original estimated amount, spreads over a range of 9.42 per cent to 284.75 per cent. The extent of time-lag of different hydroelectric projects is in the range of two to ten years. Time-lag in terms of percentage increase over the original time schedule is spreading over a range of 30 per cent to 200 per cent (Table 6.1).

Time-Lag and Cost Overrun - A Functional Analysis

The cost element and time element are two different, but related, variables of project implementation. Normally a comparative study of time-lag and cost overrun involved in project implementation has some practical difficulties. This can be reduced to a minimum level by putting these two variables into a common unit of measurement, namely, the percentage increase or decrease over the original estimated figure.

Generally, it is discussed and concluded that the projects which have higher extent of cost overrun will have higher extent of time-lag, i.e., cost overrun is mainly caused by time-lag. This general belief has a scientific logic. In a state where there exist inflationary conditions, this will occur. Again additional wages and salaries are to be paid to the existing staff during the delayed period.

Since all the completed hydroelectric projects of Kerala suffered time-lag and cost overrun, one can conclude that time-lag, along with other factors, results in a considerable extent of cost overrun. So time-lag and cost overrun can be directly related. But inter project differences in time-lag and cost overrun are considerable, irrespective of the year of project starting (Tables 6.2 and 6.3). If the cost overrun is only due to the inflationary pressure during the lagged period of project implementation it should be proportional to the inflationary level, and should be rather same to all similar projects, implemented in the same period. But the vast inter-project differences in the time-lag and cost overrun of hydroelectric projects started at the same period reveal that time-lag is only one among the contributory factors to cost overrun. Table 6.2 contains cost overrun of completed hydroelectric projects in Kerala, as percentage increase over the original, in a desenting order, and the corresponding time overrun. The analysis shows that projects which have cost overrun have time overrun. But the relationship between cost overrun and time overrun is not uniform (Table 6.2). Some projects with higher extent of cost overrun has only lower extent of time-lag. But regarding certain other projects higher cost overrun is accompanied by higher time-lag. Out of the twelve completed hydroelectric projects this rather uniform relationship is found in the case of only two projects and in the case of all others a non-uniform relationship

Table 6.2

The Relationship Between Cost Overrun and Time-Lag --
A Cost Based Analysis of Completed Hydroelectric
Projects

(Time lag and cost overrun as percentage increase over the original)

Sl. No.	Year of Project starting	Cost overrun of projects (in descending order)	Time-lag
1.	1973	284.74	55.5
2.	1975	268.5	200
3.	1979	230.85	33
4.	1956	124.79	40
5.	1933	92.48	N.A.
6.	1963	74.70	30
7.	1958-59	70.84	66.6
8.	1964-65	28.5	60
9.	1955	24.13	125
10.	1961	17.66	85.71
11.	1946	11.08	30
12.	1945-46	9.42	N.A.

Source: Compiled from Table 4.3.

Table 6.3

The Relationship Between Time Overrun and Cost Overrun-
A Time Overrun Based Analysis of Completed Hydro-
electric Projects

(Time-lag and cost overrun as percentage increase over the original)

Sl. No.	Year of Project starting	Cost overrun	Time-lag (descending order)
1.	1975	268.5	200
2.	1955	24.13	125
3.	1961	17.66	85.71
4.	1973	70.84	66.6
5.	1964-65	25.8	60
6.	1973	284.74	55.5
7.	1956	124.79	40
8.	1979	230.85	33
9.	1946	11.08	30
10.	1963	74.70	30

Source: Compiled from Table 4.3.

between cost overrun and time-lag is found to exist (Table 6.2). Thus there exist a direct non-uniform and non-proportional relationship between cost overrun and time-lag. A project-wise analysis makes this more clear (Table 6.3).

From Table 6.3 it can be seen that there are projects with higher extent of time-lag accompanied by lower extent of cost overrun. Out of ten completed projects four have this type of time-lag cost overrun relationship.

The analysis also shows that some projects which have low time overrun have comparatively high cost overrun (Table 6.3). This can be so because, the efficiency and economy of project implementation depends on two variables--time and cost. In certain cases the increase in the cost of the project is justified if it can reduce the gestation period even though the cost has increased considerably. Table 6.3 shows that, it is only in the case of two projects, such relationship is found to exist. Even in these two projects, the magnitude of time-lag, in absolute terms, is high.

Among the 12 completed hydroelectric projects of Kerala state, the existence of higher time-lag and higher cost overrun is found to exist only in the case of two hydroelectric projects. In the case of all other 10 hydroelectric projects either higher time-lag is accompanied by low cost overrun or lower time-lag is followed by high cost overrun.

These findings are true in the case of ongoing hydroelectric projects of the state too. In the case of all the ongoing and completed irrigation projects and in the case of industrial projects studied, the above conclusion is found to be correct.

Time-Lag and Cost Overrun - An Interproject Analysis

Time-lag and cost overrun of projects are influenced by the nature of the work, location of the project and the technology used. All the twelve completed hydroelectric projects in Kerala have basically the same nature of work. The hydroelectric projects in Kerala are located in remote hilly areas and as such all projects have more or less equal locational advantage as well as disadvantage. This locational disadvantage/advantage is taken into account in estimating the original cost of the project. Again the geological nature of the project site, in general, is more or less the same and so has rather equal geological and natural advantage, and the techniques of work and the technology used are rather same, still the inter project differences in the extent of time-lag and cost overrun are found to be high in Kerala as revealed by Table 6.4.

As discussed earlier, Kerala state has 12 completed hydroelectric projects. All these 12 hydroelectric projects have different extent of cost overrun and time-lag. the inter project differences in time-lag and cost overrun are given in Tables 6.4 and 6.5. If one takes into account cost overrun as percentage increase over the original only three projects come in the range of 0 to 20 per cent increase over the original and two projects come in the range of 21 to 40 per cent. Only one project shows cost escalation in the range of 281 to 300 per cent (Table 6.4).

The time overrun also reveals the same trend of inter project differences. Out of the 10 projects

Table 6.4

Classification of Completed Hydroelectric Projects of Kerala on the Bases of Cost as Percentage Increase Over the Original Estimated Cost

Sl. No.	Range (%) increase over the original	Nos. of projects with cost as % increase over the original	Cumulative percentage
1.	0-20	3	3
2.	21-40	2	5
3.	41-60	--	--
4.	61-80	2	7
5.	81-100	1	8
6.	101-120	--	--
7.	121-140	1	9
8.	141-160	--	--
9.	161-180	--	--
10.	181-200	--	--
11.	201-220	--	--
12.	221-240	1	10
13.	241-260	--	--
14.	261-280	1	11
15.	281-300	1	12
	Total	12	12

Source: Compiled from Table 4.3.

Table 6.5

Classification of Time-Lag of Hydroelectric Projects

Sl. No.	Class	No. of project based on time-lag as % increase over the original	No. of projects as cumulative % of time
1.	0-20	--	--
2.	21-40	4	4
3.	41-60	2	6
4.	61-80	1	7
5.	81-100	4	11
6.	101-120	--	--
7.	121-140	1	12
8.	141-160	--	--
9.	161-180	--	--
10.	181-200	--	--
11.	201-220	--	--
12.	221-240	--	--
13.	241-260	--	--
14.	261-280	--	--
15.	281-300	--	--
	Total	12	12

Source: Compiled from Table 4.3.

considered four projects have time lag below 40 per cent, six projects below 60 per cent and nine projects below 140 per cent, over the original (Table 6.5).

It is found that in the case of completed hydroelectric projects the inter project differences in cost overrun is higher and that of the time-lag is comparatively less. Cost overrun as percentage increase over the original spreads in a range of 0 to 300 per cent whereas time-lag spreads only within a range of 0 to 220 over the original (Tables 6.4 and 6.5). This shows that inter-project differences in cost are higher compared to time overrun. Some reservations are here in these conclusions due to the differences in the size of the project and time period of the project implementation which are analysed below.

The Size of the Hydroelectric Projects and its Relationship with Time and Cost Overrun

The size of the hydroelectric projects can be expressed either in terms of the output (generation capacity) or on the basis of the original estimated cost of the project. In the case of hydroelectric projects the output and the size of the project have not much relationship because output depends on the height of water fall and its force. So a dam of high investment may not bring out greater output. therefore the original estimated cost of the project is a better indicator of the size of the project. Further, for the analysis the time and cost overrun are expressed in terms of percentage increase over the original.

The size-wise extent of time and cost overrun of projects is presented in Table 6.6. there exists no specific and direct relationship between the size of the project and time-lag and cost overrun in the case of any of the completed hydroelectric projects in Kerala (Table 6.6). Some projects with smaller size have higher extent of time-lag and cost overrun compared with the bigger ones. The project with a size of Rs.70.76 lakhs has a cost overrun of 92.48 per cent increase over the original estimated cost. In the case of some big projects, cost overrun and time-lag are comparatively less (Table 6.6). In the case of projects with a size of Rs.3,640 lakhs, the cost overrun is only 17.66 per cent over the original cost. Same is the case with the extent of time-lag and the size of the projects (Table 6.6). The extent of time-lag and cost overrun differs from project to project irrespective of the

Table 6.6

The Size of the Completed Hydroelectric Projects of Kerala and Time-Lag and Cost Overrun

Sl. No.	Size (Original estimated cost in Rs. lakhs	Cost Overrun as percentage increase over the original	Time-lag as percentage increase over the original
1.	70.76	92.48	N.A.
2.	280.25	124.79	40
3.	290.00	24.13	125
4.	306.27	11.08	30
5.	364.73	9.42	N.A.
6.	391.00	70.84	66.6
7.	410.00	268.50	200
8.	700.00	28.5	60
9.	2340.00	284.74	55.5
10.	2418.00	230.85	33
11.	3640.00	17.66	85.71
12.	6265.00	74.70	30

Source: Compiled from Table 4.3.

size of projects. But it is seen that the projects with a size of above Rs.2,340 lakhs, show a steady, but nominal, fall in the extent of time overrun and cost overrun (Table 6.6) over the years. But this is not found to be correct in the case of ongoing hydroelectric projects.

There are some projects which witnessed higher and higher cost overrun as the size of the projects increased. Comparatively small sized projects have higher amount of cost overrun and big projects have comparatively less cost overrun, in terms of cost overrun as percentage increase over the original. Out of the twelve completed hydroelectric projects seven projects show this trend that as the size of the project increases, cost overrun as percentage increase over the original is below that of the small sized project (Table 6.6).

Again, if we take the small sized project as the base project, some projects witnessed higher and higher cost overrun as the size of the projects increased. Out of the 12 completed hydroelectric projects only four projects have this nature (Table 6.6). Hence it is difficult to establish any definite relationship between the size of the project and the increase in cost overrun over the original estimated cost.

More or less the same relationship is found in the case of the size of the project and time overrun (Table 6.6). Out of the 10 completed hydroelectric projects, if the small sized project is considered as the base, there are four projects which have a decrease in time overrun (time overrun as percentage increase over the original) as the size of the project increased and there are five projects which have an increase in time overrun (time overrun as percentage increase over the original) as the size of the project increases.

In the case of the completed hydroelectric projects of Kerala, there exists no definite relationship between the size of the project and time and cost overrun. Time-lag and cost overrun are not size dependent but are project dependent in the sense that they vary from project to project irrespective of the size of the project.

Time-Lag and Cost Overrun of Hydroelectric Projects and the Year of Project Starting

An attempt is made here to analyse the extent of time-lag and cost overrun, based on the year of project starting. Out of the 10 completed hydroelectric projects the highest extent of time-lag is found in the project started in 1975 which comes to 200 per cent increase over the original estimated time schedule and the lowest extent of time-lag is found in two projects started in 1946 and 1963, which comes to 30 per cent increase over the original estimated schedule of project completion (Table 6.7).

The magnitude of the occurrence of cost overrun of the 12 completed hydroelectric projects is presented in the descending order of magnitude in Table 6.8. Out of the 12 projects started during the period 1933-1979 the highest extent of cost overrun is found in the case of the project started in 1973 and the least extent of cost overrun is found in the case of projects started in 1945-46. It is clear from Table 6.8 that there is no direct and definite relationship between year of project starting and the extent of time and cost overrun. The extent of cost overrun of the projects started in different years fluctuates considerably. The analysis could not identify any direct and definite relationship between cost overrun and the year of project starting. Even in the case of projects carried out more or less in the same period,

Table 6.7

Time Overrun of Hydroelectric Projects and Year of Project Starting (Time Overrun as Percentage Increase Over the Original)

Sl. No.	Year of Project Starting	Time Overrun (in descending order)
1.	1975	200
2.	1955	125
3.	1961	85.7
4.	1958-59	66.6
5.	1964-65	60
6.	1973	55.5
7.	1956	40
8.	1979	33
9.	1946	30
10.	1963	30

Source: Compiled from Table 4.3.

Table 6.8

Cost Overrun and Year of Project Starting (Cost Overrun as Percentage Increase Over the Original)

Sl. No.	Year of Project Starting	Cost Overrun (in descending order)
1.	1973	284.74
2.	1975	268.5
3.	1979	230.85
4.	1956	124.79
5.	1933	92.48
6.	1963	74.70
7.	1958-59	70.84
8.	1964-65	28.5
9.	1955	24.13
10.	1961	17.66
11.	1946	11.08
12.	1945-46	9.42

Source: Compiled from Table 4.3.

considerable difference is witnessed in the matter of the occurrence of cost overrun and time-lag.

Time-Lag and Cost Overrun of Hydroelectric Projects of Kerala - Trend Over the Years 1933 to 1990.

All the 12 completed hydroelectric projects of Kerala were started and completed during 1933-1990, extending over a period of 57 years. All these projects have almost the same nature of work and technology. Since all the projects have a rather long gestation period and so all the projects were affected by inflation. The year-wise and project-wise presentation of time-lag and cost overrun of these projects are presented in Table 6.9.

The project started in 1946 is treated as the base for the analysis. This project met with a time-lag of 30 per cent over the original estimated time schedule (Table 6.9). Except in the case of one project which started in 1963, all other projects carried out during 1933-1990 resulted in increased time-lag over that of the base project. Again it is found that except three projects all other projects started after 1946 resulted in time overrun of more than double of the base project time.

Table 6.9

Time-Lag and Cost Overrun of Hydroelectric Projects

Completed--An Year-wise Study

(Time-lag and cost overrun as percentage increase over the original)

Sl. No.	Year of project implementation	Time-lag	Cost overrun
1.	1933-41	--	92.48
2.	1944-45	--	9.42
3.	1946-58	30	11.08
4.	1955-64	125	24.13
5.	1956-63	40	124.79
6.	1958-68	66.6	70.84
7.	1961-68	85.71	17.66
8.	1963-76	30	74.70
9.	1964-72	60	28.5
10.	1973-87	55.5	284.74
11.	1975-90	200	268.5
12.	1979-87	33	230.85

Source: Compiled from Table 4.3.

The period of study of the completed hydroelectric projects is divided into two stages--earlier stage and later stage. The former covers the period 1933 to 1964 and the later period is 1965 to 1990. Compared to the projects in the earlier period time overrun and cost overrun are higher in the projects of later stage. The extent of time-lag and cost overrun has reached to a level of 284 per cent increase over the original during this period which is unprecedented in the history of project implementation till then (Table 6.9).

Though all the hydroelectric projects commissioned over the years, resulted in time-lag, the study could not identify any steady trend in the extent of time-lag. It fluctuates from project to project over the years (Table 6.9). In the case of projects constructed more or less in the same period also met with wide differences in time-lag.

The cost overrun of projects started in 1946 is taken as the base to analyse the trends in cost overrun. Compared to the base period the cost of all the projects started after 1946 and completed before 1990 resulted in different extent of cost overrun (Table 6.9).

The movement of cost overrun of hydroelectric projects showed a gradual increasing trend in the case of projects started and completed during 1958-1976. But the extent of cost overrun of hydroelectric projects started and completed during 1973-1990 made a sudden jump reaching to a maximum of 284.74 per cent increase over the original estimated cost and later it showed a small declining trend (Table 6.9). But in the case of the ongoing projects it has again begun to show an increasing trend.

Compared to the extent of the increasing trend of time-lag of the hydroelectric projects commissioned during 1933 to 1990, the extent of cost overrun is higher. The time-lag of these projects started over these years escalates from project to project and from year to year. But absolutely and comparatively cost overrun of hydroelectric projects and its extent over the years show a rather increasing trend.

Time-Lag and Cost Overrun of Hydroelectric Projects - A Comparative Analysis with Other States

A comparative cross section analysis of time-lag and cost overrun of the hydroelectric projects of the different states in India is given in Table 6.10. The time-lag and cost overrun of the hydroelectric projects which were completed during 1988-89 in four different states -- Bihar, Uttar Pradesh, Himachal Pradesh and Assam are considered for comparison with the time-lag and cost overrun of the hydroelectric projects of Kerala. In Kerala, since there is no hydroelectric projects completed during 1988-89, the project completed during 1989-90 is considered. Also the projects implemented during the same period and completed in 1987 in Kerala are also taken into consideration to have a better understanding of the phenomenon. For this the time-lag and cost overrun are expressed in terms of percentage increase over the original estimated figure.

The hydroelectric projects commissioned in the same year in different states of India also suffered time-lag and cost overrun (Table 6.10). So the occurrence of time-lag and cost overrun in hydroelectric project implementation is not a unique phenomenon found in Kerala alone, but it is a common feature in India.

The size and magnitude of time-lag and cost overrun of hydroelectric projects are found to be higher in

Table 6.10

Time-Lag and Cost Overrun of Hydroelectric Projects of Kerala and Other States Completed during 1985-90

KERALA			ALL INDIA		
Name of the Project	Cost overrun as % increase over the original	Time overrun as % increase over the original	Name of the Project	Cost overrun as % increase over the original	Time overrun as % increase over the original
1. Idamalayar (1987)	284.74	55.5	1. Panchet Hill II HEP, Bihar, 40 MW, (1988-89)	192	79%
2. Idukki Stage II (1987)	230.84	33	2. Tanakpur HEP, 120 MW, U.P. (1988-89)	74	19
3. Idukki Stage III (1989-90)	268.5	200	3. Chamera HEP, 540 MW, H.P. (1988-89)	75	32
			4. Kopili HEP, Assam, 159 MW (1988-89)	324	63

Source: 1. Annual Reports (1988-90), Ministry of Programme Implementation, Govt. of India, New Delhi.
2. Compiled from Table 4.3.

Kerala, when compared to those of other states (Table 6.10). Also it is found that there exist a good extent of inter state differences in the occurrence of time-lag and cost overrun.

In general, the inter project differences in time-lag and cost overrun are an all India phenomenon (Table 6.10). But the extent of time-lag and cost overrun of the same type of projects commissioned, rather in the same period, is found to be higher in Kerala compared to that of the other states (Table 6.10). As in the case of Kerala, there exists no direct relationship between the extent of time-lag and cost overrun and the size of the project. Even in the case of same type of projects commissioned in the same year in different states there exists no direct and steady relationship between time-lag and cost overrun as in Kerala. In Assam, Kopili Hydroelectric Project has a time-lag of 63 per cent over the original and 324 per cent cost overrun. But in Bihar the Panchet Hill Hydroelectric Project has a time overrun of 79 per cent but is accompanied only by a cost overrun of 192 per cent over the original. Thus, as in Kerala, in other states too a low time overrun is accompanied by either low or high cost overrun and vice-versa.

Compared to the time-lag of the hydroelectric projects of other states, it shows a heavy increasing trend (Table 6.10) in Kerala while the same is moderate in the hydroelectric projects of other states.

Time-Lag and Cost Overrun - A Comparative Analysis of Hydroelectric Projects and Irrigation Projects of Kerala

Hydroelectric projects and irrigation projects in Kerala have more or less the same nature of work, namely, the construction of dams, tunnels, etc. Again these two types of projects are located in more or less similar places--hilly areas. So both these projects have more or less the same locational advantages and/or disadvantages. So it is feasible to compare the extent of time-lag and cost overrun of these projects.

Table 6.11 reveals that the occurrence of time-lag and cost overrun is a common feature of both hydroelectric projects and irrigation projects. It is found that time overrun is higher in irrigation projects and is comparatively low in hydroelectric projects (Tables 6.11 and 6.12) and the difference is considerable. Compared to hydroelectric projects the extent of time-lag is very high

Table 6.11

The Extent of Time-Lag and Cost Overrun of Ten Completed Hydroelectric Projects of Kerala
(Period-wise)
(Time and cost overrun as percentage increase over the original)

Sl. No.	Period (Year of completion)	Name of the Project	Cost overrun	Time over-run
1.	1955-60	Peringalkuthu	11.08	30
2.	1961-65	Neriamangalam (1963-64)	24.13	125
3.	1961-65	Panniar (1963)	124.79	40
4.	1966-70	Sholayar (1968)	70.84	66.6
5.	1966-70	Sabarigiri	17.66	--
6.	1971-75	Kuttiady (1972)	28.5	60
7.	1976-80	Idukki Stage I (1976)	74.70	30
	1981-85	--	--	--
8.	1986-91	Idamalayar (1987)	284.74	55.5
9.	1986-91	Idukki Stage II (1987)	230.85	33
10.	1986-91	Idukki Stage III (1989-90)	268.5	200

Source: Compiled from Table 4.3.

Table 6.12

The Extent of Time-Lag and Cost Overrun of Ten Completed Irrigation Projects of Kerala (Period-wise)

(Time and cost overrun as percentage increase over the original)

Sl. No.	Period (Year of completion)	Name of the Project	Cost overrun	Time over-run
1.	1955-60	Peechi (1959)	0	140
2.	1961-65	Vazhani (1962)	-00.39	120
		Walayar (1964)	43.10	175
		Meenbara (1964)	0	60
3.	1966-70	Chalakudy (1966)	0	240
		Malampuzha (1966)	49.48	240
		Mangalam (1966)	135.55	225
4.	1971-75	Pothundy (1971)	0.0001	160
		Neyyar (1973)	85.88	500
		Chunukuzhy (1973)	-0.00026	220

Source: Compiled from Table 4.1.

in irrigation projects. But the extent of cost overrun of irrigation projects is low, both absolutely and comparatively. Out of ten completed irrigation projects the extent of cost overrun is nominal, zero and even negative in the case of six projects, and in the case of the other four projects the extent of cost overrun is comparatively less (Table 6.12).

Thus a rather paradoxical situation is found in the case of irrigation projects, i.e., a greater extent of time-lag is accompanied by lower extent of cost overrun (Table 6.12).

But in the case of hydroelectric projects, not absolutely, but compared to irrigation projects, the extent of time-lag is low. Out of the ten hydroelectric projects implemented only two projects have a time overrun above 75 per cent over the original. Out of the 10 irrigation projects commissioned except one, all have a cost overrun of more than 75 per cent over the original and its extent has gone upto 500 per cent over the original (Table 6.12).

But compared to the cost overrun of irrigation projects, the extent of cost overrun is very high in the case of hydroelectric projects. A 33 per cent increase in time over the original schedule is accompanied by a 230.85 per cent increase in cost in the case of a hydroelectric project, whereas in the case of an irrigation project with a time-lag of 500 per cent over the original has a cost overrun of only 85.88 per cent over the original (Tables 6.11 and 6.12).

Thus in the hydroelectric projects of Kerala compared to irrigation projects, cost overrun is high and time-lag is low. But in the case of irrigation projects compared to hydroelectric projects, time-lag is high and cost overrun is nominal (Tables 6.11 and 6.12). So logically the traditional belief of the direct relationship between time-lag and cost overrun is negated by facts.

Since the nature of these projects are rather the same and are implemented more or less in the same period, these projects should be equally affected by inflationary pressure and so the resultant cost overrun should be more or less same. But no such inflation-time-lag-cost overrun relationship is found in the hydroelectric projects and irrigation projects. But in the case of irrigation projects time overrun to a greater extent is even followed by a nominal cost overrun only (Table 6.12).

Time-Lag and Cost Overrun and Crashing the Project

If the 'critical' areas of the projects are completed quickly, the project can be completed even before the scheduled time and the extent of time-lag can be reduced. Crashing of the project requires additional expenditure on the project. In Kerala out of the 10 completed hydroelectric projects, in the six projects, when compared to time overrun, cost overrun is higher (Table 6.1) and here it is attempted to analyse whether it is due to crashing of the project. If it is due to crashing there should exist a fall in time overrun compared to the extent of cost overrun. Out of the 10 completed projects studied only four projects started in 1973, 1979, 1956 and 1963 have comparatively low time overrun over the original estimate and the same have comparatively high cost overrun. The project started in 1973 is Idamalayar and the projects started in 1979, 1956 and 1963 are Idukki Stage II, Peringalkuthu and Idukki Stage I respectively. Idamalayar project met with the highest level of cost overrun as percentage increase over the original (Table 6.1). This much extra investment is able to put the time overrun only at a high level of 55.5 per cent increase over the original. The good extent of time-lag in Idamalayar clearly shows that crashing was not the major reason for an increase in cost of 284.74 per cent over the original.

Again in the case of Idukki Stage II, started in 1979, has a cost overrun of 230.85 per cent increase but has a time overrun of 33 per cent over the original. The major work of Idukki Stage II is only the erection of three more generators and the related works; so even this 33 per cent increase in time over the original is very high. So one can conclude that the high cost overrun in Idukki Stage II is also not mainly due to crashing the project.

Chapter 7

TIME-LAG AND COST OVERRUN--A CASE STUDY OF SABARIGIRI HYDRO-ELECTRIC PROJECT

Sabarigiri hydroelectric project was the first domestically designed and implemented hydroelectric project in Kerala. This was the biggest of the hydroelectric projects taken up for construction by the Kerala State Electricity Board (KSEB) at that time.

History of the Project

The Pamba-Kakki scheme was conceived in different ways at different periods. The earliest report on the scheme was prepared in 1946 by the Public Works Department (PWD). In 1955 another scheme with the power station located at the right bank of Kakkiyar was prepared. The planning commission approved a part of the scheme in 1958. Even when this scheme was sanctioned by the Planning Commission, there was a proposal for developing power from the combined Pamba-Kakki catchments in one stage. But because of objection raised by the Tamil Nadu government the Planning Commission did not give approval to this proposal (Project Report on Pamba-Kakki Scheme, 1960). Hence the state government had to satisfy itself with the first stage of the scheme.

When the preliminary work on the first stage was in progress in July, 1959, the scope of the project was changed so as to combine the first stage and second stage by locating the generating station at the banks of Muzhiyar. Consequently works sanctioned in the first stage are delayed.

A new proposal was sent to the Planning Commission and the commission granted sanction to the scheme in August 1960, at an estimated cost of Rs.24.91 crores; in spite of the objections raised by Tamil Nadu. The KSEB gave administrative sanction to the project in August 1961. The loan agreement for the project was signed between the U.S. and India in 1962.

The project work was completed in 1967. The power station was inaugurated by Sri V.V.Giri, the then Vice-President of India, on 28-08-1967. The generator capacity of the project is 300 MW (6x50) (Technical Completion Report, 1977).

The details of the different engineering structures of the project are:

1. Two main dams, one across river Pamba and the other across river Kakki, a tributory of river Pamba, and a flanking dam above saddle, for Kakki reservoir.

2. A tunnel 10,524' long to inter-connect the Pamba and Kakki reservoirs.

3. A power tunnel 16,858' upto the centre of the surge shaft leading from Kakki reservoir,. the first part of the water conductor system.

4. A low pressure pipe line 1,342' long from surge shaft to bifurcation point (where the valve house is located).

5. A set of 3 high pressure surface pen stocks about 3,520' long each bifurcating just above the generating station from where the 6 branches inside inclined tunnels upto the power house.

6. A power station on the bank of Muzhiar accommodating 6 multiple jet pelton turbine each coupled with a generator of 50 MW with the usual out door switch gear arrangements, etc.

7. A 220 KV double circuit transmission line from the power station with each circuit to Pallom and Kalamassery.

8. 220/110 KV sub station at Pallom and Kalamassery.

9. An inter-state transmission link with Madras.

Time-lag and Cost Overrun of Sabarigiri Hydroelectric Project

The extent of time-lag and cost overrun of Sabarigiri hydroelectric project is presented in Table 7.1. Table 7.1 shows that Sabarigiri project was scheduled to complete during 1963-64. But the project was completed only on 28-8-1967 which shows a time-lag of three years or 100 per cent increase over the original schedule.

The cost overrun of Sabarigiri project is also presented in Table 7.1. The original estimated cost of the project was Rs.2,491 lakhs. But the actual cost of the

Table 7.1

Time-lag and Cost Overrun of Sabarigiri Hydroelectric Project

(Time : year
(Rs: in lakhs)

Sl.No.	Particulars	Time/cost
1.	Scheduled year of starting	1960-61
2.	Original scheduled year of commissioning	1963-64
3.	Actual date of commissioning	18-8-1967
4.	Time overrun in years	3
5.	Time overrun as percentage increase over the original	100%
6.	Original estimated cost of the project	2491
7.	Actual cost of the project	4283
8.	Cost overrun (in Rs.)	1792
9.	Cost overrun as percentage increase over the original estimate	71.94%

Source:
1. Technical Completion Report, Sabarigiri HEP (1977), KSEB, Trivandrum, Vol.I.
2. Project Report (1961), Pamba-Kakki Scheme, KSEB, Trivandrum.
3. Project Report (1960), Pamba Kakki Scheme, KSEB, Trivandrum.

project amounted to Rs.4,283 lakhs. The cost overrun was about Rs.1,792 lakhs or 71.94 per cent over the original estimate.

Sabarigiri Hydroelectric Project--The Schemewise Study of Time-lag and Cost Overrun

In order to analyse the schemewise extent of time-lag, the major six schemes of the project are considered. The time-lag of these six areas of the project is presented in Table 7.2.

Schemewise Cost Analysis

The cost overrun of Sabarigiri hydroelectric project is studied by dividing the project work into three, viz. project proper, Transmission and Augumentation work. A comparative study of cost overrun of these divisions are presented below.

The original estimated cost of the project proper was Rs.2,333 lakhs which increased to Rs.3,746.30 lakhs, resulting in a cost overrun of Rs.1,413.30 lakhs or 60.57 per cent over the original estimate.

The original estimated cost of transmission system

Table 7.2

Scheme-wise Presentation of Time-lag of Sabarigiri Hydroelectric Project

Sl. No.	Particulars	Year of starting the work	Scheduled year of completion	Actual year of completion	Time-lag in years	Percent-age
1.	Pamba dam	1960	1963-64	Sept.1967	3	75
2.	Kakki dam	1961	1963-64	Dec.1966	2.5	83
3.	Flanking dam	1962-63	1964-65	May 1967	2	66
4.	Interconnecting tunnel	14-7-1961	13-7-1963	Sept.1963	1.5	7.5
5.	Power tunnel	Feb.1962	1963	1964	1.0	100
6.	Commissioning	1960	1964	1967	4	100

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Project Report (1961), Pamba-Kakki Scheme, KSEB, Trivandrum.

was Rs.248 lakhs which increased to Rs.524, resulting in a cost overrun of Rs.276 lakhs or 111.29 per cent over the original estimate (Table 7.3). This shows that cost overrun of transmition system is higher compared to the cost overrun of project proper.

A micro level analysis of time-lag and cost overrun of the project proper is done by dividing the work into 25 schemes. The cost overrun of transmission system is studied by dividing it into two schemes--transmission lines and substation.

The schemewise analysis of cost overrun is presented in Table 7.3.

Preliminary works

In the original estimate an amount of Rs.3 lakhs was alloted for preliminary work, but it had increased to Rs.6.5 lakhs, resulting in a cost overrun of Rs.3.5 lakhs. The cost overrun comes about 116.6 per cent over the original estimate (Table 7.3).

The preliminary work of Sabarigiri projects was done in the thick forest inhabited by wild animals. No

Table 7.3

Scheme-wise Presentation of Cost Overrun of Sabarigiri Hydroelectric Project

(Rs. in lakhs)

Sl. No.	Particulars	Original estimate (1960)	1st revision (1964)	2nd revision (1966)	Cost overrun over the original	Cost overrun as % in-crease over the original
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Preliminaries	3	6	6.5	3.5	116.6
2.	Compensation for land and forests	10	10	30.0	20.0	200.0
3.	Dam across Kakki	429	790	865	436.0	101.64
4.	Dam across Pamba	118.6	135	153.0	34.4	29.00
5.	Flanking dam for Kakki reservoir	111.4	200	245.0	133.6	119.93
6.	Interconnecting tunnel	51	55	50.0	-1.0	-1.96
7.	Intake arrangements	10	22.5	31.0	21.0	210.0
8&9.	Power tunnel and surge shaft	181	228	218.0	37.0	20.44

(1)	(2)	(3)	(4)	(5)	(6)	(7)
10.	Penstock and valves	350	386	451.0	101.0	28.86
11.	Track cutting and anchors	30	74	65.0	35.0	116.66
12.	Power house building and appurtenant works	48	76	132.0	84.0	175.00
13.	Generating sets and transformers	420	629	678	258	61.42
14.	Transformer yard	5	28	8	3	60
15.	Roads and bridges	99	165	156	56	56.5
16.	Buildings	98	120	116	18	18.36
17.	Water supply and sanitation	15	35	23	8	53.33
18.	Electrification and power supply	25	60	65	40	160.00
19.	Insurance of labour	2	2	2	0.0	0.0
20.	Construction tools and plant	120	90	187	67	55.83
21.	Consultation charges	5	20	6	1	20.00
22.	Providing telegraphic lines and intercommunication facilities	5	5	4	-1	-20

Table 7.3 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
23.	Supervision charges	130	119.50	211	--	62.3
24.	Petty supervision & contingency	67	25	44		
25.	Detailed investigation of diversion possibilities	Nil	Nil	0.80		
	Total	2333.00	3281	3746.3	1413.30	60.57
	Credit for Tools and Plant and Buildings	(-) 90	(-)80	(-)115		
PART II						
	220 KV Transmission lines	248	339	200	276.00	111.29
	Sub-Station at Pallom & Kalamassery	--	--	324		
	Total (Part I and Part II)	2491	3540	4385.36		

Table 7.3 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
PART III						
	Scheme for Augmentation of power potential	Nil	100	127.60	--	--
	Revised total cost of the project	24.91	36.40	4282.90	1792	71.94
	= 4,283 lakhs					

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Project Report (1961), Pamba-Kakki Scheme, KSEB, Trivandrum.
3. Project Report (1960), Pamba Kakki Scheme, KSEB, Trivandrum.

basic facilities were available and so there was time-lag and cost overrun.

Land acquisition and compensation for land and forest

In the original estimate only, a provision of Rs.10 lakhs was provided for this scheme. But on actual execution this has increased to Rs.30 lakhs resulting in a cost overrun of 200 per cent over the original estimate (Table 7.3). This was mainly due to the excess amount given to the forest department on account of the difference in seignorage value of sale of trees felled for the project including the reservoir clearance. The increased compensation given to estate owners for road construction has also contributed to the escalation of cost.

The KSEB experienced some delay in getting land ready for construction work from the forest department, due to bureaucratic procedures and lack of understanding among the concerned departments. So on the request of KSEB on 3-9-1958 the government decided to form a special forest division known as Hydel Forest Division under the Board on 12-2-1960 to avoid unnecessary delay.

The works of the Hydel division was satisfactory at first. But later due to the changes in their attitude, cold war between departments and the clash of rules of the two departments created delay in land acquisition which resulted in time-lag.

The Pamba Dam

The Pamba Dam was constructed across Pambayar having a length of 924' at the top, and 20' width. The height of the dam above the bed level is 171'.

The work on the Dam was started in 1960 and was completed in all respects in September 1967. But the scheme was originally scheduled to be completed during 1963-64. This has resulted in a time-lag of 3 years (Table 7.2).

Table 7.4 indicates the major events related to the project scheduling. It clearly shows that there was delay in starting the work delay in the supply of necessary items and delay in completing the work. All these resulted in time-lag.

Cost Overrun of Pamba Dam

The original estimated cost of the Pamba dam was Rs.118.6 lakhs. But it went up to Rs.153 lakhs, resulting

Table 7.4

The major events related to Pamba Dam-Sabarigiri Hydro-electric Project

Sl.No.	Particulars	Year and date
1.	Preliminary works and investigation	1958
2.	Dam construction (started)	1960
3.	Masonry work started on the dam	2-10-1961
4.	Crushers were handed over to the contractor	5-11-1962
5.	The completion of the dam as per 1960 enlarged scheme	1963-64
6.	Date of completion as per 1961 schedule	Aug. 1964
7.	1962 scheduled days for completion as per contract agreement	700 working days after the crushers were provided
8.	The completion of the dam as per the accelerated programme of execution	1963
9.	The scheduled completion of the dam as per contract agreement	Dec. 1965
10.	Rescheduled date of completion of the dam using rope-way	Mar. 1965
11.	Actual date of completion	Sept. 1967

Source:
1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. The Accelerated Programme of Execution of Pamba Kakki Scheme (1961), KSEB, Trivandrum.
3. Project Report (1960), Pamba-Kakki Scheme, KSEB, Trivandrum.

in a cost overrun of Rs.34.4 lakhs which comes to 29 per cent increase over the original estimate (Table 7.3).

The factors contributed to cost overrun and time-lag of Pamba dam are discussed below.

Tools, plants and materials related issues

Tools and plants, both indigeneous and imported, were used in the construction of the Pamba dam. Delayed supply, poor quality and insufficient supply of them were found common, which are discussed below.

Natural sand was not available in the nearest localities, even within a distance of 20 miles off the dam site. So except in the case of power house crushed sand was used. For this 8 numbers of crushing and screening plants were installed. Of the 8 crushers, 6 were to be supplied by M/s.Marshall and Company, Madras. The first crusher could be obtained only in September 1961 which got erected in January 1962. The second one was got in January 1962 and erected in April 1962. Unfortunately the performance of the crushers installed was not satisfactory. Hence the supply of the third crusher was stopped by the KSEB (Technical Completion Report, 1977). So the Board made alternate arrangement by diverting the three crushers available at Ponmudi and the one from Sholayar to Sabarigiri site. But the quality of sand produced by these crushers were not in conformity with the standard specifications of sand. As a trial and test, 10 to 20 per cent river sand was mixed with the crushed sand to bring the fineness modulus, but the improvement was not satisfactory. So new screens were manufactured and fitted to the plant by the Board.

During the course of operation the main shaft of the secondary unit of the crusher was broken and the company in England which manufactured the machine was asked to replace it. But to avoid delay twice the broken shaft was welded by the department. But the attempt did not suceed for long. The mantle piece of the crusher which had to be replaced, to get the required fineness modulus, had to be obtained from the company in England and the same was obtained from them only in January 1965.

In April 1964 another sand processing plant manufactured by Cedar Rapid Iowa, USA, arrived at the dam site, as per aid agreement and was put into operation in September 1964. The motor of the crusher was damaged shortly after its functioning but was rectified in September

1964 itself. The fineness modulus of crushed sand was also not exactly as desired. It was this delay in the arrival of the sand processing plant that caused these problems which resulted in time and cost overrun.

In working the crushers the feeding became a problem. Since the crushers were erected in different places, approach roads had to be made to different crusher sites, which was very difficult in the forest area.

The Boxter crusher which was erected on the U-stream side of the dam was dismantled before partial storage started in the dam. The approach road for this crusher was over the No.1 block of the dam and so the access to the site itself had to be cutoff even before the completion of the dam. This is an indication regarding the poor insight and planning of things.

Again during the working season of 1964 sufficient crushed sand was not available even by working all the crushers at their maximum efficiency. So sand was purchased from HCC at Kakki.

Compressed air is to be made available in the project area for drilling, quarrying etc. Under the US Aid, 6 numbers of air compressors were to be received for the Sabarigiri project. But the receipt of these compressors was delayed which caused difficulties. So portable air compressors were provided by KSEB which were in use in other projects. In July 1960, one Broom wade stationary air compressor available in Munnar circle was taken to Pamba and started functioning. But soon the problem of cooling the compressor was felt as the permanent water supply system at Pamba dam site was not completed. A 5 HP motor was used for this purpose. Since natural water is not sufficient for natural cooling; so recirculation of water was used. This caused some trouble along with the replacement of the damaged parts of the compressor.

It was only in April 1965 that the US Aid compressor meant for the project reached the dam site. It got erected in August 1965 and got dismantled in October 1966, it was this delayed supply that caused problems in the dam construction.

The devaluation of Indian currency during this period, added to the cost overrun.

Owing to river diversion problems, difficulties related to excavation in the river bed was delayed. So the progress of masonry construction was below the target. Till 1964 only about 30,30,000 cft. masonry, out of 54 lakh cft. was completed. So a cable way was erected, at Pamba dam site for completing the masonry work even before the scheduled time of March 1965.

The river sand collected from the upstream and downstream of the river was washed and used till the crushers came into operation. For this 4 nos. of sand washing units were started. Some delay was witnessed in erecting them also.

Cement for the dam was obtained from Thulukkapatty in Madras state and the main storage of cement was at Theni, from where, through contractors, cement was transported to the dam site and kept in the departmental cement store. During the peak construction periods scarcity of cement was experienced due to insufficient storage capacity in the dam site which adversely affected the work.

Construction related issues

The construction of the Pamba dam including excavation was taken up in 3 stages, ie., excavation, dam work and finishing work. The time-lag and cost overrun related to the construction of the dam is explained below.

Excavation for the dam

This included the earth work and removal of boulders. From the core boring details and general survey of the site, it was first assumed that there would not be much excavation for the foundation of the dam. But in reality this had increased and a quantity of 4,92,000 cft. of earth work excavation had to be done for the dam foundation. The work could not use any machinery and so only manual labour was used.

After the removal of the soil the rock excavation was started according to feasibility. Disintegrated rock and boulders had to be removed and foundation taken to deeper levels even though the same was not anticipated when the results of the drilling were studied. Thus the increase in time and cost resulted largely from the excess earth work, rock blasting, benching rock, drilling and grouting.

River bed excavation and coffer dam

To take up the excavation in the river bed portion a masonry coffer dam was constructed. The top width of the dam was 2' to $2\frac{1}{2}$' and the maximum height was 20'. Some delay occured in the construction of the coffer dam.

Concrete foundation and spill way

The spill way location of the dam was changed later from the left bank to the central portion. So in blocks 7 and 8 of the dam about 8' thick layer of concrete mat had to be provided for the foundation. Block 7 and 8 stand on the deepest level and in these blocks are located the construction sluice. The maximum width of the dam comes at these blocks. On actual execution of the work, there were many trenches and pits found in the foundation area, for which additional quantities of concrete had to be placed. Further excess quantity of concrete for the foundation was necessitated by the change in the design of the dam.

Rectification of fault zone

In block II of the dam while, the foundation was being prepared to receive concrete levelling course, some loose materials were noticed at certain portions. These were wedged and removed. But the process indicated a dip or a small fissure in the region and so the entire loose stuff below the rock was scooped out. The fissure portion was filled with cement concrete to a level above the general foundation level. Additional holes were drilled in this portion and grouted. Holes were also drilled in front of the upstream face of dam and grouted. This had caused delay and increase in cost.

Dam Construction Proper

Replacement of surki with cement

The dam was originally proposed to be constructed with cement mortar blended with 20 per cent surki. But it was found from laboratory tests that sufficient strength had not been achieved by using surki. At the same time procurement of surki was found to be difficult and usage uneconomical on account of the cost. The approved quality of surki in bulk quantities could not be procured in time. As such the use of surki had been abandoned and cement was used in its place. This added to the cost overrun.

The work relating to the construction of the dam including balance excavations and river diversion was sanctioned as a separate work vide letter No.C2A/381/59-60 dated 2-3-1961 by the Chief Engineer, Civil. The work was tendered and was awarded to Sri B.M.Edward.

Changes in the design of the dam

Subsequently there occurred some changes in design and the height of the dam. The dam at Pamba was originally designed as a masonry straight gravity type with a height of 1651' and the length is 825'. But later the height of the dam was increased by 6' with a total top length of 910', so as to have increased storage capacity. This resulted in an increase in time and cost. The PAC was raised from Rs.97,76,000 to Rs.1,22,50,000.

Delay in starting work

The masonry works were started in block 3 only on 2-10-1961, though it was scheduled to be started in early 1961.

Improper functioning of machinery

As against the conditions of contract the crushers were handed over to the contractor only on 5-11-1962. As seen, the progress of masonry was much affected on account of the low stock of sand and improper functioning of the crusher during the initial stages.

Lack of access to the work site

The target of construction during the working season was 75 to 100 units of masonry per day. At lower levels of dam, the cable way was not available. The materials were conveyed in lorries and truck lines and then to the site of construction by head load. As the dam reached higher levels, the progress and target were much affected, since the materials could be brought through an approach road only since other approach roads became obsolete. This meant access over the top of the dam through one route only, rendering the possibility of construction only in one block at a time. So the cable way was used from 10-10-1964, to compensate the fall in the work progress. Even the use of the cable way could not save the scheme from time-lag and cost overrun.

Delay in the construction of sluice

The sluice was constructed in the body of the dam in 1962 and was plugged in May 1965.

The preliminary arrangement for this began by 15-3-1965. But the water supply arrangements in the dam colony was affected due to closing of the down stream flow of the river for the above work, hence the ring bund had to be opened occasionally to let out water through the sluice for feeding the down stream upto 10-4-1965. Alternative arrangements were made by the contractor and the department for water supply from the upstream and so again the works in connection with plugging resumed.

Climatic factors

Yet another difficulty experienced in this work was the untimely heavy rain and rising of water level causing damage to the ring bund and great inconvenience to the work. Sufficient diesel or electric pumps were also not available to solve this.

Power failure

The power failure at critical times was another difficulty experienced in this work. The final work in this area--the concreating infront of the sluice walve--was completed on 6-5-1965 and the partial storage of water in Pamba dam was begun.

Provision of radial gates

The original proposal was to construct an ungated spill way. Later it was decided to increase the storage capacity of the reservoir by increasing the height of the dam from 165' to 171'. Hence the provision of six numbers of radial gates, with a concrete bridge for the spill way gap had to be included, which resulted in excess work leading to cost and time overrun.

Outlet arrangements

The Pamba dam has been installed with a 6' dia. disperser outlet arrangement. The place of the outlet erection was shifted from the originally planned area in 1962 which helped to save Rs.3 lakhs.

Devaluation

The increased price of imported equipments and the devaluation of Indian currency increased the cost of the scheme.

Low quality work and its rectification

The permeability test carried out in all the 10 blocks found that the permeability (leakage) was above the optimum technical level. This was especially true in the case of blocks 8, 9 and 10 where the work was carried out expeditiously to adhere to the revised targets. This had necessitated grouting in the dam. Thus the efforts to bring up the progress of work to meet the target caused a fall in the quality of work which ultimately resulted in further cost overrun.

Delay in the supply and erection of radial gates

The 224' long spill way of the Pamba dam consists of 6 nos. of radial gates. The orders were placed with M/s.Jesope and Company Ltd., Calcutta for the supply of all the 6 nos. radial gates in February 1963. The supply was to be effected in February 1964. For want of raw materials the manufacture was delayed and the supply was effected only on May 1966 and so the erection of the gate was delayed.

The erection of these gates was given on contract. The work was started on 23-9-1966. As per the schedule, this should have started in November 1965. Before June, 1967 all the gate parts were received at the dam site. The minor manufacturing defect occured was corrected by the company at the dam site. The erection work was completed on 30-8-1967 at an erection charge of Rs.17,500/- But the electric connections were given only in 1968.

Finishing work

The finishing work and balance work were carried out at this stage. The extent of time-lag and cost overrun in the finishing work was nominal.

Organisational set up of Pamba dam

During the time of investigation and connected work there was a division called No.II Division Pamba. Then the circle was organised in Pamba in 1961, amalgamating the division. All the early work of the Pamba dam was managed by 3 Assistant Engineers and subordinate staff. As the work was in progress an Executive Engineer was posted at Pamba in charge of Pamba dam. The Superintending Engineer was the account rendering officer till the completion of the Pamba dam.

Labour Organisations

As most of the work was carried out through contract agencies, the workers were recruited by the contractors. The average strength of contractor's labourers was on an average 490 per day to 1360 per day. The departmental labourers were only 5 per day to 40 per day.

Labour unrest and strike

The major contractor of Pamba dam was B.M.Edward and Company who maintained good relations with the labourers. So practically not even a single working day had been lost due to labour unrest.

But the departmental labourers conducted a strike for 10 days in October 1964 for achieving certain demands. But the work was not affected since the work was managed by the contractor's labourers with the help of the departmental executive staff.

The departmental workers again struck work for 5 days in 1966. In 1967, the Departmental N.M.R. Mazdoors struck work for 45 days for their claims on pensionable service. In 1967-68 the monthly paid staff of KSEB including Assistant Engineers agitated. But these also did not affect the work. So the increase in time and cost of the project due to labour problems was nominal.

The estimated and quoted rate

Yet another factor contributed to the increased cost of Pamba dam was the fact that the quoted rate by the contractor was greater than the estimated rate.

Time-lag and Cost Overrun of Kakki Dam

Kakki dam is the major scheme involved in Sabarigiri hydroelectric project and is located in the thick forests of Western Ghats. the dam had been constructed across Kakkiar, a tributory of river Pamba. The major events related to the Kakki dam construction programme are given in Table 7.5. This reveals that there was delay in starting the work. As per the initial plan the dam work was scheduled to start in 1961, but could start only by the end of 1962 (Table 7.5). Also there was delay in completing the work. Table 7.5 reveals that the contractor could not complete the work in time as per the contract agreement. Table 7.2 also shows that the project was originally scheduled to complete during 1963-64, but was completed only in December 1966. This has resulted in a time-lag of 2.5 years. The cost overrun of the project is presented in Table 7.3. The original estimated cost of the scheme was Rs.429 lakhs but it increased to Rs.865 lakhs, a cost overrun of Rs.436 lakhs (101.64 per cent increase over the original). A brief analysis of time-lag and cost overrun of Kakki dam is presented here.

Preliminary works of Kakki dam

The detailed investigations were done only in 1960, by the special squad from the Chief Engineer's office and was completed in December 1960.

Survey

The final survey of the dam was carried out during

Table 7.5

Kakki Dam - Major Events in Its Construction Programme

Sl.No.	Particulars	Year/date
1.	Year of starting initial investigation	1946
2.	Year of starting detailed investigation	1960
3.	Year of starting detailed survey	1961-62
4.	The original scheduled year of starting the work	1961
5.	Tenders were invited on	Dec. 1961
6.	Date of awarding the work	Oct. 1962
7.	Year of starting the work	1962
8.	Scheduled year of completion of the scheme	1963-64
9.	Date of completion as per contract agreement	31 Dec.1965
10.	Date of completion of the work	Dec. 1966

Source:
1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. The Accelerated Programme of Execution of Pamba Kakki Scheme (1961), KSEB, Trivandrum.
3. Project Report (1960), Pamba-Kakki Scheme, KSEB, Trivandrum.

1961-62. In 1961 there was an abnormal flood in Kakki river which resulted in the loss of many tools and drilling articles and caused delay. The triangulation survey of the dam was carried out in 1961 and the entire line of the dam was fixed. The contour survey was conducted in 1961-62. Geological studies were also carried out. There was some delay in completing these surveys.

Major infrastructural work

During 1954-56 a jeep road was constructed from Vallakadavu to Kakki. It was only in 1961 that the jeep road was modernised.

The staff colony of 250 houses was built at Anathodu by 1961. A contractors' colony, around 300 houses, was constructed within a period of two years. A departmental store was opened at Anathode only in 1962. A core museum was constructed very late, for ready reference, in 1966.

The whole work for the construction of Kakki dam was completely mechanised. A departmental workshop was established at Anathode which was running only on a small scale. But the contractors M/s.HCC had a well equipped workshop for the upkeep and maintenance of the heavy machinery.

The machinery of the contractors M/s.HCC had to be transported from the Rehund dam site in Uttar Pradesh where they had just completed the work. There was much delay in transporting these machineries by rail and by heavy duty vehicles from Rehund to Cochin and then to Kakki.

Dam works

Change in the nature of the dam

The original proposal was to construct an Arch dam, but this was changed later. Tenders were invited for the construction of dam in December 1961 and the work was awarded to M/s.HCC, Bombay in October 1962. As per the agreement the construction of the dam was to be completed before 31st December 1965, but it was completed only by the end of 1966. A brief account of the reasons for the delay and cost overrun of the work is given below:

Excavation and fault zones

The foundation excavation was started by HCC during 1961-62. Some additional work occurred in soil and rock excavation. Weak zones were found in actual excavation and were treated systematically. All these necessitated some additional time and cost. The river diversion was done during February 1962. A masonry coffer dam was also constructed for the same purpose.

Concreting of the dam

In the original estimate the dam was to be constructed of rubble in cement. But subsequently the dam was converted into cement. The concreting of the Kakki dam was started on 16th January 1964. The concreting work had to be closed for the monsoons of 1964 on 20th June 1964 and the same was resumed in September 1964. Initially the work at Kakki dam was not allowed to go below the revised targetted progress. But during 2-3-1965 to 21-3-1965, due to the acute shortage of cement, the work was stopped causing the work to fall below the target.

Increase in the height of the dam

Owing to the deeper foundation and the height of the dam being increased by 10' the quantity of concrete increased to 256 lakhs cft. The corresponding increase in the cost of work, on the basis of the agreed rates of the contract, worked out to approximately Rs.315 lakhs (Technical Completion Report, 1977).

Again, height of the elevator was to be increased as per the new requirement. This resulted in increased work. Installation of outlets with emergency gates and valves were not provided in the original estimate. But a nominal provision of Rs.4 lakhs was there for outlet arrangements, but it increased to Rs.24 lakhs.

In the original estimate only a portion of the concrete was proposed to be cooled. But cooling of the entire quantity of concrete was necessitated during actual execution.

The change in type of metal sealing stripe to 'U' type from the originally proposed 'Z' type has escalated cost. Excess expenditure for providing air vents for outlets and air dust to elevator shaft also resulted in cost escalation.

Erection of elevator, installation of outlets, driving and lining of drift tunnels were required to be carried out during actual execution. These were not anticipated at the time of the preparation of original estimate.

For discharging the flood during monsoons when construction was going on, Elevator No.9 of Kakki dam was kept as a spilling block which necessitated the forming of the toe of the spilling blocks. This resulted in some excess expenditure. Again, the quoted amount of the contractor was higher than the estimated amount.

Delay in partial storage

Partial storage of water in reservoir for power generation was scheduled to be by 31st May 1964. But as there was delay in obtaining the batching plant from USA, it was not possible to adhere to the above programme. So the concreting in the dam had a delayed starting in January 1964. So the revised schedule for partial storage was fixed on 27th January 1966. The various time revisions for partial storage of water in Kakki dam are given in Table 7.6.

Delay in the supply of machines

Again owing to the delay in the fabrication of penstock pipes, the construction sluice in Kakki dam could be plugged only very late on 27th January 1966 and so partial storage of water was delayed.

Natural factors

On the left side above the rest of the dam surface

Table 7.6

Time Schedule of Partial Storage of Water for Power Generation in Kakki Dam

1. Original Schedule	31 May 1964
2. Revised Schedule	1 Nov. 1965
3. Actual Schedule	27 Jan. 1966

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Annual Reports (1965-1967), KSEB, Trivandrum.

landslide occurred during construction. Again shrinkage cracks were noticed in the concrete structure of the dam. This resulted in some additional work leading to additional cost and time in the completion of concreting.

The original proposal was to install various instruments in Kakki dam for safety purpose studies. But none of them was received in time. In the ordinary course of events the installation of gates and valves for the outlets should have preceded the plugging of construction sluice. But in Kakki dam in view of the requirement to commission the generators during March-April 1966 and due to the delay in the receipt of gate parts and valves, it was necessary to install the gates later with standing water.

Gates and valves

The emergency gates and hollow jet valves were from Pacific Cost Engineering Company, USA and the orders for the same were placed by the Director General of Supplies and Disposals on 23rd December 1964 only. Much delay occurred in its delivery due to procedural process.

Since there was delay in receipt of these gate parts and valves, the two outlets were closed temporarily with flanges to store water, which added to the increased cost.

The emergency gate moved from Los Angeles on 21st November 1965 and reached the site by the end of January 1966. But the hollow jet valves were received at the site only in September 1966. The valve house was completed in 1965 and the erection of the emergency gate and hollow jet valves was completed by the end of September 1966. Much delay occurred in this work due to the delayed supply of materials and the resultant difficulties (standing water) in its erection.

Arbitration and legal issues

Hindustan Construction Company (HCC) had to import machinery only from America as per aid agreements. Their claim was that if they had been allowed to get the same from other countries they could have saved Rs.3.71 lakhs. The payment was made to HCC by KSEB.

Excess customs duty on spares

The difference in the customs duty between the date of purchase of tools and plant and the date specified in the agreement was claimed by the Company (1.18 lakhs). As far as the tools and plants were concerned there was specific provision in the agreement to pay. The dispute was whether that was applicable to spares. The dispute was settled by granting the amount to the contractor. Such disputes and legal issues between KSEB and the contractor also resulted in time-lag and cost overrun.

Flanking Dam for Kakki Reservoir

The Flanking Dam for the Kakki reservoir is located at Anathode, about 2.5 miles northeast of Kakki dam, where a low saddle existed. The flanking dam is constructed to increase the capacity of the Kakki reservoir and to locate the spill way of the Kakki reservoir. The dam has a height of 170' above foundation and a length of 1500' including the spill way. The major events in the construction programme of the flanking dam are furnished in Table 7.7.

Table 7.7 reveals that considerable delay occurred in starting the work and in completing the work. The tender invitation for the dam work was in March 1963 but it took seven months to award the contract, i.e., the period till October 1963. It can be further noticed from Table 7.7 that

Table 7.7

The Major Events Relating to Flanking Dam

Sl.No.	Particulars	Year
1.	Year of detailed investigation	1960-61
2.	Date of tender invitation	Mar. 1963
3.	Date of awarding contract	Oct. 1963
4.	Date of completion of excavation works	Mar. 1964
5.	Year of starting construction	Sept. 1964
6.	1960 scheduled period of completion	Oct. 1966
7.	1961 accelerated programme of completion	1965
8.	Actual date of completion of works	May 1967

Source:
1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Project Report (1961), Pamba-Kakki Scheme, KSEB, Trivandrum.
3. Project Report (1960), Pamba Kakki Scheme, KSEB, Trivandrum.

there was further delay in the completion of the work.

The extent of time-lag and cost overrun of flanking dam is presented in Tables 7.2 and 7.3. Originally the dam was scheduled to complete in early 1965, but the actual completion was in May 1967. Thus the flanking dam work experienced a time-lag of about 2 years.

Table 7.3 shows that the cost of the scheme increased from the original estimated amount of Rs.114.4 lakhs to Rs.245 lakhs. This has resulted in a cost overrun of Rs.133.60 lakhs which comes to about 119.93 per cent increase over the original estimate. A brief analysis of the construction programme of flanking dam with a thrust on time-lag and cost overrun is presented below. For this the dam work is classified as preliminaries, excavation, dam work and spill way.

Preliminaries and investigation (Flanking Dam)

To collect sub-surface details, drilling operations were sanctioned by the middle of 1961 at an estimated cost of Rs.64,200 for 80 Nos. of bore holes. But actually 100 Nos. were drilled and studied during November 1961 by the superintending geologist. All other surveys were carried out by the departmental staff. Based on the findings of the investigation, the final decision regarding the nature and type of the dam was taken only in January 1963 and arrangements were made to invite tenders. These have resulted in delayed starting of work.

Eviction

The dam site area was partly occupied by the private shops and encroachments which were to be evicted before the work started. But there was some delay in evicting people from the dam site area.

Departmental arrangements

The Flanking dam was under the control of one Executive Engineer with two Assistant Engineers and eight Junior Engineers. Half of them were in charge of the dam and the other half was meant for the spill way and auxiliary work. A departmental work shop was started in Anathode. For speedy maintenance of sand crusher a workshop was maintained at the crusher site itself. The US made crusher began functioning at the dam site only in July 1964. This met with some initial troubles. This had caused some delay and increased the cost of the dam.

The cable way used in Pamba dam was dismantled on

1st November 1965 and the same was erected in the Flanking dam site on 1st November 1966 at the expense of the contractor. Since the cable way was damaged due to earlier work, the 10 ton capacity cable way was used to carry only 5 tonnes. So the contribution of the cable way for the speedy completion of the project was diluted.

Excavation

There were difficulties with the conditions of the foundation of the dam, requiring realignment of the dam resulting in deeper excavation and longer length of the dam excavation. Further, during excavation it was found that the 3, 5 and 8 zones of the base of the dam were fault zones. So special treatment was done in these zones. These were not identified in the survey.

Due to narrow space of work in the dam site, sufficient labourers could not be employed. The contractor was able to do only a quantity of 350 units of common excavation against the target of 400 units. Still the progress was rather steady. But this was at the expense of the progress of the work of the spill way. The excavation work of the dam was completed by March 1964 only.

Dam construction

The actual construction of the dam was commenced only in September 1964. Since deeper and longer excavations were done, the masonry in the dam has increased considerably from the estimated 40 lakhs cft. to 63 lakhs cft. This was one of the major factors contributing to time-lag and cost overrun of the scheme.

At a later stage, it was decided to have partial storage in Kakki reservoir in June 1965. So an accelerated programme of construction of the dam was started. This caused shifting of attention from the spill way to dam and resulted in the time-lag of the spill way work also.

Spill way work

The major events in the spill way work and the item-wise time-lag are presented in Table 7.8. In the spill way channel excess quantity of rock excavation occurred. Excess concreting was necessitated due to the change in design and fault zones. Increase in the price of spill way gates also contributed to the increase in cost.

Table 7.8

Scheduled and Actual Programme of Work of Spill way

Work	Target date	Actual date	Time-lag in years	Reason
Commencement of spill way excavations	Mar.1964	Mar.1964		
Completion of spill way excavation	Dec.1965	May 1967	1.5	On account of the deviation of road taken through spill way, due to partial storage.
Commencement of spill way concreting	Sept.1965	Nov.1966	1.2	Attention concentrated in the flanking dam to effect partial storage.
Completion of spill way concreting	Mar.1966	Jul.1967	1.25	Late beginning of concreting

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Project Report (1961), Pamba-Kakki Scheme, KSEB, Trivandrum.

Supply and erection of radial crest gates of the flanking dam

The spill way has 4 Nos. of radial gates to regulate flood discharge, controlled by separate hosting arrangements for each. The gates and accessories were supplied by M/s.Pacific Coast Engineering Company, California. Orders for the supply of the same were placed by the Director General of Supplies and Disposals, Government of India only on 20th October 1964. Originally scheduled shipping date had to be extended to January 1966 due to labour problems in the factory.

The contract for erection was awarded on 17th November 1966 by the Special Officer, Central Mechanical Unit, Pallom at the quoted rate of Rs.234/- per metric ton which was above the estimated one. The work was started on 20th January 1967.

As per the agreement the contractor was expected to do the actual erection of gate, only after completion of civil works. But due to delay in concreting of the hoist bridge, the erection work was carried out with special arrangements, as instructed by the department, which led to an increase in the cost of the scheme.

Interconnecting tunnel

The Pamba reservoir and the Kakki reservoir of the Sabarigiri hydroelectric project have been connected by an interconnecting tunnel, 10450' long, lined with cement concrete. The details of the work scheduling as visualised in the project reports and actual execution are given in Table 7.9.

Table 7.9 reveals that both the excavation of the face of the tunnel and the drilling of tunnel resulted in time-lag. The extent of time-lag and cost overrun of the scheme is presented in Tables 7.2 and 7.3. The project had a time-lag of 1.5 months but had a negative cost overrun. The original estimated cost of the project was Rs.51 lakhs but the actual execution of the scheme made use of only Rs.50 lakhs. The fall in the cost of the scheme was due to the general savings in the estimated quantity of work.

The detailed study of time-lag in the tunnelling is carried out here. For the speedy completion, the work was started even before the triangulation survey was over and when it was over the work of 200 ft. of tunnel was done.

Table 7.9

Major Events Related to the Interconnecting Tunnel

Sl.No.	Particulars	Year
1.	Date of awarding contract	15-3-1961
2.	Date of starting face excavation for the tunnel	13-4-1961
3.	Original scheduled duration of face excavation	2 months
4.	Actual period taken for excavation	3 months
5.	Date of starting tunnelling	14-7-1961
6.	Original scheduled duration of the work	24 months (13-7-63)
7.	Actual period taken to complete the work	25.5 months (9-1963)
8.	Time-lag	1.5 months

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Project Report (1961), Pamba-Kakki Scheme, KSEB, Trivandrum.

The work was divided into two: the interconnecting tunnel section I and II and the contract was awarded on 15th March 1961 to two contractors.

At the inlet and exit locations of the tunnel the opening of face was commenced on 13th April 1961 and 20th March 1961 respectively and the work was completed on 10th July 1961 and 20th May 1961 respectively. One contractor completed the face excavation in time, i.e., within 2 months and the other took one more month over the scheduled time.

The tunnelling was started on 14th July 1961 at the inlet section and on 25th May 1961 at the exit face. The works on the first section were completed in one week ahead of the original schedule. The completion of work by the other contractor was delayed by 1.5 months. The delay was mainly due to (1) frequent power supply failure, particularly during the first year of tunnelling; (2) scarcity of compressed air, (3) limited supply of explosives due to the declaration of national emergency, and (4) poor quality of the rock.

Owing to the poor quality of the rock, a heavy roof fall occurred in the tunnel. So a lot of concreting became necessary to give strength to the rock. For this five Nos. steel supporters were to be fabricated and that took some time. Leakage of water in certain areas also caused additional work. Again lack of trained labour at the beginning was a serious problem in tunnelling.

Concrete lining of tunnel

The target of concrete lining was achieved in the exit drive. But at the inlet side there was shortfall and delay due to unforeseen rock fall. It took nine months to remedy it. Again as the tunnel was slopping from inlet to exit all the cumulative leakage of water had to be tackled in this area.

The Intake Arrangement of the Power Tunnel

This is located on the left bank of the reservoir up stream of the Kakki dam. It consisted of a shaft with a length of 237'. The flow of water is regulated by one vertical lift gate. The arrangements have been erected on a hoist platform. Trash rack arrangements are also provided.

The preliminary studies and drilling were done in August 1962. The excavations were done in December 1963. The control shaft was located just below the access road to the top of Kakki. So protective walls were to be constructed, resulting in excess expenditure and additional time.

The driving of the shaft was started on 21st January 1964. The widening of the shaft was started in May 1964 and completed in June 1964. The concrete lining was started on 9th December 1964 and completed on 27th September 1965.

The control gate and accessories were supplied by Allis-Chalmers, USA. The transportation of the same to the site met with some problems and delay. The erection work was commenced on 27th July 1965 and completed on 15th November 1965.

The cost overrun of intake arrangements is presented in Table 7.3. The original estimated cost of the project was Rs.10 lakhs which had increased to Rs.31 lakhs, resulting in a cost overrun of Rs.21 lakhs. this comes to about 210 per cent increase over the original estimated cost.

Additional works such as removal of overburden, additional excavation at power tunnel intake were necessitated during actual execution of the work which increased the time and cost of the scheme.

The cost of intake gates for power tunnel and interconnecting tunnel had increased due to increase in the customs duty and devaluation of Indian currency. The cost of trash rack arrangements and erection charges were debited to this item. Further the quoted rate of the contractor for various items of work was higher than the estimated rate. All these contributed to the increase in cost of the scheme.

Power Tunnel - Sabarigiri Hydroelectric Project

The power tunnel started from the Kakki reservoir and ended at the L.P. pipeline with its surge shaft at the exit side. The length of the tunnel is 18274' and the tunnel has three audits. The major events related to the work of this scheme is presented in Table 7.10.

Tenders for driving of tunnel were invited in February 1961 and the same were awarded to P.M.Paili Pillai, for tunnelling the 8000' on the inlet side and the 10200' length at the exit portions was awarded to HCC in August

Table 7.10

Power Tunnel--Schedule of Work

Item	Year
Investigation of the tunnel started	Dec. 1959
Survey started in	Jan. 1961
Tenders invited for tunnel driving	Feb. 1961
Date of awarding contract	Aug. 1961
Tunnelling started on	Feb. 1962
Scheduled duration of the work	32 months
Tunnelling completion date as per the accelerated programme of execution of Pamba-Kakki Scheme 1961	Middle of 1963
Date of completion of tunnelling	1-1-1964
Intake arrangement completed and tunnel ready for commissioning	15-11-1965

Source: 1. Project Report (1960), Pamba Kakki Enlarged Scheme, KSEB, Trivandrum.
2. Pamba Kakki Execution Report (1961), Accelerated Programme, KSEB, Trivandrum.

1961. The time of completion contemplated was 32 months for the entire portion. Though faulty zones are found, the work was completed in a speedier way because of healthy competition between two contractors. As against the target of 250' per month 714' per month was attained by one contractor as against a record attained by the HCC about 612' in certain months. These were record events of that time in India.

Table 7.10 shows that the tenders were invited in February 1961 but the work was awarded only in August 1961 and the work was started only in February 1962. Thus it took one year to start work after the tenders were invited.

Surge shaft and power tunnel

The surge shaft of Sabarigiri hydroelectric project is located at the end of a 16858' long head race tunnel. The major events related to this scheme are presented in Table 7.11.

The cost overrun related to this scheme is presented in Table 7.3. The original estimated cost of the scheme was Rs.181 lakhs which increased to Rs.218 lakhs, resulting in a cost overrun of Rs.37 lakhs. This comes to

Table 7.11

Major Events Related to the Surge Shaft Work

Sl.No.	Particulars	Year
1.	Date of starting the work	23-2-1963
2.	Date of starting work as per 1960 project report	Early 1963
3.	Scheduled date of completion	2-5-1964
4.	Actual completion of the work in all respects	Feb.1965
5.	Time-lag in years	1 year

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Project Report (1960), Pamba Kakki Scheme, KSEB, Trivandrum.

be about 20.44 per cent increase over the original estimate. The surge shaft work resulted in 100 per cent increase in the time schedule of completion (Table 7.11).

The existence of quartzite rock, which was not identified earlier, necessitated 25 per cent increase in cost and the same was given to the contractor for the work where quartzite rock was found.

Portions of the tunnel, particularly, on the exit side passed through comparatively weak and stratified rock. This resulted in some over breakages and required extra quantity of lining, some portion with reinforcement also. All these have contributed to time-lag and cost overrun.

Track cutting and anchors for penstock

The penstocks of Sabarigiri hydroelectric project run down from inside the power tunnel to the turbines. The site for the pipeline was traced out in the year 1960. Tenders were invited for the work of track cutting during 1962-63. The work was awarded in 1963, to Shri Joshua Kollamgodu. But he could not complete the work. Later, the original cost was revised due to increased quantity of work in actual execution over the planned one and the work was retendered.

This so happened because the core borings and studies were not fully done before the original estimate. So during the actual execution of the work, wide variations were found in the nature of soil and rock. There was considerable increase in the quantity of work also. In the original project estimate, the length of the penstock was estimated as 6050'. But in actual execution the length increased to 8563'. This necessitated an increase in track cutting length also. The depth of the track cutting also increased in actual execution. Again, against the plan, more heavier anchors were used. The decision of using additional anchors was taken later and so this work was arranged through another contract agency.

All these led to time-lag and cost overrun of the scheme implementation. The extent of cost overrun related to track cutting and anchors is provided in Table 7.3. The original estimated cost of the scheme was Rs.30 lakhs which increased to Rs.65 lakhs, and resulted in a cost overrun of Rs.35 lakhs.

Penstocks and valves

The penstocks of Sabarigiri hydroelectric project run down from the inside of the power tunnel to the turbines.

The supply of major equipments was from M/s.Chicago Bridge and Iron Company, USA and a few items were obtained from Switzerland.

The fabrication and erection of penstocks were awarded to M/s.Giovanola Binny Ltd., who started their penstock factory in Palluruthy during 1960-61. The fabrication of L.P. pipes was started in July 1964 and completed in Fabruary 1965. The fabrication of H.P. penstock was started in December 1964 and made available at the site in 1966.

Roads, costing around Rs.90,000/- and four dump yards were constructed at a cost of Rs.2,60,000/-. Cranes and power supply were arranged at the site. A departmental workshop also was started at the site to avoid delay. But these works also resulted in time and cost overrun.

The average rate of erection of penstocks was 750 tonnes per month. During January 1966 to April 1966 a record progress of 1000 tonnes in erection work per month was achieved which is considered to be one of the world records in this type of work. But the delayed supply of cranes and the difficulty in operating winches caused some problems.

The inclined tunnel

The inclined tunnel is located between Anchor No.19A of the penstock route and power house. From Anchor No.19A the three electrically welded penstocks later pass through 3 Nos. of inclined tunnels each line branching into two and these six numbers are connected to the turbo generators.

The contract of the driving of the inclined penstock tunnels was given to M/s.HCC, Bombay, for an estimated amount of Rs.5,60,600/-. The work normally requires a period of nine months to complete. But it took only six months to complete starting from 17th June 1963 to 31st December 1963.

The cost overrun related to penstock and valves is presented in Table 7.3. The original cost of the project was Rs.350 lakhs, which increased to Rs.451 lakhs. This resulted in a cost overrun of Rs.101 lakhs which comes to be about 28.86 per cent increase over the original estimate.

The changes in the original proposal, due to the land slip at the switch yard, resulted in additional work and expenditure. Still the work was completed before the revised scheduled time.

The entire penstock was originally proposed to be in mild steel construction. But later on as decided, the use of mild steel was confined to the top portion of the penstocks. For the lower portion of the penstock high tensile steel was used. These were imported from USA. The increased customs duty, increased price of materials and the devaluation have also contributed to cost overrun.

The quantity of steel imported from USA increased to 14246 metric tonnes against an original estimated quantity of 13500 metric tonnes. Increase in tonnage of steel had also increased the cost of steel plates, fabrication, transport and erection charges. No provision was made in the original estimate for the supply of miscellaneous mild steel materials such as rounds, bends, flats, nuts, bolts, etc. Fabrication and erection cost increased by about 25 per cent due to increased price of the materials used. Increase in engineering fee paid to

M/s.Giovanola Binny Ltd., due to price variation was another reason. Cost of steel lining for the surge shaft was also included under this item, since fabrication and erection of the same was done along with that of penstocks. All these have contributed to the increase in cost.

Power house

The power house of the integrated Pamba-Kakki hydroelectric project is situated at the banks of Muzhiyar. The power house building was completed in 1967. The extent of time-lag and cost overrun related to power house and related works is furnished in Tables 7.2 and 7.3. The contributory factors to time-lag and cost overrun of power house are explained here.

For levelling the site of the power house, transformer yard and switch yard and the construction of the retaining walls, tenders were invited in May 1961 and the contract was awarded in June 1961 to two contrctors for the speedy completion of the work, but the work started only in September 1961.

The progress of the work was considerably affected owing to heavy rain and flood during 1962. During actual execution the actual quantity of work had exceeded the estimated quantity due to the modifications in the original plan. Owing to certain issues contractor C.N.George stopped the work on 30th June 1963.

The balance work was given to Shri C.V.Kuriakose by inviting tenders, who started the work on 13th August 1963. This caused a delay of about 2.5 months.

The work awarded to Shri C.M.Joseph was terminated on 10th March 1963. This so happened because he was not willing to carry out the work at the agreed rate and the Board was not willing to increase the rate. So the remaining work was retendered and awarded to M/s.P.K.P. & Sons at a rate below the one quoted by Shri C.M.Joseph. They started the work on 12th November 1963 and stopped it on 1st June 1963. The work left over by M/s.P.K.P. & Sons was entrusted with Mr.C.V.Varghese as a stop gap arrangement at a higher rate to take advantage of the working season.

A heavy land-slip occurred in the switch yard site in July 1963. This along with the termination of contracts caused delay. Due to the land-slip the original proposal of the switch-yard was changed. Thus the balance work and new work were awarded to Shri C.M.Joseph by inviting fresh tenders. He commenced the work on 4th October 1963 and completed the work on 30th June 1965. All these resulted in extra cost and extra time to complete the work.

The work of foundation excavation for the power house was awarded to Shri C.P.Varghese. He started the work on 16th November 1962 and stopped it on 1st June 1963. The balance work was completed by another contractor.

The tender for the construction of power house was invited in June 1963 and the same was awarded to Shri Cherian Panthrose in August 1963 and the work was commenced on 22nd August 1963. The changes in the original plan resulted in extra work, and revision of estimate.

There was a 11 KV power line to supply power to the power house site. A 66 KV line was planned to get constructed. But it did not get materialised due to the difficulties in crossing the Kakki dam site. This had resulted in power shortage during peak periods of work. A thermal power plant imported from USA was erected in the power house site and operated till the completion of the project.

The construction of the power house building also met with delay due to the delayed delivery and faulty design of steel structures by the contractors, M/s.Allis Chalmers International, USA. The company assumed that there would be lateral supports at various floor levels for the roof slab of the power house. KSEB executed the works without lateral supports. This created much trouble, delay and increased cost. The company in USA which supplied the fabricated steel could not act according to the solutions they had suggested for the above issue but, at a later stage, they demanded the execution of an agreement for an additional claim of about 1 million rupees. This was unacceptable to KSEB. So the KSEB approached CWPC for alternative proposal. The work was kept in abeyance for a period during January to June 1965. Later the strengthening work was done after consultation with Mr.Fried of M/s.Pioneer Service and Engineering Company, Chicago, who was deputed to Kerala by Allis Chalmer Company, USA on request of KSEB.

The excavation done for fixing the transformers was found to be insufficient as per the finally approved drawings of the generator suppliers. This called for additional work and delay.

The non-cooperation of Forest Department, objections raised by estate owners, delay in making agreements with land owners, unexpected heavy floods, weak and incomplete planning etc. resulted in time-lag and cost overrun in the construction of roads to the power house site.

The original estimate was made on the basis of preliminary drawings which had to undergo major changes during actual execution. The layout of the switchyard had also to be modified in view of the earth slippage that occurred in July 1963. Based on the revised proposal for the layout of the switch yard, the level of power house had also to be raised by 5 ft.

Certain traiting work was done on the small stream of Gobiar river which discharged its water into the tail race channel. Many items which were not included in the original estimate but which were found to be necessary during the course of construction were done during actual execution.

The quoted rates of the contractors for most of the items were higher than the original estimated rates.

Protective work at the slipped area for forming switch yard was charged for this item. All these contributed to time-lag and cost overrun.

Generating sets and transformers and cost overrun

Six generating sets were placed in Sabarigiri hydroelectric project and all these were imported from USA. The time-lag of the scheme is given in Table 7.2. The scheme resulted in a time-lag of 1.8 years. The cost overrun related to generating sets and transformers are furnished in Table 7.3. The original estimated cost of the scheme was Rs.420 lakhs. This increased to Rs.678 lakhs resulting in a cost overrun of Rs.258 lakhs with a 61.42 per cent over the original estimated cost.

The accepted bid for the generating sets, transformers, etc. is considerably higher than the original estimate. Increase in price of imported equipments from USA was one of the main reasons for excess under this item. Devaluation of rupee and increased customs duty also added to this excess.

Transformer yard

The construction of the transformer yard also resulted in cost overrun amounting to Rs.3 lakhs. The estimated cost of the scheme has increased from Rs.5 lakhs to Rs.8 lakhs, i.e., a cost overrun of 60 per cent over the original estimate (Table 7.3). The land-slide in the transformer yard contributed to the delay and cost overrun.

Roads and bridges and cost overrun

The original estimated cost of this scheme was Rs.99 lakhs which increased to Rs.155 lakhs. This has resulted in a cost overrun of Rs.56 lakhs, i.e., 56.5 per cent increase in cost over the original (Table 7.3).

Additional construction of roads, increasing the quality of roads and increase in the price of men and materials, increase in compensation to land owners and delay in land acquisition have contributed to the time and cost overrun of this scheme.

Buildings and cost overrun

The cost of buildings (accommodation) increased from Rs.98 lakhs to Rs.118 lakhs. This caused a cost overrun of Rs.18 lakhs. This is about 18.36 per cent increase over the original estimate (Table 7.3).

Additional accommodations were necessitated to meet the requirements of the staff. The increase in the price of men and materials also contributed to cost overrun.

Water supply and sanitary arrangements

A cost overrun of Rs.8 lakhs over the original estimate is found in this work. The cost of this scheme has increased from Rs.15 lakhs to Rs.23 lakhs. The increase in cost is 53.33 per cent over the original (Table 7.3).

Electrification and power supply

The original estimated cost of this scheme was Rs.25 lakhs which increased to Rs.65 lakhs resulting in a cost overrun of Rs.40 lakhs and this is about 160 per cent over the original (Table 7.3).

In actual execution the length of 66 KV lines has increased over the estimate. Two diesel generating units costing Rs.20 lakhs were purchased, which were not included in the original estimate. The high operational cost of the power generating units has also contributed to cost overrun.

Cost overrun related to tools and plants

The original estimated cost of plant and machinery was Rs.120 lakhs, which has increased to Rs.187 lakhs resulting in a cost overrun of Rs.67 lakhs. This comes to 55.83 per cent increase over the original estimate (Table 7.3).

The running expenses of all the workshops were included under this head which is one of the major reasons of cost overrun. The increase in the price of spare parts also added to cost overrun.

Cost overrun and consultation charges

The original estimate for this was Rs.5 lakhs which had increased to Rs.6 lakhs resulting in a cost overrun of one lakh rupees (Table 7.3).

The additional visits of the Board of Consultants contributed to cost overrun.

Cost overrun and communication network

This is one among the two schemes where negative cost overrun occurred. The original estimated cost of the project was Rs.5 lakhs. On actual execution it declined to Rs.4 lakhs (Table 7.3).

Supervision charges and cost overrun

The supervision charges went up from Rs.130 lakhs to Rs.211 lakhs, resulting in a cost overrun of Rs.81 lakhs. This is 62.3 per cent over the original estimate (Table 7.3).

Normal revision of pay scales and benefits along with arbitration awards and industrial dispute settlement resulted in cost overrun. The time-lag in the completion of the project added to this. There were 793 KSEB staff, employed in the project both in the civil and electrical wing (Table 7.12). A delay in project implementation implies maintenance of these staff for additional time.

Excess work and cost overrun in Sabarigiri hydroelectric project

The preceding discussions have identified the total and scheme-wise cost overrun of Sabarigiri hydroelectric project. Here an attempt is made to analyse the relationship between excess work over the original estimate and cost overrun.

Cost overrun in projects can occur due to (1) excess work and (2) other factors like time-lag. The

Table 7.12

Organisation of Staff for Sabarigiri Hydroelectric Project During the Main Construction Period

Category	Establishment of staff in Civil wing	Establishment of staff in Electrical wing
(1)	(2)	(3)
Superintending Engineer	2	1
Executive Engineers	6	1
Research Officer	1	-
Assistant Engineers	24	8
Junior Engineers	77	14
Research Assistants	2	-
Senior Superintendents	2	-
Medical Officers	2	-
Assistant Accounts Officer	1	-
S.A.S. Accountant	1	-
Divisional Accountants	5	1
Junior Superintendents/ Head Clerks	4	-
First Grade Overseers	99	16
Store Keeper	4	1

Table 7.12 (contd.)

(1)	(2)	(3)
Upper Division Clerks	49	5
Stenographers	7	1
Upper Division Typists	3	1
Lower Division Clerks	119	10
Second Grade Overseers	114	4
Nurses	2	-
Compounders	1	-
Tracers	9	2
Estimate Copyists	2	-
Blue Printers	3	-
Attenders, Peons etc.	92	17
Lower Division Typists	34	4
Assistant Store Keepers	5	-
Cashiers	5	-
Assistant Foremens	2	-
Roller Drivers	2	4
Line Helpers	10	4
Crane Operators	--	1
Fitters--Mechanical	--	6
Work Superintendents	--	--
Pump Operators	--	--
Total	691	102

Source:
1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Planning Cell, KSEB, Trivandrum.

occurrence of excess work is due to the change in the size of the project, change in the nature of the project, unforeseen factors like climate, existence of fault zones, the under estimation of the work, etc. But whatever be the reason, excess work implies cost and time overrun.

Here an effort is made to quantity the exact contributions of excess work and the other factors contributing to cost overrun. For the study, the excess work of Sabarigiri hydroelectric project is considered. The study requires the quantity of excess work, its material cost and implementing cost. But obtaining the material cost is very difficult. This is because of two reasons: (1) the supply of materials is not by a single agency, and (2) different contracting and sub-contracting systems are found to exist here. Further, though the quantity of materials used for the work can be collected, obtaining the prices of these materials used during the construction period spreading over years is very difficult.

So an indirect method is used to quantify the share of cost overrun due to excess work. The relationship between the material cost and implementing cost is identified by studying the cost overrun of Kakki dam, the major work of Sabarigiri hydroelectric project. This relationship is used to identify the share of cost overrun due to extra work.

The excess cost of Kakki dam due to excess work is Rs.315 lakhs (Table 7.13). The implementing cost (contract cost) is Rs.58 lakhs. So the material cost alone of the dam is Rs.257 lakhs. By using the material cost and implementing cost, the ratio of the same is worked out. The ratio of the implementing cost and material cost is 1:4.5 (Table 7.13).

The scheme-wise and item-wise excess work in Sabarigiri hydroelectric project is given in Appendix I. By using the unit rate of construction, the excess implementing cost is also worked out in Appendix I. The extent of cost overrun is Rs.197,30,795.98 (Rs.198 lakhs), excluding the material cost (Appendix I).

Based on this relationship between implementing cost and material cost (1:4.5), the role of excess work in cost overrun is worked out in the case of Sabarigiri hydroelectric project. This is presented in Table 7.14).

Table 7.13

The Role of Excess Work and Cost Overrun in Kakki Dam, Sabarigiri Hydroelectric Project

Sl.No.	Particulars	Amount (Rs. in lakhs)
1.	The cost overrun of Kakki dam	436
2.	The share of cost overrun of Kakki dam due to to the increase in the height of the dam by 10' (estimated) (Material cost + implementing cost)	315
3.	Increase in contract cost (implementing cost) due to the increase in height of the dam	58
4.	Material cost of the dam (Sl.No.2 - Sl.No.3) (3 5-58)	257
5.	The relation between implementing cost and material cost (i.e. Sl.No.3 and Sl.No.4) (ratio)	1:4.5

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Planning Cell, KSEB, Trivandrum.

Table 7.14

Cost Overrun and Extra Work in Sabarigiri Hydroelectric Project

Sl.No.	Particulars	Amount (Rs. in lakhs)
(1)	(2)	(3)
1.	The total implementing cost of all the extra work in Sabarigiri hydroelectric project (Appendix I)	198
2.	Implementing cost of extra work which have not much material cost (Appendix I)	58
3.	Implementing cost of extra work which need large amount of materials (Sl.No.1 - Sl.No.2)	140
4.	The total amount of material - cost required to provide materials for Rs.140 lakhs worth implementing cost as per the implementing cost material cost ratio of 1:4.5 (Table 7.13) (Material cost is 4.5 times of the implementing cost)	630
5.	The total cost of extra work (Material cost + implementing cost) (i.e., Sl.No.3 + Sl.No.4)	770

Table 7.14 (contd.)

(1)	(2)	(3)
6.	The total cost overrun of Sabarigiri hydroelectric project (Table No.7.1)	1792
7.	Cost overrun of Sabarigiri hydroelectric project due to extra work(Sl.No.5 of this table)	770
8.	Cost overrun of Sabarigiri hydroelectric project due to other factors (Sl.No.6 - Sl.No.7)	1022
9.	Cost overrun of Sabarigiri hydroelectric project due to excess work as percentage of the total cost	40.2%
10.	Other factors led to cost overrun of Sabarigiri hydroelectric project as percentage of the total cost	59.8%

Source: 1. Technical Completion Report (1977), Sabarigiri HEP, KSEB, Trivandrum, Vol.I.
2. Planning Cell, KSEB, Trivandrum.

It is clear from Table 7.14 that out of a cost overrun of Rs.1792 lakhs, Rs.770 lakhs is due to excess work (40.2%) and the balance Rs.1022 lakhs (59.8%) is due to other factors. So it can be generalised that in the case of hydroelectric projects with considerable excess work, around 40 per cent of the cost overrun is due to extra work and the remaining 60 per cent of the cost overrun is due to other factors. This is true only in the case of projects with considerable excess work and in other projects the role of other factors in cost overrun should be higher than 60 per cent.

If extra work occurs in a project the resultant cost overrun cannot be avoided. But the cost overrun resulting from other factors like time-lag can be avoided or reduced. Fortunately the major share of cost overrun found in the hydroelectric projects of Kerala (59.8 per cent) according to the above study is avoidable. So better management and improved project planning can reduce cost overrun in the hydroelectric projects in Kerala.

Some reservations are there in generalising the conclusion. The study is based on Kakki dam where the height had increased by 10 feet . The additional implementing cost may be less because most of the infrastructure was already there. So here the construction cost could be less than the actual one.

Conclusion

The case study of Sabarigiri hydroelectric project reveals that the project met with a time-lag of three years (100% increase over the original time schedule). Also the project resulted in a cost overrun of Rs.1792 lakhs which is 71.94 per cent over the original estimated cost. It is estimated that 59.8 per cent of the cost overrun is due to other factors like time-lag, which can be controlled through better management.

Chapter 8

CAUSATIVE ANALYSIS OF TIME-LAG AND COST OVERRUN OF HYDROELECTRIC PROJECTS - A MACRO-ANALYSIS

Micro level and project based analysis of time-lag and cost overrun is carried out in the earlier chapters. Here an attempt is made to study the factors contributing to time-lag and cost overrun, at the macro level.

The causative analysis is based on the various stages of project implementation, starting from project sanction to project commissioning.

I. The Approval, Sanction and Clearance of Hydroelectric Projects and Time and Cost Overrun

In a Federal State like India, the subject 'power' appears in the Concurrent List of the Constitution and as such the responsibility of power development is vested with both the Central and State Governments. To start a hydroelectric project in the State, it requires the direct or indirect approval, sanction and clearance of a number of agencies and institutions related to both the Central and State levels. The agencies and the relevant Acts in this case are:

1. Department of Power under the Ministry of Power
2. Ministry of Forest and Environment
3. Central Working Committee on Power
4. Central Electricity Authority (CEA)
5. National Hydroelectric Power Corporation under the Ministry of Power
6. Regional Electricity Board
7. Electricity Supply Act of 1948
8. Indian Electricity Act 1910
9. Forest Conservation Act 1980
10. Central Water and Power Commission
11. Planning Commission, Govt. of India
12. State Government
13. Kerala State Electricity Board

The bureaucratic nature of the process of sanction of a hydroelectric project in Kerala is given below:

The investigation wing of Kerala State Electricity Board (KSEB) and other specialised agencies make the investigation. Based on this the project reports are prepared by the planning cell of KSEB. In preparing the project reports it keeps liaison with State Planning Board, State Government, Central Electricity Authority (CEA), Working Group on Power and the Planning Commission. On finalisation of the draft project report, the same is presented for sanction from all these agencies. The proliferation of agencies involved in sanctioning hydroelectric project results in time-lag. The bureaucratic procedure, communication and clarification delay adds to it. The study found that all the hydroelectric projects of Kerala resulted in varying degrees of time-lag, on account of procedural formalities.

The proliferation of sanctioning and approval agencies and institutions is for a positive result namely to consider and assure socio-economic and ecological factors associated with projects.

If these various institutions and agencies work in a co-ordinated manner, under a single umbrella, effectiveness can be improved and the extent of time-lag connected with sanction can be reduced.

II. Land Acquisition, Eviction and Rehabilitation and Time-Lag and Cost Overrun

All the hydroelectric projects of Kerala made use of forest land which is to be acquired from the forest department. A chain of formalities are there to be observed for getting forest land from the forest department. The conflicting rules and the cold war between KSEB and forest department make the situation worse. The Forest Conservation Act, 1980 made the situation more complicated.

The Idukki Stage III is one of the projects in Kerala worst hit by Land Acquisition problem (Annual Report, KSEB, 1981-82). The same is the case with Kakkad project.

The eviction of the inhabitants from the project site and their rehabilitation are also factors contributing to the delay in starting work and interruption in work, causing time-lag. In the case of Idukki Stage III, this was a contributory factor to time-lag. The Erattayar Diversion Dam, a scheme of Idukki Stage III, during 1980-81, against the target of 12000 m^3 only 4347 m^3 of concrete and masonry could be done, mainly due to obstruction of work by local community and encroachers demanding the rehabilitation of the evicted people.

III. Infrastructure and Time-Lag and Cost Overrun

A good project planning system should have an equally good infrastructural planning programme. This is because the direct investments on projects are only proceeding the investment on infrastructure. In the case of hydroelectric projects in Kerala, located in remote forest area, it is the infrastructural investment that comes first. So any delay in infrastructure development will delay the project.

Insufficient and low quality infrastructural facilities provided in the hydroelectric project sites also have contributed to time-lag and cost overrun, since highly sophisticated machines and equipments are to be transported and kept in the project area till the project is completed.

Power is one of the most important infrastructure at the implementing stage of the project. Adequate and regular availability of power at the project site helps the timely completion of the project. The major works of the project like drilling, mixing, concreting, etc. require machineries like compressors which require 440 volts power. But in Kerala even during the normal days between 6.30 p.m.

and 9.30 p.m. the voltage will be generally below 400 volts. This voltage deficiency causes stoppage of work for 3 hours every day between 6.30 and 9.30 p.m. A project like Kakkad with 12 years construction history, the delay and time-lag on voltage deficiency alone will be around 540 days. This voltage deficiency could have been rectified by erecting boosters. But it was only after 12 years of project construction, i.e., in 1992 that a booster was erected to rectify voltage deficiency in Kakkad project. Such untimely and delayed supply of infrastructural facilities are common in the hydroelectric projects of KSEB. Again, power cut, load shedding, etc., are the common features in Kerala. These also have played their part in enhancing time-lag in project implementation. Above all, provision of infrastructural facilities such as roads, communication facilities, stores, etc. are often delayed and the delays on this account also results in time delay and cost overrun of the projects.

IV. Investigation and Survey Related Issues and Time-Lag and Cost Overrun

The identification of the project is followed by different surveys and studies either by KSEB or by specialised agencies. The detailed engineering drawing of the project depends on the findings of the study, and as such it occupies an important role in influencing time and cost overruns.

The investigation and surveys for the hydroelectric projects are carried out in the interior part of thick forests where no facilities are available. The preliminary survey of the Sabarigiri Project was made at a place which was 30 miles away from the nearest access point by road. A variety of surveys are to be carried out. Naturally, along with other factors, this results in time lag. The survey and investigation of Sabarigiri hydroelectric project were started in 1944 but completed only during 1959-60, of course with considerable intervals. This is true in the case of almost all the hydroelectric projects in Kerala.

Furthermore, the findings of the survey and studies may not be always correct. This necessitates radical changes or increase in the work, resulting in time-lag and cost overrun. The interconnecting tunnel of Kakkad hydroelectric project is a typical example to this. The detailed survey of the rock was made and its hardness was studied in detail at the time of investigation. But in

1988, in the interconnecting tunnel of Kakkad project, 32 metre long portion of the tunnel was shattered down. This was due to insufficient hardness of the rock, which could not be identified in the survey. The expert committee recommended that the interconnecting tunnel was to be cleared and the rock should be properly supported by concrete. But even after four-and-a-half years the work is not yet completed. This poor rock survey had resulted in additional work such as drilling tunnels to remove the collapsed rock and then support the tunnel by concreting. This has contributed to time-lag and cost overrun.

V. The Planning and Designing of Hydroelectric Projects

The plan, design and nature of hydroelectric projects of Kerala were decided by foreign engineers till the implementation of Sabarigiri Project. The plan, design and nature of the hydroelectric projects, constructed after Sabarigiri hydroelectric project, were determined and implemented by the Board's own engineers.

But as the experience of KSEB in planning, designing and fixing the nature of the project increased the defect and deficiencies of plan, design and nature of the projects, it seems, are on the increase. So it is not rare that even after starting the project construction, the size of the project and even the nature and design of the project undergo radical changes due to wrong calculations and faulty design by KSEB.

The composite dam, one among the dams of the Kuttiadi Augmentation Scheme, is an example for the defective planning, unrealistic drawings, design and insufficient technical feasibility study in dam construction by KSEB. The contract for the construction of the composite dam was awarded in June 1981 at an estimated cost of Rs.11.07 crores. The nature of the dam was a combination of rubble masonry and soil dam. The work on the dam was started in November 1981 and was scheduled to be completed in November 1985. It was after three years of project work that the KSEB found that there were some major technical difficulties in implementing the project. So KSEB suggested that the design of the dam was to be changed completely. So in January 1984 the Chief Engineer, Planning, KSEB, asked the Engineer, I&A, to study the issue. He recommended to change the design of the dam. Hence KSEB changed the design and nature of the dam. The idea of composite dam was changed into a complete earth rolled dam and the location of the spill way was also changed. This was done three years after the project work was started. Till then the Board could not find out this. This change resulted in cost overrun of Rs.167.81 lakhs.

Again in June 1984 further changes were introduced in the dam by Chief Engineer, I&A. This involved increasing the height of the dam by 4 metres. Thus the cost overrun had increased further to Rs.1,025.19 lakhs. The KSEB had approved of all these changes and the cost of the project had increased from Rs.11.07 crores to Rs.22 crores with considerable time-lag. As per the revised 1986 time schedule, the project was to be completed in March 1989, but even in August 1994 it remains incomplete. Even after doing same type of work in different projects by KSEB, serious engineering and survey defects are found on the projects later started. The power tunnel construction of the Kakkad hydroelectric project met with serious engineering defects. The tunnel constructed in between Seethakuzhy and Pannikkunnu when completed failed to connect together. The resurvey conducted by the engineers of KSEB found that the direction and angle of the tunnel had deviated from the right path. To rectify this an additional 250 metre tunnel had to be constructed causing an additional expenditure of Rs.50 lakhs. This additional work had also resulted in time-lag.

VI. The Contracting System of Hydroelectric Projects and Time-Lag and Cost Overrun

Normally, the implementation of a hydroelectric project by KSEB is done through contract system. But there are occasions when certain construction works of the hydroelectric projects are directly carried out by KSEB by using its own employees and hired labour. The tunnel construction of Idamalayar project, at a later stage, was undertaken by KSEB when the contractor left the site without completing the work. But this type of direct work implementation was very rare in KSEB. So generally the construction of hydroelectric project is done through the contractor and contract agreements.

The study of the contract system of KSEB reveals that there exist the following major forms of contracts in the construction of the hydroelectric projects.

1. Construction contract
2. Machine contract
3. Materials contract
4. Transporting contract

5. Erection contract, and
6. Manufacturing contract.

The sub-contract system is also found in the construction of hydroelectric projects.

The Tendering System of KSEB

The tendering procedure of KSEB is rather unique in the sense that it covers two distinct operations, i.e., the pre-qualification tender and the tender for the work. In certain cases these two operations are carried out at two different steps and in certain cases these are done together. The objectives of this procedure is to select the most competent contractor for the work. There are broad technical criteria for selection of the contractor, but the political and other factors seem to influence the selection. The contractor who is rejected once in the pre-qualification bid is again considered and selected in the case of other similar schemes by KSEB even in the same project.

The study reveals that there exists yet another uniqueness in the system of awarding contract of hydroelectric projects of KSEB. The contractors who are selected in the pre-qualification tender are only allowed to participate in the final tender for awarding the work. Still the work need not be awarded to the lowest bidder. It fully depends on the discretion of the officials of the KSEB. Though the Board considers the terms and conditions of the contractor along with the amount of the contract, there exists no generalised and clear cut criteria in awarding the contract.

The preparation of the tender details are based on the Detailed Project Report (DPR). This DPR is based on the studies, surveys and investigations on the dam site by KSEB and other specialised agencies. The delay in these leads to the delay in the preparation of tender documents. Again the estimation of the cost of the project also has a complex nature. In some cases the rate of the work is to be fixed according to the PWD rate and in some other cases the local rates are to be used. In certain other cases the rate is to be fixed according to the Minimum Wages Act.

Even after the finalisation of the tender documents, further delay is experienced in inviting tenders and pre-qualification tender. The awarding of the contract and forming the contract agreements again meet with time-lag because the terms and conditions of the contract are to be discussed and settled.

The comparative, economic and technical analysis of the quotations for work and its analysis are very difficult. In certain quotations the amount of the work may be comparatively low but the terms and conditions are so rigid. Yet in other tenders both the amount and terms and conditions may be comparatively better acceptable but its escalation clause and revision criterion may be so rigid. So the study of the tender documents and the selection of the right contractor is a time-consuming programme.

As per AID Agreements, in certain cases international and national quotations are to be invited. This further adds to delay in awarding the contract.

The study found that even after awarding the contract, there is 3 to 12 months delay in starting the work by the contractor. This may be due to the issues related to the contractor or may be due to the inefficiency of KSEB in providing the necessary conditions as per the contract agreement or may be due to the factors like labour problems, etc.

The study of the completed and ongoing hydroelectric projects reveals that the major works of the dam are split up into different schemes or events for speedier completion and the contract for the construction is given to different contractors. The dam construction, tunnels, inlet valves, surge shafts, power house, equipments and generators are the different schemes of the works of hydroelectric projects. As such separate contracts were given for them. Since the work is located in different sites, the same can be carried out simultaneously. In the case of some hydroelectric projects even the work of a single scheme or event is given to two contractors for simultaneous work and to reduce the time of completion. The power tunnel construction of Sabarigiri Project was given to Hindustan Construction Company and M's.Paili Pillai is a typical example for this.

But the contract for implementation of the various schemes of a project has no logical order. A project consists of different schemes - dam, tunnels, power house, shafts, etc. All of them have to be completed according to the sequential order, if the project is to be commissioned without time-lag and cost overrun. But the work schedule and contract offer by KSEB in certain case ignore this, causing excess cost and time-lag. The KSEB has scheduled the work of the Flanking dam - one among the three dams of Sabarigiri Project only after the completion of the construction of Pamba dam, another among the three dams of the Sabarigiri hydroelectric project. And the work was given to the same contractor who completed the Pamba dam. Though these three dams are located in different places, it was not carried out simultaneously. Such misplanning in giving contract is common in the hydroelectric projects of KSEB causing time-lag and cost overrun.

VII. Equipment Supply Contract

In the construction of hydroelectric projects of Kerala, there are two types of equipments in general - equipments for construction and equipments for generation.

Generally as per the contract agreement, the major equipments for construction are to be provided by KSEB to the contractor. The cable way, compressor, generator, etc. are typical examples of machineries provided by KSEB. The KSEB gets it either from open market purchase or by inviting tenders. In most of the cases studied, it is found that the equipment suppliers seldom provide the equipment and spare parts in time or of the right quality. So the KSEB is not able to deliver them to the contractor in time. This causes delay and revision of cost. As seen in the case study of Sabarigiri hydroelectric project, the delayed supply of crusher is a typical example for this. In certain hydroelectric projects of Kerala, the KSEB could not satisfy the contract agreement relating to the supply of construction equipments to the contractor in time. So the contractor cites this as the cause of time-lag and demands for cost revisions.

The equipments for power generation were imported for the projects started prior to Idamalayar project, as per foreign aid agreements. Here KSEB had no discretion to obtain the generating equipments but to take them as per the aid agreement. So the price of the equipments might be higher. In the case study of Sabarigiri hydroelectric project, it is found that Hindustan Construction Company, the contractors of Kakki dam, claimed compensation for getting certain equipments from the aid providing country at a higher price than that in the open market. This affects the cost of the project. But in the projects started after the Idamalayar hydroelectric project, domestically manufactured equipments are widely used. Equipments are supplied and erected by BHEL, Toshiba, TELK, etc. Owing to the internal problems of these industries, lack of raw materials, etc., there was delay in certain cases, in the supply of the equipments, causing time-lag.

Again, paradoxically the timely supply of generating equipments also is contributing to cost overrun in certain cases. In the case of Kakki hydroelectric project, the civil works witnessed time-lag but the generating machines were supplied earlier, by 1989 as per agreement. These had to be neatly kept. Some of these machines are to be erected and worked within a stipulated time. So delay in erecting the generating equipments results in damage and rusting. Thus the cost of keeping the machinery and the loss due to damage of the machinery contribute to cost overrun.

Manufacturing Contract

Certain items of the hydroelectric projects are to be got manufactured. For this KSEB provides the necessary raw materials. But there is delay in providing them in time by the manufacturing contractors. Since some of these materials are critical ones in the project, the non-availability of the same results in the halting of work. The pressure shaft works of Kakkad hydroelectric project is a typical example. Steel lining was to be made in the pressure shaft of Kakkad project. For this the contract for manufacturing 59 steel pipes was given to Indian Hume Pipes (IHP), Pune. KSEB had provided the necessary steel plates to the contractors for the manufacture of steel pipes. But months after the expiry date of supply in 1992, only 24 pipes were supplied and made available at Seethathode. This was because of labour strike in IHP Factory. Since the pipes were not available the pressure shaft work could not proceed. So KSEB made an attempt to take back the steel plates provided by it to IHP for manufacturing the pipes, so that it could be got manufactured by some other company. But the striking workers of IHP did not allow the Board to take back the steel plates from IHP factory. So the Board had no option but to wait till the IHP provided the same, causing time-lag and cost overrun.

Material Supply Contract

As per the contract agreement KSEB has to provide some of the major materials for construction to the contractor. But in certain cases the supply of these materials by KSEB is untimely and insufficient. Owing to transporting problems or due to insufficient availability, cement supply was irregular particularly during the peak time of work in projects like Sabarigiri hydroelectric project, Idamalayar hydroelectric project, etc.

VIII. **Tender Cancellation and Contract Termination**

Tender cancellation, termination of the contract and voluntary leaving of the work by the contractor without completing the work contribute to time-lag and cost overrun. These are one of the most common factors contributing to time-lag and cost overrun in almost all the hydroelectric projects in Kerala.

The termination of the contract during construction may be due to slow progress in work, poor quality of work or the conviction of KSEB about the inability of the contractor to complete the work in time.

It is found that the major reasons of slow progress in work is due to:

1. The deliberate delaying tactics of the contractor.
2. The genuine inability of the contractor to pull on the works.

3. The contractor is prevented from speedy work progress due to labour strike, etc.

The contractor himself avoids the contract because he feels that at the existing rate it is a loss to him to continue the work and that the Board and the Government are not willing to increase the rate and release funds. The tunnel works of Kakkad hydroelectric project is an example. The KSEB invited tenders for the tunnel driving for the Kakkad hydroelectric project in 1979. The contract was awarded to one G.Gopinathan on 22-5-1979. As per the contract the work was to be completed in 1983. The work was started on 21st June 1980. But, due to labour problem and strike, the contractor could not advance the work as estimated. So KSEB terminated the contract with G.Gopinathan on 18th June 1981, just after the work for Rs.7 lakhs had been executed. KSEB retendered the work and awarded the same to two contractors. The work of the I.C. tunnel was awarded to C.V.George and work of power tunnel to C.S.Company on 12th June 1983. It was only after two years that the work could be retendered causing a time-lag of another two years. The C.S.Company after one year's nominal work for Rs.7 lakhs, for the power tunnel, gave up the contract. So for the driving of the power tunnel, KSEB made an arrangement of splitting the power tunnel driving into three works and the contract was awarded to three contractors. They started work on 28th April 1986. The work was entrusted to the new contractors only two years after the C.S.Company had given up the work, causing another two years' time-lag. The original cost of the project was Rs.3.80 crores, which was increased to Rs.10 crores. Thus a time-lag of four years due to termination of the contracts and retendering had given rise to a cost overrun of Rs.6.20 crores.

Almost all the hydroelectric projects experienced this type of contract related issues contributing to time-lag and cost overrun.

IX. The Scheduling and Monitoring System of Hydroelectric Projects

The experience that KSEB gathered over the years in project management and project scheduling and project monitoring has not contributed to a better project management that could reduce time-lag and cost overrun. But on the other hand the time-lag and cost overrun of projects later implemented are on the increase. This is due to the insufficiency and inefficiency of planning, scheduling and monitoring system of KSEB.

The KSEB has the necessary network for project scheduling and monitoring. KSEB is making use of the modern techniques like flow chart, C.P.M. and network analysis to avoid time-lag and cost overrun still the project implementation experiences time-lag and cost overrun.

This is because the KSEB makes use of all these modern techniques as a routine matter and a part of centralised bureaucratic administration. Also the ever increasing political influence, financial position and official connections of the contractors, at least in certain cases, have gone to such a level that it could nullify the better monitoring effects of KSEB. Here, in some cases, it seems that it is not the KSEB that controls the contractors but the contractors who control KSEB. To avoid or to reduce this undue influence of the contractors, what is just and right and what is needed should be sanctioned and implemented at the right time by KSEB. A just and fair administrative system should develop in

KSEB. But in certain cases, today, it is the contractor who mobilises the KSEB in taking decisions and in providing the same. It should develop a system where KSEB mobilises the contractor.

Again for better project monitoring the KSEB should have common criteria in revising the rate of work, in releasing the fund, etc. It should create a feeling that things will be automatically done according to the common criteria and not according to the influence of the contractor.

It is also found that the project management is made complicated by the contract system of KSEB. For example, in certain cases, KSEB will provide some of the equipments, tools, materials, etc. and some others by the contractor. This type of contracting might be necessary in the past when the projects were implemented with foreign technical and financial assistance. Also, the contractors of that time might not be so much experienced, and might not have much financial status and equipments and expertise. But now things have changed. Various schemes of work should be tendered fully and not in part. This will make KSEB to concentrate more on project management and scheduling.

The project scheduling and monitoring involve the co-ordination of different institutions and individuals involved in project implementation and it is to be mobilised at the right time. The funds and materials should be made available in the right quantity and quality. The monitoring system should also mobilise the contractors. Halting of work even for years continuously in projects pinpoints to the existing defects of the project management and monitoring.

To rectify all these requires better organisational facilities and improved human resources with assured continuity in project management along with autonomy and accountability. The project implementation programme of KSEB is more or less fully an engineer's programme. It should make use of a team of specialised manpower and management technocrats in monitoring the project implementation.

X. The Labour Strike and Time-Lag and Cost Overrun

The history of the construction of hydroelectric projects in Kerala substantiates the evils of excessive trade unionism and the negative impact of the same on the completion of the project at the scheduled time and cost. Also it reveals the instances of worst management and control of the same.

Labour strikes and the resultant halting of work and the tense atmosphere in the work-site are a common feature in the construction programme of hydroelectric projects in Kerala. Strikes as means of collective bargaining is present where trade unions are in existence. But some of the strikes witnessed in the hydroelectric projects have certain unique features.

The causes of most of the strikes are simple and silly. Even the strike of a handful of workers could stop the entire work at the site and the period of the strike is very long.

The strike that broke out in the tunnel driving section of Idamalayar hydroelectric project in April 1981 is a typical example for this. The strike was settled only in July 1983, years after it was started. The number of workers on strike were only 150. The cause of the strike was that the contract workers demand for appointment as permanent staff of KSEB. The strike started when the work was about to complete, i.e., out of 1500 M long tunnel, only 24 M work remained undone. The strike spread over the administrative periods of the two governments and the governor-administration. It took 2 years and 2 months to settle the strike by terminating the workers, giving Rs.13 lakhs as compensation to these 150 workers.

A study of the strikes in the power house construction of Kakkad hydroelectric project also will prove the long extent of strikes for very simple reasons and the poor measures taken to settle the strike. The power house construction was started in 1985 by the contractor. Even before starting the work tension emerged. The trade unions demanded that the contractor should not employ his own workers. So starting of the work was delayed for two months. Later the contractor made use of 10 workers from the local place, i.e., Seethathode. After two weeks of slow work, the trade unions were served notice demanding the termination of these 10 workers who were selected without the permission of the trade unions. Still the contractor continued the work. Later, after 5 conferences with the labour officer, the contractor agreed to terminate these 10 workers in November 1985.

The members of AITUC who demanded the termination of the 10 workers, now began to strike demanding that these 10 workers should not be terminated. By this time all these 10 workers joined the AITUC. The strike went on for 11 days. The strike was later settled on condition that these 10 workers would be taken back whenever vacancy arose. But this settlement created a non-cordial relationship between the unions and the contractors for two years, which even resulted in declaring the dam site a protected area.

Another strike broke out in 1987 due to the termination of a welder by the sub-contractor of Kakkad hydroelectric project. All the unions participated in the strike against this termination. After two months strike the subcontractor agreed to reinstate him on duty. But the welder was not interested to rejoin and intimated the same to the contractor. On hearing this the unions instead of withdrawing the strike found other reasons to continue it. They demanded wages for the strike period, increased wages, etc. The strike extended over five months, till the contractors settled the strike by agreeing to increase the wages.

Again the workers of the Kakkad hydroelectric project started strike on 20th August 1988 even without serving any notice. They demanded an advance payment of Rs.2,000/- each to every worker and 25 per cent bonus. The strike lasted for 80 days, till the long term agreement was made on 2nd November 1988. Thus all these strikes by the workers of the power house resulted in a loss of 247 working days contributing to more than 247 days of time-lag.

The role of labour problems in contributing to time-lag and cost overrun is studied by the case study of Idamalayar hydroelectric project. Here an attempt is made to study the total strikes witnessed in the Edamalayar hydroelectric project and its direct contribution to time lag and cost overrun. Idamalayar hydroelectric project is selected for the study because the highest extent of cost overrun is found in this project.

Strike by the workers affected the work of the project several times. The first strike, started on 8th December 1976, was settled without much loss of time. The strike started on 6th June 1979 was ended only on 25th

March 1980 resulting in a loss of six months and 15 days (excluding monsoon off) and the man-days lost due to this strike was 2 lakhs. The financial loss incurred due to this strike is estimated to Rs.125 lakhs and the cost escalations was to the order of Rs.142.5 lakhs.

The tunnel work employees had gone on strike from 9th June 1980 which was settled only on 20th November 1980 (5 months and 11 days) leaving a loss of more than 16000 man-days.

The strike which started on 10th April 1981 by the tunnel workers demanding permanent absorption in the KSEB was ended only on 10th June 1983 resulting in a further loss of 2 years and 2 months in the completion of the project. The total extent of labour strike in Idamalayar project was 51 months.

The direct financial commitment due to the strike which stretched the gestation period of the project by 51 months is estimated to Rs.150 lakhs. This is in addition to cost escalation to the tune of Rs.167 lakhs. The loss of revenue due to delay in commissioning the project because of strike is estimated to Rs.40 crores as the annual return from this project is estimated to be Rs.9.77 crores. The cumulative loss as a result of all these are estimated to Rs.43.17 crores.

XI. Disputes and the Legal Issues and Time-Lag and Cost Overrun

It is found disputes emerge between the contractor and KSEB about work, payments, etc. Disputes may also arise between the workers and the contractor. These disputes are settled by discussions and mutual understanding, and by legal settlements in the court. This may result in delay and cost overrun.

The construction of the surge shaft of the Idamalayar project was given up by the contractor after driving the pilot shaft. Now the contractor registered a case for getting compensation from KSEB. The KSEB also had registered a case to get compensation from the contractor. Such litigation often results in time-lag and cost overrun.

XII. Documentation and Study of Project Work

There should be an efficient system of collecting information and data regarding project work, its progress, material supply, etc. These informations and data should be interpreted and intimated to the rightfull authority so that corrective measures, if needed, can be taken in the right time. Further if such things are documented, it will be of great use in implementing new projects at the scheduled time and cost. The study found that KSEB is giving only less importance to such programmes.

XIII. KSEB and Time-Lag and Cost Overrun

In Kerala, the investigation, planning, designing, implementation, generation and distribution of power are entrusted with KSEB. So the extent of time-lag and cost overrun of the hydroelectric projects are closely related to its functioning.

At the top of the organisational system of KSEB is the Board Chairman along with the Board members and Board secretariat. The policy matters are taken up by the Board according to the technical advice of the Chief Engineers of the Board and other experts. Though KSEB is an autonomous organisation, the directions of the Ministry of Power, Government of Kerala, influences it.

Even today KSEB gives stress to centralised planning, scheduling and monitoring. Of course, the project level systems are there in existence but these are fully dependent on the centre, and everything is expected to come from the centre. It is found that the central administration of KSEB is thoroughly bureaucratic in nature and all the units of this system are apparent in the working of the system.

The autonomy and accountability of management at the project level, is practised to a limited extent. But it seems that when compared to autonomy it is more of accountability that is being delegated. The delegation of responsibilities without delegating authority will not lead to better project management.

In addition, political interference is playing havoc in the administration of the Board. Honest officers are transferred and harassed. A feeling is created that nothing works without greasing the palms of the people who hold the reigns of power. A lot of dilly-dallying is witnessed with reference to crucial decisions. The delay in the tunnel driving work of Kakkadu project is an evidence to this phenomenon. The work on tunnel driving was started in 1985 and scheduled to be completed by 1988. There was a 299 days' strike in the tunnel work which ended in 6th August 1991. Even after the strike the contractors were not ready to continue the work and this went on for more than a year. This was because the Board failed to take decision on the demand of the contractors to increase the rate of work. The demand was made on the plea that the tender of the work was given as per 1982 estimate. The request for revision was first served in 1989. But no decision was taken on it even in 1991. The Chairman of the KSEB, on 22nd October 1991, promised to pay a part of the loss of equipments due to the strike and an amount on the basis of the general price index to compensate the cost escalation. The contractors agreed to it and the matter was intimated to KSEB.

The KSEB, instead of taking any decision on this matter, forwarded it to the government. The Secretary to Power and the Chief Secretary recommended revision of rate, but placed the matter with the Minister for Power for taking decision. The Minister placed the matter before the Cabinet. The Cabinet headed by the Chief Minister returned the file to KSEB, commenting that KSEB is an autonomous body and the government was not interested in interfering in the functions of KSEB. The matter was again studied by the experts of the Board, and ultimately the

Board had taken the decision not to implement the Chairman's promises to the contractor on 5th May 1992. The Board Chairman and the members had again invited the contractors for discussion for settling the issue. The contractors stick to the point that if the relief amount promised by the Chairman could not be sanctioned, their contract should be terminated. This shows that the management of KSEB was not able to solve an issue developed in 1989, and even after 3 years, it remained unsolved, though the experts who studied the matter recommended solutions. But the concerned authority without taking any decision had either shifted or evaded from its duty. Perhaps may be due to the fear of corruption allegations that may arise out of it. It is a fact that most of the cost revisions of KSEB is accompanied by allegations of corruption. And it has gone to such a level that the authorities are afraid of taking even the right decision.

In the tunnel driving of Idamalayar hydroelectric project, a strike broke out at a time when the work was about to complete. The strike was started in April 1981 and the same was settled only in July 1983 by terminating 150 workers by giving a compensation of Rs.13 lakhs. It took years to take the decision to solve the issue.

XIV. The Proliferation of Projects and Thin Spreading of Investment Funds

Generally the criteria for undertaking new infrastructural projects are the current and anticipated demands for the output produced and the availability of funds. But in Kerala, due to the political influence and pressure from the coalition form of Government, hydroelectric projects are sanctioned without looking into the availability of funds. If more and more projects are undertaken without the availability of sufficient funds then the available funds are to be spread thinly over all these projects which is mainly used for meeting the establishment charges like payment of salaries, wages, etc. So the actual project work will not advance. This will cause time-lag and cost overrun. The spill-over effect created by time-lag necessitates the diversion of funds and adds to the thin spreading of resources.

In Kerala KSEB has 15 ongoing hydroelectric projects. As far as the demand for power is considered this is not too much. But when the cost and gestation period of these projects are considered the availability of funds are quite insufficient to meet the needs of all these projects, though the government has spent 19 per cent of the total plan expenditure on power. So most of the meagre fund allotments are used to meet office expenses and salaries to the existing staff. Thus the thin spreading of available funds results in time-lag and cost overrun.

XV. Climatic Conditions and Time-Lag and Cost Overrun

The power projects in Kerala are entirely hydro-based. So these are to be constructed across the rivers. But there are two rainy seasons in Kerala. So certain works cannot be taken up during the rainy season due to flood conditions. Untimely and unexpected rain, climate change, etc. can adversely affect the work progress and time and cost of the project.

XVI. Excess Work and Time and Cost Overrun

As seen earlier, the study found that excess work in the project may be due to poor quality of the survey results, faulty and weak zones, in the project area, change in the size and nature of the project, etc. Whatever be the reason, excess work results in time and cost overrun.

It can be concluded from the causative analysis that the time-lag and cost overrun which occur in the three phases of hydroelectric projects implementation, i.e., project sanction, starting the work and completing the work, can be identified as avoidable and unavoidable. The study of the causes of time-lag and cost overrun clearly reveals that most of the contributory factors to time-lag and cost overrun are either avoidable or its intensity can be reduced through fair and better planning, management and scheduling of the project.

But one cannot effectively solve micro-level problems and issues in all situations by macro level policy measures. Time-lag and cost overrun of the hydroelectric projects of Kerala, as seen earlier, are unique to each project and so it is project dependent. So in the policy measures taken to reduce the extent of time-lag and cost overrun, the thrust should be in the micro level planning and project level implementation. Everything should not be from the centre, but some thing at least should immediately and spontaneously develop from the project site itself to suit the needs and problems that occur in project implementation.

Chapter 9

THE IMPACT OF TIME LAG AND COST OVERRUN ON ECONOMIC DEVELOPMENT

The level and rate of growth of an economy are determined by the quantity and quality of investment. The quality of investment represents the income generating and capacity creating effect of investment. These are adversely affected by time-lag and cost overrun. Time-lag and cost overrun reduce and delay the target achievements. This invariably leads to a reduction in new resource generation in the economy. This in turn reduces the current income generation and thereby the quantity of future investments. Thus the current and future rate of growth of the economy is restricted by time-lag and cost overrun.

This is so because if a project is not completed at the original estimated cost, additional investment on the project results in wastage of resources, since such additional investment do not result in any additional output. Such expenditure on projects results in capital wastage.

Had there been no time-lag, there could have been the generation of output and income, during the lagged period. Time-lag results in income loss. Thus time-lag and cost overrun of investment result in capital wastage and income loss which restricts the growth effect of investment directly.

Capital investments are generally undertaken with the objective of generating additional benefits to the society either in the form of additional employment, or in the form of income and output. But if the investment does not take place as per schedule and if the project slips then the economic viability of the project itself will be in jeopardy.

Generally the size of current investment largely depends on the success of the earlier investments and the absorbing capacity of the economy. Consequently any time-lag and cost overrun with reference to the earlier investments will have adverse impacts on current as well as future investment.

The heavy investments on projects unaccompanied by increased output contributes to the increased inflationary condition which results in further cost overrun. In order to meet this situation governments resort to a system of public borrowing. Again the government is forced to impose additional taxes on the people to tide over the growing deficit and increasing expenditure of the government. Taxes, particularly indirect taxes, add to the inflationary situation, leading to further cost overrun. Thus time-lag and cost overrun breed further time and cost overruns which consume away the newly generated income. Further, as seen, time-lag and cost overrun result in capital wastage and income loss. Thus time-lag and cost overrun not only reduces the income generating process, but also consumes the additionally generated income. So, if the extent of time-lag and cost overrun are high it will nullify not only the growth effect of investment but also push the economy into stagnation. Thus time-lag and cost overrun can create a paradoxical situation of increased investment accompanied by economic stagnation.

In Kerala during 1951-90 the plan expenditure alone amounted to Rs.6,064.88 crores. But the rate of growth of the economy during 1990s was nominal or rather stagnant. Here an attempt is made to analyse the role of time-lag and cost overrun in keeping the rate of growth of the economy low or even stagnant.

The power and irrigation projects are selected for the study. This is because power and irrigation occupy the second and third priority in the allocation of funds during 1951-90, i.e., 19.8 per cent and 16.9 per cent respectively (Table 9.1). Out of the total plan expenditure of Rs.6,064.88 crores during 1951 to 1990, Rs.2,213.30 crores, i.e., 36.7 per cent of the plan expenditure was made on power and irrigation programmes. So a census study of time-lag and cost overrun of the projects of these two sectors, to a good extent, will be representative. To substantiate the study, a sample study of time-lag and cost overrun of industries is also done.

Cost Overrun and Capital Wastage in Completed Hydroelectric and Irrigation Projects

Kerala State had made a total investment of Rs.40,084.37 lakhs on 10 completed hydroelectric projects and irrigation projects. Out of this investment of Rs.40,084.37 lakhs, Rs.20,760.02 lakhs has been used to meet the cost overrun of these projects (Table 9.2). This is 51.79 per cent of the total expenditure on completed hydroelectric projects and irrigation projects. This shows that more than half of the investment made by Kerala State

Table 9.1

Cumulative Plan Expenditure (Percentage)

during 1951-1990

Sl.No.	Section	Percentage expenditure
1.	Social service	25.20
2.	Energy	19.8
3.	Irrigation and flood control	16.9
4.	Agriculture and allied services	11.4
5.	Industry and minerals	10.5
6.	Transport	8.7
7.	Rural development	5.5
8.	Science, Technology and Environment	1.00
9.	General economic services	0.80
10.	Special area programmes	0.20
		100.00

Source: State Plan Expenditure (1951-1990), State Planning Board, Govt. of Kerala, Trivandrum.

Table 9.2

Cost Overrun of all the Hydroelectic Projects and Irrigation Projects in Kerala

(Rs. in lakhs)

Sl. No.	Sector	Original cost	Actual/ latest cost	Cost overrun in Rs.	Cost overrun as percentage increase over the original
(1)	(2)	(3)	(4)	(5)	(6)
1.	Hydroelectric Projects (10 completed projects)	17476.01	37730.54	20254.53	115.89
2.	Irrigation Projects (10 completed projects)	1849.00	2353.83	505.49	27.33
	Total	19325.01	40084.37	20760.02	107.42

Table 9.2 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)
3.	Hydroelectric Projects (15 ongoing projects as on March 1991)	16049.00	36508.00	20459.00	127.47
4.	Irrigation Projects (17 ongoing projects as on March 1991)	11661.00	136265.00	118604.00	671.55
	Total	27710.00	172773.00	139063.00	501.85
	Grand Total	47035.01	212857.37	159823.02	339.79

Source: Compiled from tables 4.1, 4.2, 4.3 and 4.4.

on completed irrigation and hydroelectric projects are consumed by cost overrun. This also implies that if these projects had been implemented at the original estimated cost, the rate of growth of these sectors would have been more than double of what has been achieved with this investment. In other words the state had attained only less than half of the development with the investment on completed hydroelectric and irrigation projects, since more than half of the investment was wastefully consumed by cost overrun.

Cost Overrun and Capital Wastage in the Ongoing Hydroelectric and Irrigation Projects

The extent of cost overrun and the resultant capital wastage in the ongoing hydroelectric projects and irrigation projects are given in Table 9.2.

Kerala State has 32 ongoing hydroelectric projects and irrigation projects (two projects each from hydroelectric projects and irrigation projects are excluded, since their work is in pending).

The total original estimated cost of all these 32 projects is Rs.27,710 lakhs (Table 9.2). As per the latest estimate the cost of these projects has increased to Rs.172,773 lakhs. So the cost overrun of these 32 projects is Rs.139,063 lakhs, i.e., 501.85 per cent over the original estimate. Thus 80.48 per cent of the investment on these projects are to be used to meet cost overrun.

The above facts and figures imply that what could have been attained with the investment of Rs.27,710 lakhs, as per the original estimate, is to be attained by an investment of Rs.172,773 lakhs. This means that an investment of more than 5 times over the original estimate is needed now to attain the scheduled target and development in these two areas. In other words the economic effect of this investment is reduced by more than five times due to cost overrun.

A combined cost analysis of all the 52 completed and ongoing hydroelectric and irrigation projects undertaken by Kerala State till 1992 is also presented in Table 9.2. The total investment on these projects is Rs.212,857.37 lakhs, out of which Rs.159,823.02 lakhs are to meet cost overrun. Thus 75.08 per cent of the total expenditure on hydroelectric and irrigation projects in Kerala is to cover cost overrun alone. So the growth rate in these two areas is only one-fourth of what could have been achieved with the investment, since 75.08 per cent of investment in these two areas were to meet cost overrun.

The target set in irrigation and power sectors in Kerala could have been attained, as per the original estimated amount of Rs.47,635.01 lakhs. But due to cost overrun, to attain the same targets, an additional investment of Rs.159,823.02 lakhs is made in these projects unaccompanied by any increase in output. Thus the productivity or efficiency of the additional investment of Rs.159,823.02 lakhs is rather zero. So this amount used to cover the cost overrun is a clear waste of investment funds. Had the projects been completed at the original estimated cost, with this actual investment, an increase of more than three times in output and rate of growth could have been generated, since the cost overrun is 339.79% over the original estimated cost (Table 9.2).

The magnitude of cost overrun of the irrigation and hydroelectric projects can be understood by a comparative study of the five year plan expenditure of the state and the cost overrun of all the 52 projects in these two sectors. The cumulative plan expenditure of Kerala from first plan to sixth plan is Rs.146,955 lakhs (Table 2.1). As per the latest estimates the cost overrun of all the 52 irrigation and hydroelectric projects are Rs.159,823.02 lakhs. The cost overrun amount in these two sectors alone is more than the total plan expenditures of Kerala State from first plan to sixth plan.

When such a high extent of cost overrun occurs the output generated in the economy will not be proportionate to the volume of investment. This is because when cost overrun occurs, there emerges a difference between the quantity of investment expenditure and the real quantity of investment expenditure. The real quantity of investment can be obtained by deducting the cost overrun amount from the total quantity of investment expenditure. The rate of growth of the economy will be according to the real quantity of investment and not according to the total quantity of investment, if cost overrun is present. The economic growth will lag behind the growth in investment. The growth effect of investment can be nullified, if the cost overrun increases according to investment, which may result in economic stagnation, as occurred in Kerala.

Cost Overrun and Capital Wastage in Industrial Projects of Kerala

A sample study of cost overrun of five public sector industrial units started during 1978 to 1982 is carried out to identify the extent of cost overrun in this sector. The findings of this sample study are presented in Table 9.3.

The total expenditure on these five industrial projects amounts to Rs.18,512.62 lakhs. The cost overrun was to the tune of Rs.6,357.62 lakhs, i.e., an increase of 34.34 per cent over the original estimated cost. If it can be generalised, more than one-third of the investment in the industrial sector resulted in wastage, since it is used to meet cost overrun and so the rate of growth of the industrial sector is reduced to this extent.

The above interpretation is made on the assumption that cost overrun is neither due to crashing the project nor due to the change in the nature and capacity of the project for increasing the output.

Income Loss and Capital Wastage Due to Time-Lag

Here an attempt is made to quantify the extent of the loss in production and income due to time-lag. For

Table 9.3

Cost Overrun and Capital Wastage in the Industrial Projects of Kerala

(Rs. in lakhs)

Sl. No.	Industry	Year of starting	Original cost	Actual cost	Cost overrun	Cost over-run as % increase over the original
1.	Kerala Metals and Minerals Ltd.	1978	6499.8	9840	3340	51.38
2.	Kerala State Drugs and Pharmaceuticals Ltd.	1979	500	943.62	443.62	88.72
3.	Malabar Cements Ltd.	1980	3350	5400	2050	61.19
4.	Carbon and Chemicals India Ltd.	1981	1250	1774	524	41.92
5.	Kerala State Wood Industries Ltd.	1982	555	555	0	0
	Total		12154.88	18512.62	6357.62	52.30

Source: Compiled from table 4.5.

this a census study of the direct impact of time-lag of the hydroelectric projects, both ongoing and completed, is carried out. The extent of time-lag in the completed and ongoing hydroelectric projects, and industries, are furnished in Table 9.4. Cumulative time-lag with reference to 10 completed hydroelectric projects is estimated to be 40 years and that of the 10 completed irrigation projects is 92 years. The five public sector industrial units studied resulted in a cumulative time-lag of 9.3 years (Table 9.4).

Time-Lag and Capital Wastage

Time-lag results in income loss, capital loss and capital waste. The capital wastage resulting from time-lag can occur in different ways.

If time-lag occurs the cost of the project will have to be revised according to the price level. When the cost of men and materials increases, no doubt there will be even more than proportionate increase in the cost of the project.

In KSEB, there is no specific criterion for revision of cost. This often leads to disputes between

Table 9.4

Cumulative Time-lag of Completed and Ongoing Hydroelectric Projects and Irrigation Projects

Sl.No.	Sectors	Original years for commissioning	Actual years/anticipated years for commissioning	Time-lag in years	Time-lag as % increase over the original
1.	Hydroelectric Projects (10 completed projects)*	62	102	40	64.51
2.	Hydroelectric Projects (15 ongoing projects)**	58	140	82	141.37
		120	242	122	101.66
3.	Irrigation Projects (All the 10 completed projects)	48	140	92	191.66
4.	Public Sector Industries (5 Nos.)	10.58	19.88	9.3	87.9

* Two projects are excluded. ** Poyankutty is excluded.

Source: Compiled from tables 4.1, 4.3, 4.4 and 4.5.

contractors and the Board which result in halting of work. Further, the formalities regarding cost revision cause further delay which often results in the cost revisions and labour disputes and strikes. Until and unless some accepted criterion is adopted with reference to cost revision, it will be extremely difficult to break this vicious circle which results in cost overrun and capital wastage.

It is found that there is a relationship between time-lag and the economic viability of the project (Table 9.4). Time-lag ultimately results in operational loss which is often met by government. The additional expenditure that the government is forced to incur on this account is really capital wastage.

Time-Lag and Income Loss

Investment is the productive utilisation of resources. If, in the process of investment, time-lag occurs, it will delay the capacity creating, income generating and the employment providing effects of investment. This directly results in income loss. The delay in income generation adversely affects the saving capacity of the society and future availability of investment funds and further growth of society. This antigrowth effect of time-lag aggravated by the emergence of sectoral imbalance, and disproportionality crisis, results in the under-utilisation of the existing capacity and prevents the creation of additional capacity. Thus indirectly too time-lag results in income loss.

The direct income losses of completed and ongoing hydroelectric projects resulting from time-lag of hydroelectric projects are presented in Tables 9.5 and 9.6.

The project-wise study of the magnitude of income and output loss due to time-lag in the completed and ongoing hydroelectric projects is given in Tables 9.5 and 9.6. The total energy loss of the 10 completed hydroelectric projects owing to time-lag is estimated to be 19416 Mu. The rate of power per unit is assumed to be 10 ps. (As per the latest tariff revision, the price of power unit is 60-270 ps). The total income of 19416 Mu of power at a unit rate of 10 ps. is Rs.194.16 crores. At a unit rate of Re.1, this will be around Rs.1,941 crores. Thus in the case of 10 completed hydroelectric projects the loss on account of time-lag comes to Rs.194.16 crores at 10 ps. per unit and to Rs.1,941 crores at Re.1 per unit.

Table 9.5

Time-lag Led Output and Income Loss of the Ongoing Hydroelectric Projects of Kerala as on March 1992

Sl. No.	Name of the project	Energy poten-tial (Mu)	Time lag (years)	Loss	
				Mu	Rs.crores
1.	Sabarigiri Augmentation	125	13	1625	16.25
2.	Kakkad HEP	262	11	2882	28.82
3.	Kallada HEP	65	8	520	5.20
4.	Lower Periyar	493	5	2465	24.65
5.	Madupetty HEP	6	5	30	0.30
6.	Malampuzha	5.6	5	28	0.28
7.	Azhutha Diversion	57	3	171	1.71
8.	Malankara HEP	42	7	294	2.94
9.	Peppara HEP	11.5	5	57.5	0.57
10.	Chimmini	6.5	6	39	0.39
11.	Vadakkepuzha Diversion	12	3	36	0.36
12.	Kuttiar Diversion	36.6	3	109.8	1.09
13.	Peringalkuthu L.B.	38	3	114	1.14
14.	Kuttiady Tail Race	15	2	30	0.30
15.	Vazhikkadavu Diversion	24	3	72	0.72
	Total		82	8773.3	84.72

Note:- Pooyankutty HEP excluded. Unit rate 10 ps.

Source: Economic Review (1990-1993), State Planning Board, Govt. of Kerala, Trivandrum.

Table 9.6

Time-lag Led Output and Income Loss of Completed Hydro-electric Projects in Kerala

Sl. No.	Name of the Project	Energy potential (Mu)	Time lag (years)	Loss	
				Mu	Rs.crores
1.	Pallivasal HEP	284	--	--	--
2.	Sengulam	182	--	--	--
3.	Peringalkuthu	170	3	510	5.10
4.	Neriamangalam	237	5	1185	11.85
5.	Panniar	158	2	316	3.16
6.	Sholayar	233	4	932	9.32
7.	Sabarigiri	1338	3	4014	40.14
8.	Kuttiady	268	3	804	8.04
9.	Idukki Stage I	1199	3	3597	35.97
10.	Idamalayar	380	5	1900	19.00
11.	Idukki Stage II	1199	2	2398	23.98
12.	Idukki Stage III (Aug.)	376	10	3760	37.60
	Total	6024	40	19416	194.16

Source: Economic Review (1990-1993), State Planning Board, Govt. of Kerala, Trivandrum.

In the case of the sixteen ongoing projects the output loss due to time-lag is estimated to be 8773.3 Mu of power and the value of the same constitutes Rs.87.73 crores at 10 ps. per unit and Rs.877.3 crores at 1994 prices (average of Re.1 per unit).

The total direct output loss of ongoing and completed hydroelectric projects due to time-lag is estimated at 28189.3 Mu of power and the resultant income loss is Rs.281.89 crores at 10 ps. per unit and Rs.2,818.9 crores at Re.1 per unit. As seen, the capital wastage owing to cost overrun is Rs.408 crores and the direct income loss is Rs.281.89 crores at 10 ps. per unit or Rs.2,818.9 crores at 100 ps. per unit. Thus the direct total loss (cost overrun plus value of output lost) resulting from time-lag and cost overrun of 25 hydroelectric projects of Kerala is Rs.690 crores (at 100 ps. per unit) or Rs.3,226 crores (at 10 ps. per unit). When we take into consideration the linkage effect of this, the resultant figure will be a gigantic one.

The Indirect Loss Due to Time-Lag in Hydroelectric Projects

The direct impact of time-lag and cost overrun is analysed in the preceding part. Here indirect loss resulting from time-lag is discussed.

1. <u>The capital waste and interest payment</u>

As in March 1992, KSEB had spent a sum of Rs.20,234 lakhs on the ongoing hydroelectric projects (Table 9.7). If time-lag of one year occurs in these projects, where Rs.20,234 lakhs is spent, the interest at the rate of 10 per cent will come to Rs.2,023.4 lakhs per year. This amount is to be paid from the fund allotted to the project every year. This may push up the cost of the project without any corresponding benefit. The cumulative time-lag of 10 completed hydroelectric projects is estimated to be 40 years and that of the 10 completed irrigation projects 92 years. So the extent of time-lag is very high and the interest charges too must be extremely high.

2. <u>Sectoral imbalance and disproportionality crisis</u>

Inter-sectoral dependence and linkage are found to be strong in the process of economic development. If the growth of one sector falls behind the planned level, its negative impact on the growth of the related sector will be high. If it is found in the sectors like power, where the linkage effect of investment is found to be higher, the

Table 9.7

Expenditure on the Ongoing Hydroelectric Projects as on March 1992

(Rs. in lakhs)

Sl.No.	Project	Expenditure
1.	Kakkad	6224
2.	Kallada	1161
3.	Lower Periyar	10759
4.	Malampuzha	188
5.	Madupetty	181
6.	Peppara	213
7.	Chimony	54
8.	Malankara	89
9.	Peechi	--
10.	Pooyamkutty	450
11.	Azhutha diversion	242
12.	Kuttiar diversion	64
13.	Peringalkuthu L.B. Extension	609
	Total	20234

Source: Economic Review (1990-1993), State Planning Board, Govt. of Kerala, Trivandrum.

negative contribution of this sector on economic development will be alarmingly higher.

The targets to be achieved in each sector is planned in such a way that there should be a proportionate growth in different basic sectors. The sectoral allocation of funds is made in accordance with this criterion. But since time-lag delays target attainment and cost overrun results in capital wastage, these lead to the generation of sectoral imbalance and thereby disproportionality crisis in the economy.

The power sector of Kerala is a good example for this. The target and achievement of power in various five year plans of Kerala are presented in the Table 9.8. It is clear from the table that till the sixth five year plan, only one five year plan had attained the power targets.

Table 9.1 shows that 19.8 per cent of the total plan expenditure from first plan to eighth plan is made on power. Also in the case of the majority of plans the expenditure on power is higher than the outlay. So the non-achievement of the power plan targets are not mainly

Table 9.8

Physical Target and Achievement of Power during the Five Year Plan (Cumulated)

Sl.No.	Item	Installed Capacity	
		Target	Achievement
1.	First Plan	134.00	85.50
2.	Second Plan	215.00	147.50
3.	Third Plan	546.50	192.50
4.	Fourth Plan	1011.50	621.00
5.	Fifth Plan	960.00	1011.50

Source: Five Year Plan Documents, State Planning Board, Govt. of Kerala, Trivandrum.

due to fund insufficiency. As seen earlier, the heavy time-lag and cost overrun are the major factors that contributed to this situation.

The non-achievement of power plan targets added to the extent of power deficiency. The power imported to Kerala over the years are presented in Table 9.9. The increasing trend in power deficiency in the state can be understood from Table 9.9. Had the projects started generation of power as per schedule, without time-lag and cost overrun, the gap in power deficiency could have been reduced or avoided. Tables 9.5 and 9.6 show the extent of power loss due to time-lag in completing the hydroelectric projects in Kerala.

Thus time-lag and cost overrun in the implementation of hydroelectric projects in Kerala have contributed to the gap between power generation and power consumption. The gap has gone to such a level that demand for power in the state cannot be fully satisfied even with power imports. This has led to the introduction of power cuts, load-shedding, etc. in the state, the extent of which is given in Tables, 9.10, 9.11 and 9.12. This has led to

Table 9.9

Power Export and Power Import in Kerala in Mu

Sl.No.	Year ending	Export (Mu)	Import (Mu)
1.	1.4.1951	--	16.9
2.	31.3.1956	--	1.5
3.	31.3.1961	11.6	56.8
4.	31.3.1966	--	116.0
5.	1.4.1969	28.2	19.00
6.	31.3.1974	317.8	1.2
7.	31.3.1978	1605.4	1.5
8.	31.3.1980	1932.9	49.7
9.	31.3.1981	1770.9	43.6
10.	31.3.1982	1774.89	45.67
11.	31.3.1983	668.00	83.4
12.	31.3.1984	90.25	143.71
13.	31.3.1985	356.00	123.52
14.	31.3.1986	396.00	227.67
15.	31.3.1987	19.15	511.85
16.	31.3.1988	17.00	1009.00
17.	31.3.1989	10.38	1264.71
18.	31.3.1990	103.6	1159.7

Source: Economic Review (1957-1991), State Planning Board, Govt. of Kerala, Trivandrum.

Table 9.10

Load Shedding in Kerala from 1-1-1987 to 31-12-1987

Period	Duration
3-8-1987 to 7-8-1987	Half hour in night
8-8-1987 to 10-8-1987	Day time - two hrs in cities and 3 hrs in villages Night time - ½ hr
11-8-1987 to 18-8-1987	Day time - 4 hrs Night time - ½ hr
19-8-1987 to 5-10-1987	Day time - 6 hrs Night time - 1 hr
6-10-1987 to 3-11-1987	Day time - 6 hrs
4-11-1987 to 16-12-1987	Day time - 5 hrs
17-12-1987 to 31-12-1987	Day time - 3 hrs

Source: Economic Review (1987), State Planning Board, Govt. of Kerala, Trivandrum.

Table 9.11

Power Cut in Kerala from 1-1-1989 to 31-7-1989

Period	Quantity
1-1-1989 to 31-1-1989	20% for HT and EHT
1-2-1989 to 30-9-1989	40% for HT and EHT
1-5-1989 to 31-5-1989	60% for HT and EHT
1-6-1989 to 15-6-1989	100% for HT and EHT
16-6-1989 to 20-6-1989	40% for HT and 100% EHT
20-6-1989 to 31-7-1989	40% HT
1-7-1989 to 31-7-1989	60% EHT
From 1-8-1989 the cut was lifted.	

Source: Economic Review (1990), State Planning Board, Govt. of Kerala, Trivandrum.

Table 9.12

Load Shedding in Kerala from 2-5-1989 to 20-6-1989

Period	Duration
2-5-1989 to 15-5-1989	Day time - 3 hrs
16-5-1989 to 15-6-1989	Day time - 5 hrs
16-6-1989 to 20-6-1989	Day time - 3 hrs
1-6-1989 to 3-6-1989	Night: city - ½ hr villages - 2 hrs
4-6-1989 to 15-6-1989	Night: city - 1 hr Rural - 2 hrs
16-6-1989 to 20-6-1989	Night: city - ½ hr Rural - 1½ hrs.

Source: Economic Review (1990), State Planning Board, Govt. of Kerala, Trivandrum.

the under-utilisation of existing capacity and have contributed to the low growth of new investments.

The Operational Efficiency of the Firms and Time-Lag and Cost Overrun

Yet another indirect negative impact of time and cost overrun is associated with the operational efficiency of the firms. The impact of time-lag and cost overrun on the project itself is crucial, since it adversely affects the future operational efficiency of the project. The operational inefficiency results in operational loss. If the extent of time-lag and cost overrun is very high as in the case of many projects implemented in Kerala, the project becomes economically nonviable. The continuous occurrence of operational loss will be the net result.

For analysing the operational efficiency of the projects and time-lag and cost overrun, the public sector industrial projects are considered. The study of four public sector industries which resulted in time-lag and cost overrun found that among these projects three projects are accumulating operational loss (Table 9.13). The case study of four loss making public sector units confirms the relationship between loss making characteristics of industries and time-lag and cost overrun.

Table 9.13

Time-lag, Cost Overrun and Economic Performance of the Public Sector Industrial Units

(Rs. in lakhs)

Sl. No.	Name of the Company	Cost over-run as % increase over the original	Time over-run as % increase over the original	Paid up capital as on March 1989	Accumulated loss as on March 1989
1.	Kerala State Drugs and Pharmaceuticals Ltd. (10/1983)	88.72 (443)	137.5	420	1065.06
2.	Malabar Cements Ltd. (10/1984)	61.19 (2050)	125	159.3	1642.51
3.	Carbon and Chemicals India Ltd. (1/1984)	41.92 (5.24)	75	--	--
4.	Kerala State Minerals and Metals Ltd. (1/1985)	51.38 (3340)	72.34	2892.27	6100.96

Notes: Dates in brackets are the date of completing the project work.
Figures in bracket are the cost overrun in rupees.

Source: 1. Economic Review (1989, 1990), State Planning Board, Govt. of Kerala, Trivandrum.
2. Compiled from company documents.

The Kerala State Minerals and Metals Ltd. started production in 1985 and has accumulated a loss of Rs.6,100.96 lakhs. An investment of Rs.9,840 lakhs in the project and 8 years of operation of the industry have not been able to generate any surplus income, but have accumulated a loss of Rs.6,100.96 lakhs. So the time-lag and cost overrun have not only contributed to nullify the income generating effect of investment, but also generated a negative effect. This is so because the state has to spend this amount to compensate the operational loss of Rs.6,100.96 lakhs. So the amount that would have been available for new investment is directed to meet the loss of the project.

Time-Lag, Cost Overrun and Growth Effect of Investment

It is clear from the preceding analysis that time-lag and cost overrun in projects result in capital wastage and income loss and as such they nullify the growth effect of investment. In certain cases time-lag and cost overrun generate negative income, i.e., even the existing income is to be diverted for meeting the operational loss of the projects, as in the case of some of the public sector industries in Kerala. The sectoral imbalance and disproportionality crisis resulting from time-lag and cost overrun also negatively influence the income generating aspect of investment through linkage effect.

Thus the study reveals that the existence of time-lag and cost overrun in project implementation breaks the hitherto established relationship between investment and cumulative economic growth, i.e., investment-production-employment-income-saving-investment-growth. This is because time-lag and cost overrun result in lags and leakages of investment funds.

Chapter 10

CONCLUSIONS AND RECOMMENDATIONS

The following paragraphs brief the major findings of the study. It is hoped that this will be of some help to policy makers and project executors to reduce or avoid the extent of time-lag and cost overrun in the formulation and implementation of projects in the state in the coming years.

The role and significance of investment are stressed in development theory. This is reflected in Indian planning also. But unfortunately in India the thrust is mainly on the quantum rather than the quality or efficiency of investment. This is true in the case of Kerala also. During 1951-1990 Kerala made an investment to the tune of Rs.6,064.88 crores under the plan schemes. Crores of other forms of investment also have been made under other projects and programmes by private and government agencies. But this failed to dynamise the Kerala economy.

If investment to be meaningful it must effectively generate new production capacity and income, both directly and through linkage effects. This, in fact, depends on the quality of investment. But unfortunately the efficiency of investment is rather poor. The efficiency is pulled down by the prevailing extent of time-lag and cost overrun. Consequently it, in fact, negatively influenced the rate of growth of the economy. The study reveals that if there were no time-lag and cost overrun, the investment made in the economy could have resulted in an accelerated rate of growth in the economy and consequently much of the problems that the economy faces today could have been avoided.

The Extent of Time-lag and Cost Overrun

In India, as on 1st January 1990, there were 331 mega, major and medium ongoing projects spreading over 13 sectors. Out of the 331 projects 163 (50%) resulted in time-lag and 184 (55.5%) in cost overrun over the latest estimate. Further, a census study of the 165 projects completed during 1987 to 1991 in the central sector indicates the occurrence of time-lag and cost overrun.

What is found to be true in the case of central sector projects is also found to be true in the case of state sector projects. All the completed hydroelectric and irrigation projects in the state resulted in time-lag. Similarly all the completed hydroelectric projects and 70 per cent of the completed irrigation projects have resulted in cumulative cost overrun. All the ongoing hydroelectric and irrigation projects in Kerala resulted in time-lag and cost overrun. The case studies of the state's industrial projects also reveal the universal nature of time-lag and cost overrun.

Magnitude of Time-lag and Cost Overrun

The study on time-lag and cost overrun in all the Mega, Major& Medium projects completed in the central sector during 1987-91 and the ongoing projects as on 1st January 1990 reveals that, in the central sector, the magnitude of time-lag and cost overrun are relatively high. For example, the coal projects completed in 1988-89 witnessed a time and cost overrun of 100 per cent and 322 per cent respectively. In the case of ongoing projects in the central sector, time-lag is found to be in the range of one month to 157 months. The cost overrun of the 331 ongoing projects, over the latest estimate, is found to be Rs.15,457.4 crores.

In the case of the state level projects also the magnitude of time-lag and cost overrun is found to be very high. The time-lag and cost overrun of all the completed hydroelectric projects are 64.51 per cent and 115.89 per cent respectively over the original estimate. In the case of ongoing hydroelectric projects time-lag and cost overrun are found to be 141.37 per cent and 127.47 per cent respectively over the original estimate.

Time-lag and cost overrun are absolutely and comparatively high in the projects implemented in Kerala. In the case of completed hydroelectric projects time-lag and cost overrun are in the range of 30 per cent to 200 per cent and 10 per cent to 285 per cent respectively over the original estimates. In the case of ongoing hydroelectric projects the same is found to be 66 per cent and 300 per cent respectively, over the original estimates. More or less the same trend is identified in the case of irrigation projects also.

Sectoral Difference in Time-lag and Cost Overrun

Sectoral analysis of time-lag and cost overrun of completed and ongoing central sector and state level projects reveals the wide intersectoral difference in time and cost overrun. In the central sector there were 331 Mega, Major and Medium ongoing projects spreading over 13 sectors as on 1st January 1990. The time-lag and cost overrun of projects in these sectors exhibit wide differences. The highest extent of time-lag and cost overrun, in the case of ongoing projects, in the central sector is found in the fertilizer sector. All the projects in this sector resulted in time-lag, ranging from 2 to 126 months and all the projects have a cost overrun of 63 per cent over the original estimate. But in the case of civil aviation projects the same is found to be nominal and that too only in few projects. Similar inter-sectoral differences in time-lag and cost overrun are found to exist in the case of the completed central sector projects during 1987 through 1991.

The high inter-sectoral difference in time-lag and cost overrun is found to be true in the case of ongoing and completed state level projects too. For example, the cost overrun in the case of 10 completed irrigation projects was 27.33 per cent over the original estimate. In the case of 12 completed hydroelectric projects and 5 public sector industries the same was 115.89 per cent and 49.15 per cent respectively. This is more or less the same in the case of time-lag also.

The major works in the case of irrigation as well as hydroelectric projects are rather the same. In spite of this these projects show wide sectoral difference with reference to time-lag and cost overrun.

The study on time-lag and cost overrun of public sector and private sector industrial projects in Kerala also reveals wide sectoral differences. The time and cost overrun of public sector industries was 80.8 per cent and 49.15 per cent respectively over the original estimates. But in the case of private sector projects studied, time-lag is found to be zero and cost overrun a mere 4.28 per cent over the original estimate. This shows that, compared to public sector projects, private sector projects have only minimum time-lag and cost overrun.

Intra-Sectoral Differences in Time-lag and Cost Overrun

The analysis of intra-sectoral variations of time-lag and cost overrun of power projects - thermal power projects, atomic power projects, gas power projects and hydroelectric projects—in the central sector also indicates wide variations. The highest cost overrun is found in the case of hydroelectric projects and the lowest in the case of gas power projects. In certain cases there are no time-lag and cost overrun as in the case of gas based power projects.

Inter Project Differences in Time-lag and Cost Overrun

The project-wise analysis of time-lag and cost overrun of ongoing and completed projects shows that inter-project differences in time-lag and cost overrun are very high. A study of 31 ongoing power projects, all the railway line construction projects and fertilizer projects, in the central sector confirms the above conclusion. The project level study of all the completed projects in the central sector during 1987-88 through 1990-91 also substantiates the same.

The project-wise analysis of all the completed and ongoing hydroelectric and irrigation projects in Kerala also indicates the inter-project differences in time and cost overrun. The case study of industrial projects started during 1978-82 in Kerala also revealed the varying nature of time-lag and cost overrun.

Even in the case of the same type of projects started and implemented during the same period the extent of time and cost overrun varied.

A comparative study on inter-project differences in time and cost overrun of hydroelectric projects in the central sector and state sector shows wide variation. Time-lag and cost overrun are found to be higher in Kerala compared to central sector hydroelectric projects.

Since time-lag and cost overrun vary from project to project on temporal and spatial basis irrespective of the size and nature of the project, it is inferred that the extent of time-lag and cost overrun is entirely a project dependent phenomenon.

Relationship Between Time-lag and Cost Overrun

The sectoral and project level study on time-lag and cost overrun of ongoing and completed projects spreading over different states, different time periods, different sizes and nature could not confirm the widely discussed direct relationship between time-lag and cost overrun. A higher extent of time-lag in most cases has not resulted higher cost overrun. The study on the time-lag and cost overrun in the central sector projects and state level projects could not identify any uniform or one to one relationship between time-lag and cost overrun even in the case of the same type of projects implemented during the same period.

In the case of the completed hydroelectric projects in Kerala, time-lag and cost overrun were 62.71 per cent and

115.89 per cent over the original estimate respectively. But in the case of ongoing hydroelectric projects time-lag has increased from 62.71 per cent to 122.41 per cent over the original estimate while cost overrun has come down from 115.89 per cent to 85.46 per cent showing an inverse relationship between time-lag and cost overrun.

In the case of completed hydroelectric projects in Kerala cost overrun is found to be comparatively high (115.89%), and time-lag comparatively low (62.72%). But in the case of completed irrigation projects just the opposite is noticed (time-lag 191.66% and cost overrun 27.33%). The above facts of time-lag and cost overrun at the sectoral level clearly disprove the general view on the direct relationship between time-lag and cost overrun. The same is rather true in the case of industrial projects studied.

The project level analysis of cost overrun and time-lag also substantiates the above findings. Out of the 12 completed hydroelectric projects only two projects have higher time-lag and higher cost overrun. In the case of 5 completed hydroelectric projects a higher time-lag is accompanied by comparatively low cost overrun, and in other projects a comparatively high cost overrun is accompanied by lower time-lag.

The time revisions and cost revisions of certain projects like Kallada hydroelectric project show that even four time revisions, each extending to at least one year, are not accompanied by any cost revision which also reveals typical relationship of time-lag and cost overrun.

The split up scheme-wise analysis of time-lag and cost overrun shows that only certain areas of work and its cost respond to time-lag while others are not fully responding to it.

The response of cost overrun to time-lag is found to be more in the ongoing and completed central sector projects than that in the projects of Kerala.

All these findings related to the completed and ongoing central sector and state level projects clearly break the generally accepted time-lag - inflation - cost overrun direct and proportional relationship.

Trends in Time-lag and Cost Overrun in the State Level Projects

The sectoral as well as project level study of the trends in time-lag and cost overrun found that, in general, they are on the increase, though not steady. The time-lag and cost overrun of all the completed hydroelectric projects are comparatively low, amounting to 62.71 per cent and 115.89 per cent respectively over the original estimate. But in the case of ongoing hydroelectric projects the same is 122.41 per cent and 85.46 per cent respectively. Compared to the completed hydroelectric projects cost overrun declines from 115.89 per cent to 85.46 per cent in the case of ongoing hydroelectric projects. Since, most of the work of a good number of ongoing hydroelectric projects are not completed, there is every possibility of a further sharp increase in cost, as revealed by some projects, the works of which are advanced considerably.

The highest extent of time-lag and cost overrun of the completed hydroelectric projects is 200 per cent and 284 per cent respectively over the original estimate. But the same in the case of ongoing hydroelectric projects is 450 per cent and 844 per cent respectively over the original, exhibiting an increasing trend.

In the case of completed irrigation projects time-lag and cost overrun are 191.66 per cent and 27.33 per cent respectively over the original estimate. But in the case of ongoing irrigation projects the same has increased to 359 per cent and 532.64 per cent respectively, exhibiting increasing trend.

The project level study of irrigation projects also confirms a monotonic increasing trend with reference to time-lag and cost overrun. Among the completed irrigation projects the highest extent of time-lag and cost overrun are 500 per cent and 135.5 per cent respectively over the original estimate. But the same in the case of ongoing irrigation projects are 800 per cent and 3347 per cent over the original respectively, exhibiting a sharp increase in time and cost overrun.

But the sectoral and project-wise study of completed and ongoing Mega, Major and Medium projects in the central sector as on 1-1-1990 exhibited, in general, a declining trend in the occurance of time-lag and cost overrun. In certain sectors and projects it sharply came down and even reached to zero and negative.

Causative Factors of Time-lag and Cost Overrun

The study of time-lag and cost overrun of central sector and state level projects found that time-lag and cost overrun occur in all the three stages of project implementation, viz., in sanctioning the project, in starting and in completing the project work.

The causative analysis of time-lag and cost overrun found that the emergence of time-lag and cost overrun in project implementation are due to many factors. But more or less the same factors are contributing to time-lag and cost overrun in all the projects, but their role and intensity vary from project to project.

In the case of hydroelectric projects of Kerala, four major agencies are involved in the project implementation, viz., Government, KSEB, contractors and workers. Time-lag and cost overrun of hydroelectric projects are closely related to the defective functioning of these agencies which are influenced by the socio-political and economic factors prevailing in the state.

The other basic factors contributing to time-lag and cost overrun are time-lag related cost overrun and excess work led time-lag and cost overrun.

Time-lag Led Cost Overrun

The study identified the major factors contributing to time-lag. It is found that time-lag in project implementation is caused by most of these factors together and is not the result of any single factor. Of course, the intensity and the role of these factors vary from project to project. For example, the most commonly occurring causes of time-lag in the central sector are related to the project sanction, eviction, rehabilitation, etc. Out of 163 projects studied, 45 projects experienced these. At the state level projects lack of co-ordination, misplanning, mismanagement etc. are found to be the most common factors contributing to time-lag.

Whatever be the reasons for time-lag, it is believed that the response of cost overrun to time-lag is positive and significant. Theoretically there exists a direct relationship among time-lag, inflation and cost overrun. The study found that the relationship among these variables are positive in most cases, but not significant. It is neither proportional nor uniform at the project level.

It is found that, at the sectoral level in certain cases, the relationship is even not positive. For example, in the case of completed hydroelectric projects, the time and cost overrun are 62.71 per cent and 115.89 per cent respectively over the original estimates. But in the case of ongoing hydroelectric projects time-lag has increased to 122.41 per cent but cost overrun has come down to 85.46 per cent. Since time-lag and cost overrun relationship varies from project to project which are implemented in the same period and with the same type and nature; time-lag alone cannot explain the massive occurrence of cost overrun.

Excess Work, Time-lag and Cost Overrun

Additional or extra work that may occur in the course of implementing the project due to underestimation of the quantity of work, change in the size and nature of the project, etc., is a determining factor of the extent and magnitude of time-lag and cost overrun. But the case study of Sabarigiri hydroelectric project, which experienced sizable increase in the quantity of work mainly due to the increase in the capacity of the dam, found that only around 40 per cent of the cost overrun is due to excess work.

From the causative analysis of time-lag and cost overrun it is concluded that basically the causes contributing to time-lag and cost overrun are of two types - avoidable/reducible and unavoidable. The climatic factors, geological conditions and the like factors led time and cost overrun is rather unavoidable. In the case of 163 central sector projects studied only 11 projects are delayed and resulted in cost overrun due to such unavoidable factors. So most of the factors and forces contributing to time and cost overrun are avoidable/reducible, provided deliberate measures are taken at the right time.

Impact of Time-lag and Cost Overrun

The impact analysis of time-lag and cost overrun revealed that both time-lag and cost overrun adversely affected the concerned projects, the related sectors and ultimately the rate of growth of the economy.

Impact of Time-lag and Cost Overrun on the Concerned Projects

The case study of industrial projects found that there exists a relationship between the occurence of time-lag and cost overrun and its profitable running. The study of public sector industries which resulted in considerable extent of time-lag and cost overrun found that all these projects witnessed operation loss and in certain cases the accumulated loss over the years have increased over the paid up capital. This resulted in resource drain.

Impact of Time-lag and Cost Overrun on the Related Sectors

Inter-sectoral dependence and linkages are strong in the process of economic development. Time-lag and cost overrun in certain projects, by creating disproportionality crisis, can dilute the above relationship. The power supply in Kerala is a typical example for it. Except in the case of Fifth Five Year Plan the target set in power sector could not be achieved mainly due to time-lag and cost overrun of the hydroelectric projects. This has contributed to power deficiency in the state. The resultant power cut, load shedding, etc. lead to the under-utilisation of existing capacity and adversely affected the growth of new capacity in different sectors of the economy. Thus time-lag and cost overrun of hydroelectric projects obstructed the growth of related sectors.

Time and Cost Overrun of Projects and the Rate of Growth of the Economy

Time-lag and cost overrun result in capital wastage and income loss which restrict the growth effect of investment. The inflation resulting from time-lag and cost overrun further adds to cost overrun and consumes away the newly generated income. Thus time-lag and cost overrun not only restricts the income generation but also consumes the additionally mobilized income. These adversely affect the rate of growth of the economy and may even push the economy into stagnation. The direct income loss of hydroelectric projects in the state due to time-lag is worked out as Rs.2,818 crores at the rate of 1 Re. per unit of power. The capital wastage resulting from cost overrun of hydroelectric project is Rs.40,713.53 lakhs. So the total income and capital loss due to time-lag and cost overrun is very high. If there were no time-lag and cost overrun in the hydroelectric projects of Kerala and if these amounts were invested in power, then the rate of growth would have been much more than the present level.

RECOMMENDATIONS

The following recommendations are made in the context of the present study:

1. Since time-lag and cost overrun are project dependent, any attempt to avoid time-lag and cost overrun should give thrust to project based programme, rather than the present system of macro-level programmes.

2. Since most of the factors that result in time-lag and cost overrun could be controlled by better management and co-

ordination, measures on this line will reduce the extent of time-lag and cost overrun.

3. Today the project implementation is found to be rather an engineers programme. But it should also make use of expertise of economists, managers, etc., which will improve the efficiency in management.

4. There should be better documentation of the history of completed programmes so that it will help as a ready reckoner for the implementation of new projects without time-lag and cost overrun.

5. There should be more autonomy coupled with accountability at the project level management. As far as possible it should ensure the continuity in management also.

6. Since today the capacity of the contractors and their experience in implementing projects have increased, and so the single contracting system is to be followed at least in various schemes of the project.

7. There should be a central co-ordinating agency to co-ordinate the various agencies involved in project implementation.

BIBLIOGRAPHY

BOOKS

Ahluwalia, I.J., (1984), Industrial Growth in India, Stagnation since Mid-sixties, Oxford University Press, Delhi.

Gangadharan Pillai, V., (1980), The Public Sector in Kerala Administrative Problems, The Kerala Academy of Political Science, Trivandrum.

Krishna Iyer, S., (1975), Keralathinte Sampath Vyavastha, Bhasha Institute, Trivandrum.

Rao, H., (1985), "Inter-State Disparities in Development in India", in G.P.Mishra (Ed.), Regional Structure and Development in India, Vol.I, Ashish Publishing House, New Delhi.

Roy Chowdhury, S.K. and P.R.Shukla., (1991), "Industrial Projects Time and Cost Overruns", in S.K.Roy Chowdhury and P.R.Shukla (Eds.), Encyclopaedia of Economic Development, Vol.20, Akash Deep Publishing House, New Delhi.

Sankaranarayanan, K.C. and V.Karunakaran., (1985), Kerala Economy, Oxford and IBH Publishing Company, New Delhi.

Sinha, Baswan and Ramesh Bhatia., (1982), Economic Appraisal of Irrigation Project in India, Agricole Publishing Academy, New Delhi.

ARTICLES

Agarwal, A.K., (1989), "Energy for Economic Development", Yojana, Vol.XXXIII, No.17.

Aravindakshan, K., (1987), "Puyankutty Hydroelectric Project - Reed Workers Affected", Economic and Political Weekly, Vol.XXII, No.4.

Balasubramanian, R., (1989), "Water Resources Management - A Case Study", Yojana, Vol.XXXIII, No.22.

Barnes, Douglas F. and P.Binswanger., (1986), "Impact of Rural Electrification on Infrastructural and Agricultural Changes, 1966-80", Economic and Political Weekly, Vol.XXI, No.1.

Bhagavan, M.R., (1986), "India's Energy Policy in the Late 1980's", Economic and Political Weekly, Vol.XXI, Nos.44 & 45.

Bhaskara Reddy, Udaya., (1980), "Narmada Multipurpose Project;Boom or Bane", Yojana, Vol.XXXII, No.7.

Cantor., (1988), "Work Effort and Contract Length", Economica, Vol.XXXXXV, No.219.

Chaudhary, C.M., (1989), "Changing Dimensions of Public Debt in India", Yojana, Vol.XXXIII, No.4.

Correspondent-EPW., (1977), "Power Sector Heading for a Crash", Economic and Political Weekly, Vol.XII, No.43.

Correspondent-EPW., (1978), "Public Sector: Probe into High Living", Economic and Political Weekly, Vol.XIII, No.2.

Correspondent-EPW., (1983), "Irrigation; The Prodigal Sector", Economic and Political Weekly, Vol.XVIII, No.27.

Correspondent-EPW., (1987), "Electrical Equipments Preference for Imports", Economic and Political Weekly, Vol.XXII, No.1.

Correspondent - Special., (1988), "Global Energy Scenario", Monthly Commentary on Indian Economic Conditions, Vol.XXX, No.1.

Dasgupta, Subhendu., (1981), "Transnational Corporations in Electric Power Sector, 1947-1967; Continuity of Linkages", Economic and Political Weekly, Vol.XVI, No.28.

Datta, Prabhatkumar., (1984), "Govt. Bureaucracy in the Transitional State", State and Society, Vol.V, No.1.

Dogra, Bharat., (1985), "The Other Side of the Dam", Economic and Political Weekly, Vol.XX, No.15.

Ganguly, Nirmal and B.K.Sharma., (1988), "Infrastructure as Determinent of Industrial Growth", Yojana, Vol.XXXII, No.9.

George, K.K., (1986), "Discretionary Budgetary Transfers - A Review", Economic and Political Weekly, Vol.XXI, No.46.

George, K.K., (1990), "Kerala's Fiscal Crisis: A Diagnosis", Economic and Political Weekly, Vol.XXV, No.37.

Gopalaswamy, Kavita., (1990), "The Energy Scenario in India", Yojana, Vol.XXXIV, No.5.

Gulati, I.S., (1988), "An Approach to the Eighth Five Year Plan", Kerala Calling, Vol.IX, No.1.

Gupta, D.R. and N.Ram Lal,, (1981), "Financial Resources for the Sixth Plan - Feasibility Analysis", Economic and Political Weekly, Vol.XVI, No.40.

Gupta, P.S., (1989), "Power Field from Dependence to Self Reliance", Monthly Commentary on Indian Economic Conditions, Vol.XXXI, No.1.

Guha, Amalender., (1977), "Bureaucracy and the Ruling Class", Economic and Political Weekly, Vol.XII, No.27.

Institute of Public Opinion., (1985), "The Dilemma of Higher Growth Rate in a High Cost Economy (1986-1990)", Monthly Commentary on Indian Economic Conditions, Vol.28, No.5.

Institute of Public Opinion., (1987), "India's Energy Outlook: 1985-2000", Monthly Commentary on Indian Economic Conditions, Vol.XXIX, No.5.

Institute of Public Opinion., (1988), "Energy Planning: Issues and Prospects" Monthly Commentary on Indian Economic Conditions, Vol.XXIV, Nos.10 & 11.

Jain, L.C., (1988), "Monitoring Public Investments: A Creative Initiative", Economic and Political Weekly, Vol.XXIII, No.23.

Jeffery., (1989), "Intra Industry Spill-Overs", Review of Economic Studies, No.186.

Jha, L.K., (1986), "Priorities in Economic Policies 1987-2000", Monthly Commentary on Indian Economic Conditions, Vol.XXVIII, No.9.

Jha, L.K., (1986), "Autonomy and Accountability in India's Public Sector Enterprises", Monthly Commentary on Indian Economic Conditions, Vol.XXVIII, No.1.

Kalathil, Mathew., (1988), "Sardar Sarovar: Claims and Reality", Economic and Political Weekly, Vol.XXIII, No.49.

Khurana, I.R., (1987), "You Delay, They Suffer", Yojana, Vol.31, No.19.

Kumarsingh, Satyajit., (1985), "From the Dam to the Ghettos; the Victims of Rihand Dam", Economic and Political Weekly, Vol.XX, No.39.

Maheshwari, B.L., (1981), "State Level Public Enterprises: Issues of Autonomy and Performance", Economic and Political Weekly, Vol.XVI, No.47.

Majumdar, K.C. and Debdas Bandyopadhay., (1985), "Estimation of Total Five Year Plan Investment: An Alternative to the Sixth Plan Model", Economic and Political Weekly, Vol.XX, No.36.

Mathew, E.T., (1977), "Power Development in Kerala", Social Scientist, Vol.VI, No.2.

Mehta, R.J., (1988), "Industrial Disputes Bill: Old Wine in New Bottle", Monthly Commentary on Indian Economic Conditions, Vol.XXIX, Nos.10&11.

Mekibbin Warwick, J., (1989), "Time Consistant Policy: A Survey of the Issues", Australian Economic Papers, Vol.XXVIII, No.53.

Mitra, Ashok K., (1989), "Mounting Antagonism Towards Big Dams", Economic and Political Weekly, Vol.XXIV, No.31.

Morris, Sebastian., (1990), "Cost and Time Overrun in Public Sector Projects", Economic and Political Weekly, Vol.XXV, No.47.

Nalappat, M.D., (1978), "Kerala Irrigation Muddle", Economic and Political Weekly, Vol.XIII, No.20.

Nayanar, E.K., (1981), "Kerala and Sixth Plan - Sharing of Resources", State and Society, Vol.11, No.2.

Oliveina De, Adilson., (1990), "Energy Diagnosis", World Development, Vol.XVIII, No.4.

Pal, S.P. and C.R.Roy., (1982), "Environmental Implications and Economic Evaluation of Large Scale Irrigation Projects - Some Methodological Issues", Margin, Vol.XIV, No.4.

Pandit, B.L., (1986), "Financial Surplus in Public Sector", Artha Vijanana, Vol.XXVIII, No.4.

Pant Niranjan., (1983), "Issues in Irrigation Development", Economic and Political Weekly, Vol.XVIII, No.30.

Parameswaran, M.P., (1990), "Kerala's Power Predicament: Issues and Solutions", Economic and Political Weekly, Vol.XXV, No.37.

Patodia, D.N., (1987), "The High Cost Economy and Industrial Structure", Monthly Commentary on Indian Economic Conditions, Vol.XXIV, No.1.

Rodrigues, Denis., (1985), "Another Morvi in the Making", Economic and Political Weekly, Vol.XXIV, No.14.

Satyanarayana, K., (1989), "Visualising Future Power Demands", Yojana, Vol.XXXIII, No.17.

Shafiq, Chandrakala., (1988), "Satal Hydro Electric Project: A Dam Comes True", Yojana, Vol.XXXII, No.10.

Shenbagavati., (1985), "Comprehensive Legislation for Construction Workers", Economic and Political Weekly, Vol.XX, No.49.

Shastri, P.P., (1990), "The Economic Implications of Corruption", Southern Economist, Vol.XXIX, No.1.

Singh, Satyajit K., (1990), "Evaluating Large Dams in India", Economic and Political Weekly, Vol.XXV, No.11.

Sinha, S.L.N., (1990), "The High Cost of Inefficiency", Southern Economist, Vol.XXIX, Nos.2&3.

Trivedi, Prajapati., (1986), "Public Enterprises in India; If Not Profit, Then for What?", Economic and Political Weekly, Vol.XXI, No.48.

Venkiteswaran, S. and C.C.Cheriankunju., (1989), "Development of Irrigation in Kerala", Southern Economist, Vol.XXVIII, No.8.

Wirtshafter, Robert M., (1990), "Decentralisation of Chinas Electricity Sector - Is Small Beautiful?", World Development, Vol.8, No.4.

UNPUBLISHED RESEARCH WORKS

Achuthamenon, K., (1986), 'Interest cost in Indian Industry', M.Phil Dissertation, University of Bombay.

Babu Ram, D., (1985), 'Material Management System in A.P. State Electricity Board', Ph.D. Thesis, Andhra University, Waltair.

Babu Thomas., (1983), 'The Flight of Traditional Industries from Kerala with Special Reference to Cashew Industry', M.Phil Dissertation, CUSAT.

Chalapathi Rao, G.U., (1985), 'Material Management in the State Electricity Board with Special Reference to A.P., M.P., T.N. and W.B.', Ph.D. Thesis, Osmania University, Hyderabad.

GOVERNMENT REPORTS AND PUBLICATIONS

Government of India, Annual Reports (1987-1990), Ministry of Programme Implementation, New Delhi.

Government of India, Basic Statistics Relating to the Indian Economy 1981 and 1982, Central Statistical Organisation, New Delhi.

Government of India, Committee on Public Undertaking, 1980-81 (Seventh Lok Sabha), Eighth Report on Khetri Copper Complex of Hindustan Copper Limited, Lok Sabha Secretariat, New Delhi.

Government of India, Committee on Public Undertaking 1981-82 (Seventh Lok Sabha), Fourtyfourth Report on Bharat Heavy Electricals Limited, Lok Sabha Secretariat, New Delhi.

Government of India, Committee on Public Undertakings 1982-83 (Seventh Lok Sabha), Seventy-fourth Report on Mazagon Dock Ltd., Lok Sabha Secretariat, New Delhi.

Government of Kerala, Committee on Public Undertakings 1986-87, Seventh Kerala Legislative Assembly, Fiftyeighth Report, Trivandrum.

Government of Kerala, Economic Review 1955-1993 (Various Issues), State Planning Board, Trivandrum.

Government of Kerala, Five Year Plan Documents: I Plan to VIII Plan, Dept. of Public Relations/Planning Department, State Planning Board, Trivandrum.

Government of Kerala, Kerala: Facts and Figures (1979), Bureau of Economics and Statistics, Trivandrum.

Government of Kerala, Kerala Budget in Brief; 1986-87 to 1991-92, Trivandrum.

Government of Kerala, Kerala Economy in Figures (1988), Trivandrum.

Government of Kerala, Report of the High Level Committee on Industry Trade and Power (1984), Vol.III, Report on Power Development, State Planning Board, Trivandrum.

Government of Kerala, State Plan Expenditure 1951-90, State Planning Board, Trivandrum.

Government of Kerala, Statistics for Planning 1977, 1980, 1983 and 1986, Directorate of Economics and Statistics, Trivandrum.

Industrial Development Bank of India, Report on Development Banking in India 1992-93, Bombay.

Kerala State Electricity Board, Annual Plan Proposals (1990-1992), Trivandrum.

Kerala State Electricity Board, Annual Reports (1972-1988), Trivandrum.

Kerala State Electricity Board, Draft Eighth Five Year Plan (1992-1997) and Annual Plan (1992-93), Trivandrum.

Kerala State Electricity Board, Eighth Plan (1992-97) and Annual Plan 1992-93 (1991), Trivandrum.

Kerala State Electricity Board, Project Report, Sabarigiri Hydroelectric Project (1960), Trivandrum.

Kerala State Electricity Board, Project Report, Accelerated Construction Programme of Pamba, Kakki Scheme (1961), Trivandrum.

Kerala State Electricity Board, Project Report, Idukki Hydroelectric Project Stage II (1978), Trivandrum.

Kerala State Electricity Board, Technical Completion Report on Sabarigiri Hydroelectric Project (1977), Trivandrum.

NEWSPAPER

Ananthakrishna Pillai, P., (1990), "Damn Dams", Indian Express, June 9.

Balashankar, B.R., (1991), "Rs.30,000 crores Down the Drain", Financial Express, Sept.10.

Correspondent., (1990), "Pallivasal--50 years", Deepika, March 31.

Johnson, M.A., (1990), "Panitheeratha Swapnangal", Deepika, May 23-25.

Mathur, W.D., (1990), "How 496 Crore Became 1260 Crore in Just Three Years", Indian Express, March 14.

Naik, B.M., (1983), "Management Analysis of Projects", Economic Times, Dec. 28.

Nair, T.K.G., (1988), "Pathathiude Panipurayil", Malayala Manorama, July 27-30.

Radhakrishnan, M.G., (1990), "Kuttiadi Project", Mathrubhoomi, December 10.

Rajendran, N.P., (1991), "Panithittum Panitheeratha Pathathikal", Mathrubhoomi, Dec.3-7.

Rangnekar, K., (1991), "Vicious Circle of Prices and Taxes", Economic Times, Aug.4.

Ravi Kanth, D., (1991), "Devaluation will Make Power Projects Rs.30,000 crores Costlier", Economic Times, July 11.

Thampuran, Ravi Varma., (1992) "Mudanthunna Pathathikal", Malayala Manorama, Aug.4-8.

Roy, W.C.K., (1986), "Poorthiyakatha Pathathikal - 850 Crores Thulachu", Malayala Manorama, Feb.18-27.