ECONOMICS OF IRRIGATION: WITH SPECIAL REFERENCE TO WATER RATES IN ANDHRA PRADESH,1865-1991

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by

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This is to certify that I, U. Hemantha Kumar, have carried out the research embodied in the present thesis for the full period prescribed under Ph.D. ordinances of the university.

I declare to the best of my knowledge that no part of this thesis was earlier submitted for the award of research degree of any university.

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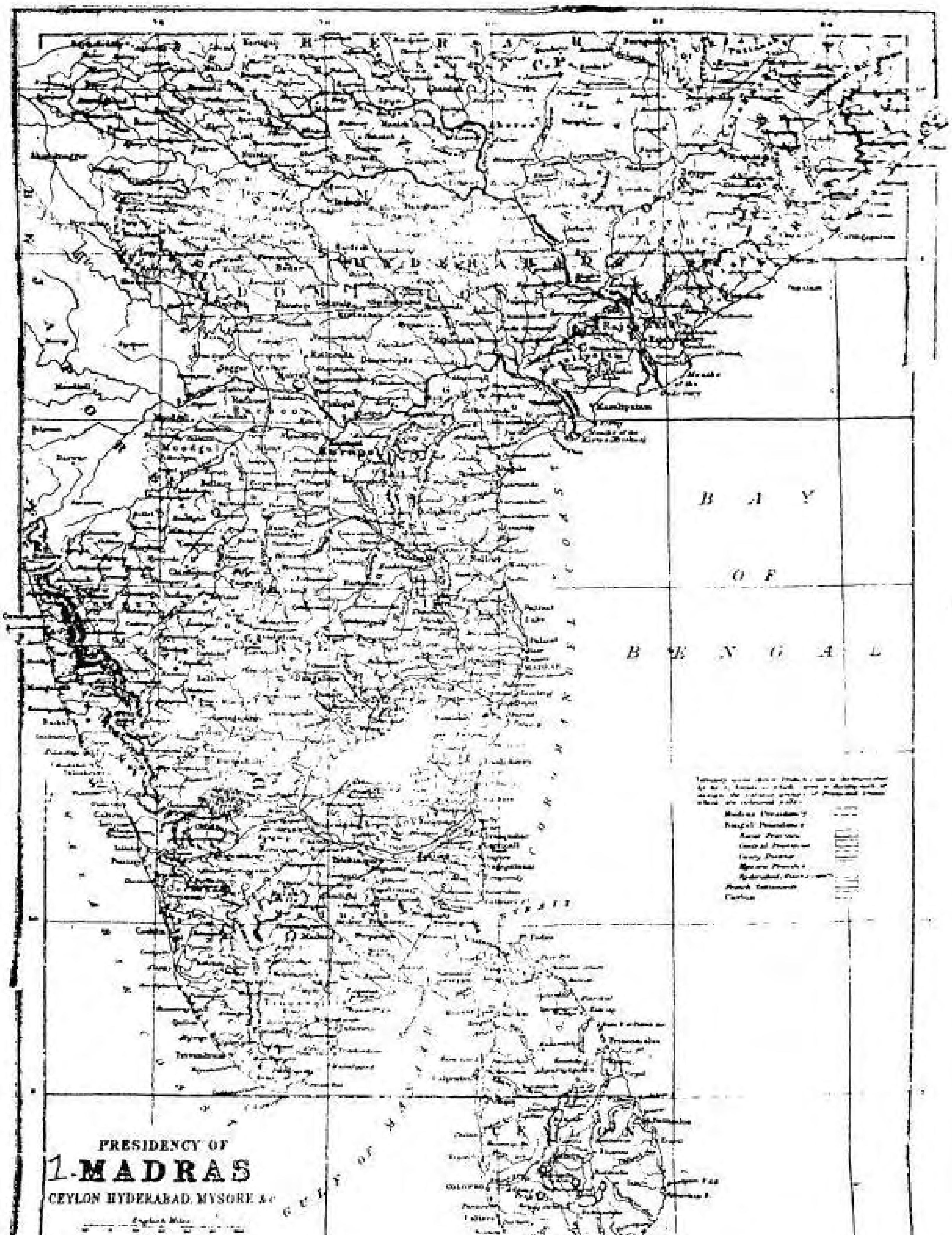
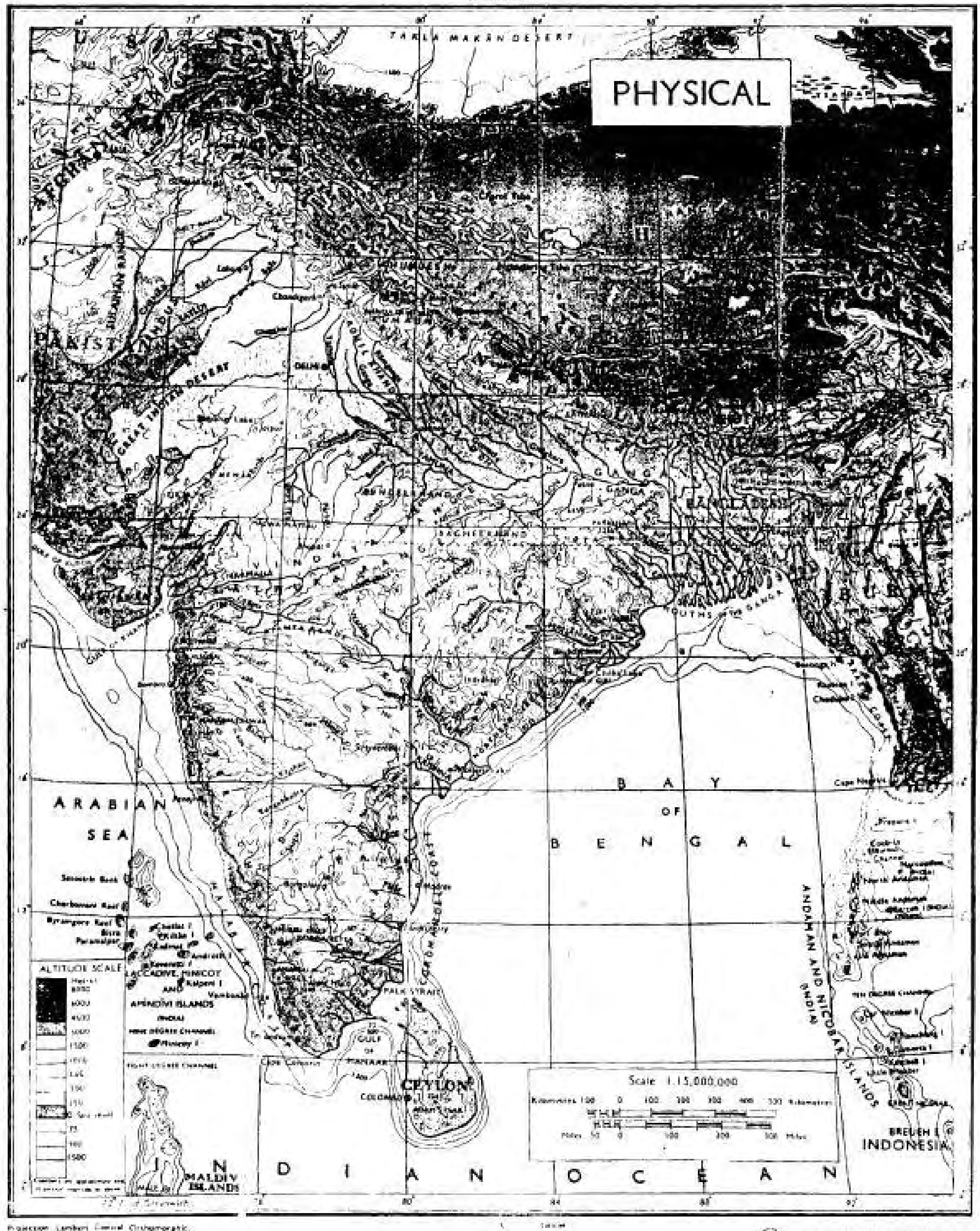


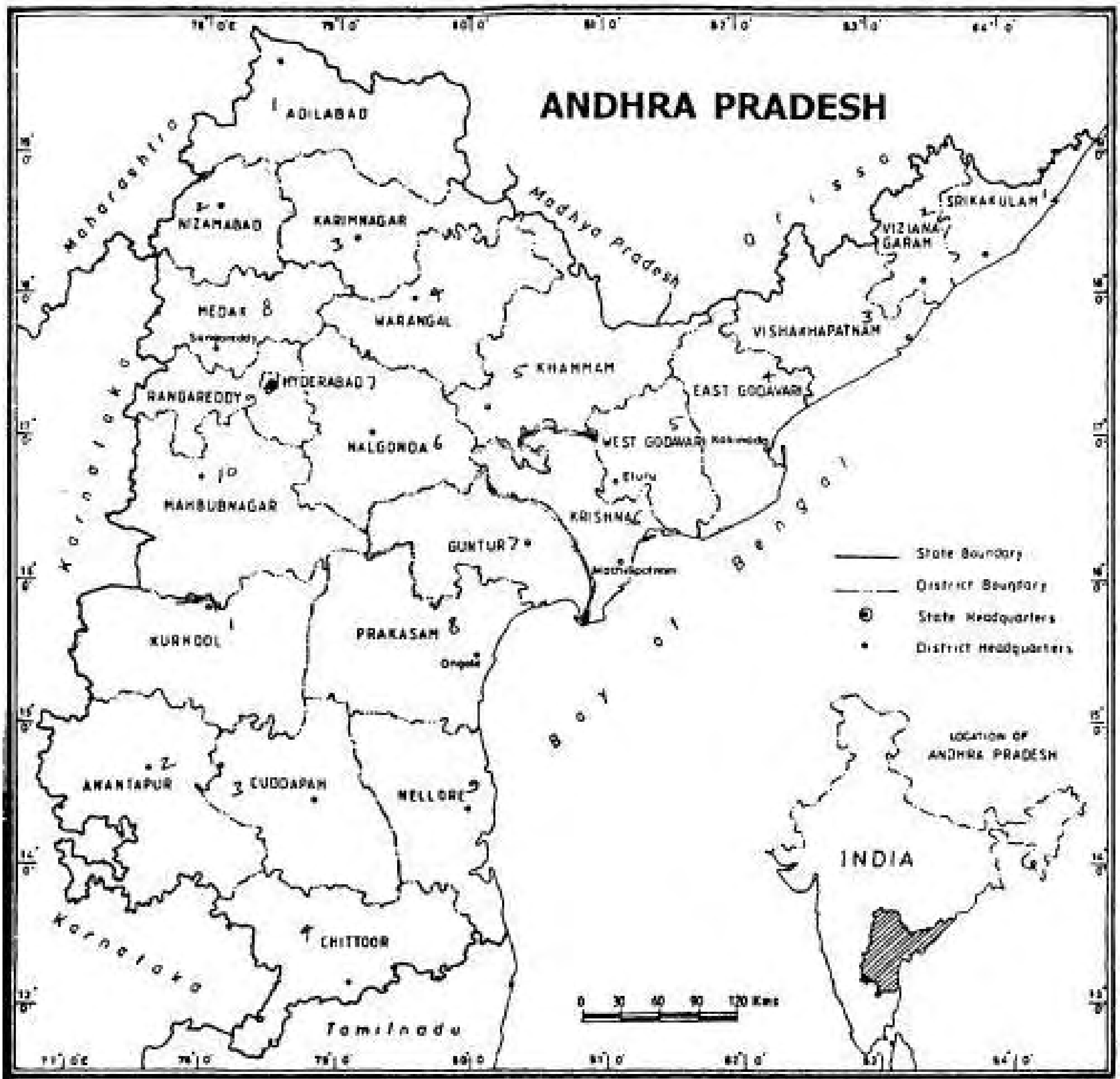
Source : C.D. Maclean, (1885), 1987, P.



Projection: Lambert Conical Orthomorphic.
Meghalaya is an autonomous state within the state of Assam.
The boundary of Meghalaya shown on this map is as interpreted from the Assam Re-organisation (Meghalaya) Act, 1969, but has yet to be verified.
The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Source : "Government of India, 1971, "Indian Agriculture Atlas", Directorate of Economics and Statistics, Ministry of Agriculture, New Delhi, P. 2.

DISTRICT MAPS
OF
ANDHRA PRADESH



Source: Hanumantha Rao, V, 1998., (Ed.):

CHAPTER-1

INTRODUCTION

I

The problem

1.1.0 Introduction:

Development and management of irrigation would continue to be the important aspects of agricultural progress in India, as agriculture continues to be the dominant sector in providing employment and alleviating poverty and malnutrition. According to the population census of 1991, agriculture continued to be the most important sector in the rural economy employing about 185.2 million rural workers; 110.6 million person as cultivators and 74.6 million person as agricultural labourers. Both agricultural labourers and cultivators constituted about 64.9% out of a total of 285.4 million workers in Indian agriculture (Census of India, 1991, p. 18). The growth of agriculture, especially of the oil seeds sector, at the expense of coarse cereals resulting in the availability of cheap edible oils vis-a-vis coarse cereals are expected to bring about shifts in the consumption pattern of these commodities. Edible oils are generally considered superior in terms of nutrition when compared to coarse cereals. Whereas vegetable oils are known to be rich in calories derived from fat, coarse cereals have an abundance of minerals and vitamins in addition to protein and calories (Vinita Kumar, 1997, P.216). India wife a population of about 846 million (Census of India, 1991, p. 15)[1] may find it difficult to feed and clothe herself without the corresponding and proportionate rate of development in agricultural production in the next century.

1.1.1 Production and Consumption Pattern of Foodgrains:

It is imperative that India should produce sufficient quantity of foodgrains and other agricultural products to ensure its population a reasonable level of consumption. A task force was set up by the Planning Commission in 1977 to estimate the minimum needs. Based on the age-sex-occupational characteristics of the population, the task force arrived at a norm of 243S calories for rural areas and 2995 calories for urban areas. Using appropriate conversion factors, the calorie content of consumption baskets corresponding to various per-capita expenditure classes were worked out (Government of India, 1979, pp. 1-31). The 27th round of the NSS Consumer Expenditure Survey relating to 1972-73 estimated the intake of calories by households in different expenditure classes for the first time. It was observed on the basis of this data that of the 11,468 sample households belonging to all expenditure classes(total of 14 classes), 3298 had a calorie intake of below 2300 per consumer unit, and they were found in all expenditure classes, the top five expenditure classes- accounting for 497 or 15.1%. Equally difficult to explain is the fact that as many as 8,170 rural sample households had a daily intake for consumer unit of more than 3200 calorie and of these 2585 or 31.6% were accounted for by the bottom five expenditure classes (Rao,V.K.R.V, 1981, pp. 1205-1209). The country had adopted several food sell-sufficiency programmes especially with regard to rice and wheat in the 1970's. Rice is mostly an irrigated crop followed by wheat depending on the seasonal rainfall.

1.1.2 Agricultural Strategy and Food Needs:

A new strategy for agricultural development in the Fourth Five Year Plan was outlined in 1965 with three main objectives. First was to apply scientific techniques and knowledge of agricultural production at all stages, particularly in the fields. Second was to select a few areas with assured rainfall and irrigation for concentrated application of a package of inputs based on improved varieties of seed responsive to heavy doses of fertilisers, and other modern inputs. And the third was to achieve higher production of subsidiary foods both through intensive production programmes and overall development (Government of India, 1965, pp. 42-44). Irrigation is one of the chief inputs in increasing the production of rice apart from oil seeds and cotton. According to the Report of the Expert Croup on Cropping Pattern, with the compound growth rate of total food-grams from 1967-68 to 1984-85 at 2.68, the projected foodgrains production for the years 1989-90 were 162 million tones, 1994-95 were 185.91 million tones and for 1999-2000 were 212.19 million tones respectively. And projected demand for foodgrains during the year 1999-2000 was 221.00 million tones (Government of India, 1988, pp.1-17). But the output from the irrigated lands should expand at a high rate so as to meet the projected food needs of the next decades.

1.1.3 Poverty and Foodgrains:

Poverty cannot be reduced without a rapid increase in me supply of foodgrains. The reason is that foodgrains make up a large share of direct consumption in a low-income economy. With an annual total expenditure of Rs.1558 billion for a population of 797 million, per-capita monthly expenditure comes to Rs.163 in 1986-87(Radhakrishna,R.and Ravi,C, 1992, pp.2-3). The rural-urban differences in per-capita expenditure was fairly large. The rural areas had a per-capita expenditure of Rs.141 per month with two-thirds of it devoted to food, whereas urban areas had Rs.226 per month with slightly more than one half devoted to food. Though, the share of food in total expenditure was lower, urban areas had a higher per-capita expenditure of 39% on food because of their higher level of per-capita expenditure. There is need to increase the ability of poor people to purchase food, and therefore the growth in foodgrains production has to be sustained through irrigation and technological improvements.

1.1.4 Irrigation and Its Effects on Agricultural Development

Irrigation can increase the direct employment in agriculture to the poor workers. Also important are the indirect effects on employment generated by spending the increased agricultural income. The Government of India since Independence adopted a muni-pronged strategy to affect income distribution in favour of the poor (Government of India,1980-85 p.17). The policies and programmes for indirect and direct transfers of income to the poor encompass input subsidies in agriculture, food subsidy through the public distribution system and self-employment and wage employment programmes for the rural poor. The first-two measures had only an indirect bearing on poverty through availability of foodgrains at low prices (Vinita Kumar, 1997, pp. 164-205). The problem of food security, is likely to attain continuous importance for several reasons. Like most other densely populated countries, India faces a formidable challenge in providing food security for its population. Economic reforms, in general, and structural adjustment policies for agriculture in particular, that are designed to eliminate discrimination against agriculture, may result in raising the prices of tradable agricultural commodities including foodgrains vis-a-vis manufactured goods (Bhalla G.S., 1994, p.28). The year-to-year fluctuations in agricultural and foodgrains production are very wide (ADB and IIMI, 1986, P.2).

The progress of Indian agriculture since the introduction of economic planning in the country is substantial There has been growth in the production of all (he crops, though at different rates. However, this growth has not been smooth and it has become increasingly unstable. At least two factors seem to be contributing to the increased fluctuations in crop output **Firstly,** crop output, particularly of foodgrains, is sensitive to variations in rainfall. Secondly, changes in the prices of inputs tike fertilisers would also include the demand for inputs resulting in a variation in output (Hanumantha Rao, CH., etal, 1988, P. 15). Hence, what is needed is a search for realistic and pragmatic policies which can ensure food security and self-sufficiency in foodgrains. This underlines the importance of the development of water resources for irrigation in India,

1.1.5 Irrigation and Investment Allocation:

At the time of Independence, there were only two major storage reservoirs namely Mettur Sukkur and Krishnarajasagar both on the Cauvery in South India. Thereafter, a number of major storage works were undertaken and the country embarked on a large number of new irrigation projects. There had been considerable delays in their completion and the gestation periods were prolonged and extended beyond expectations. The major distortion was came in the Fifth Five Year Plan 1974-78 with as many as 73 new major and 331 medium irrigation projects which were already under execution at the beginning of the Fifth Five Year Plan (G.O.I, 1974-79 Appendix). Although the number of new projects declined gradually thereafter, particularly in the 1980's concerted efforts were not made to clear up the backlog. The spill over costs of irrigation projects continued to be high with the result mat at the beginning of the Eighth Five Year Plan as many as 182 major and 312 medium and 100 extension/renovation/modermzation schemes were in the list of ongoing irrigation projects. About Rs.39,044 crores at the 1990-91 price level had spilled-over into the Eighth Five Year Plan (GOI, 1993, P. 58). The direct impact of such a large number of ongoing projects has been the enormous cost and they have overrun the allotted time. This has led to a slowdown process in the rate of growth of foodgrains production in the country.

1.1.6 Irrigation and Its Creation and Utilisation:

The lag in utilization of irrigation facilities had tremendous impact from the investment since the non-utilization of the already created irrigation potential meant heavy investment without much financial returns. From Plan-to-Plan basis, the lag in the utilization had ever been increasing with the lag of 3.89 million ha under major and medium, and 4.80 million ha. under the irrigation projects at the end of 1989-90. The investment cost of this potential that remained un-utifized could be approximately Rs. 12,580 crores (Water Management Forum, 1992, P. 823). However, besides such huge investment without any financial returns, there is also a financial loss of approximately Rs.4,300 per year on account of loss in incremental foodgrain production which would have otherwise come from this area, had it been under irrigation. This had discouraged further investment in agriculture.

1.1.7 Irrigation Development and Inefficiency in Cost Recovery:

The percentage of costs recovered from farmers had been very low. The revenue collections had not been sufficient even to cover the costs of operation and maintenance of the irrigation systems. One of the reasons for sub-optimal utilization of the existing irrigation facilities is the poor direct cost recovery from the sale of water. Financial difficulties in the irrigation sector are related to the fact that public irrigation is often heavily subsidized and the subsidies are often large in our country, and Government is not in a position to allocate financial resources further because of the overall budgetary constraints. Rationalisation and restructuring of water rates is envisaged, in view of the urgent need for upward revisions so as to bridge the widening gap between receipts and expenses. Fixation of water rates at present is under the purview of the State governments. Some states have already undertaken works relating to improvement of irrigation systems and farmers turnover with a view to recover full operation and maintenance costs in a phased manner (U.N.O., 1996, p. 17). Under various political and administrative compulsions, the states have not been able to adhere to recover the revenue. There is a variety of political interests and pressures which affect the practical establishment and implementation of financial reform of irrigation institutions. Inevitably, the issues mat arise will include the political viability of any scheme for irrigation fees; me genuine political problem of charging low income farmers anything at all, even if product prices are increased ; the opposition to reform of officials who benefit from the opportunities for corruption, created by the economic rents mat occur in subsidised irrigation and coping with the genuine social and cultural impediments to change when traditional values are in conflict with modern methods of financing (Small L.E, and Ian Carruthers, 1991, P.203). As a consequence, the actual receipts varied from less man 1% to a maximum of 2.9% of me gross output Sometimes, the existing projects are not maintained property owing to resource crunch. The flow of funds into the treasury is very low in the form of water rates, or returns to the capital invested on different irrigation projects. "It is often noted that the water rates collected are so low mat they are not sufficient to pay the salaries of the staff and not to speak of re-investment in the new schemes" (Gulati, etal, 1994; pp.73-75). The mounting costs, frequent revision of project estimates and the consequent delays in the completion of irrigation projects had been causing great concern to me government since a long time (GOI, 1993, P. 58). Several governments in the world are forced to reconsider their policies toward fanners' payments and for participation in irrigation developmental activity (Small and Carruthers, 1991, P.28). At this juncture, mere is a need for a scientific study of the economics of irrigation water rates, covering the phenomenon of both pre-and post-Independence periods.

To conduct such a study taking the entire nation as a unit, is not viable. Hence, the scope of the study is limited so as to facilitate comprehension of as much reality as possible. Consequently, Andhra Pradesh is chosen for a case study. The development of irrigation during the pre-Independence period is significant, since a number of projects were constructed across its major rivers by the British Government[2] Hence, the study of their policies on irrigation is highly valuable for evolving policies for the further development and management of irrigation. Also there have been no major recent and useful studies about water rates in the state of Andhra Pradesh.

II
A Brief Review of Literature

1.2.0 Introduction:

The approaches to irrigation pricing need to be understood in relation to the objectives of a nation's irrigation development programme. Among the various economic considerations of irrigation planning, some primary concerns of the pricing of irrigation water can be identified. Increased national food production, help for the subsistence farmers, national and regional development and generation of increased revenues to the Government are some of me considerations.[3] (Small L.E, etal.,1989, P.1). But other considerations such as employment, income and sustainability are much more important than these objectives. Review can be divided into some convenient and broad heads like Irrigation pricing and development, impact of irrigation, and irrigation and investment allocation.

1.2.1 Irrigation Pricing and Development:

The pattern of agricultural growth in India during the nineties represents a shift in the cropping pattern and the spatial distribution of crops in response to the emerging resource and input constraints which may reflect improved allocative efficiency and interplay of improved management techniques in production. The increased productivity of rice could be explained to some extent by the area shift from high irrigation and input intensive north -western states (Punjab and Haryana) to more heavy rainfall areas of West Bengal, Bihar and Orissa having less irrigation facilities but abundant cheap labour. Rice being both a water and labour intensive crop is perhaps better suited for me Eastern states with a natural comparative advantage for growing this crop (Vinita Kumar, 1997, pp.212-214). Given the importance of poverty and agriculture, the expansion of rice cultivation in these states as well as in other parts of India would have provided additional employment opportunities and minimise large scale 'uneconomical' migration of labour from these states to the western states of India.

Increased national food production is an objective underlying the irrigation development of many nations. A rapid increase in irrigation in Bangladesh, was seen as a key element in meeting the primary objective of the medium term food production plan and "to ensure food security to the nation by achieving foodgrain sett-sufficiency" (Huq, M.1989, P. 168). Achievement of self-sufficiency in rice has been an important element underlying me irrigation development plans of Philippines and Indonesia. In Malaysia, the government used irrigation as a means of increasing the domestic production of rice consumption in the country (Small, L.E., etal., 1989, P.1). Just as irrigation development is seen as an important component of the strategy for achieving the self-sufficiency objectives of these nations, the irrigation pricing mechanism must also be seen as consistent with these objectives.

Increasing the production and income of farmers for their subsistence was the chief objective underlying the development of irrigation in India and Pakistan during the late 19th and 20th centuries. Projects which, when judged by a financial productivity criterion, were deemed to be "unproductive," had an important place in the irrigation development programme if they would benefit the nation by reducing famines. Such projects might also have some fiscal advantages to the government in the form of reduced expenditures on famine relief (National Council of Applied Economic Research, 1959, P.65). The explicit income distribution objective associated with this policy had clear implications for pricing mechanisms. In particular, *it* would be inconsistent to use a mechanism requiring the water-users to pay for the fun cost of the development and operation of the irrigation system. Investment in "Productive" irrigation works thus had an objective similar to mat which governs investment in a profit motivated private sector. This had obvious implications for me types of pricing mechanisms that would be appropriate. The formulation of irrigation water price is likely to be influenced by a large number of variables. Some of mem can be conveniently reviewed under the impact of irrigation.

1.2.2 Impact Of Irrigation:

The direct impact of irrigation is chiefly on productivity, employment, income and environment Indirect effects are me profits earned on commodities of the projects which are sold locally, profits expected to accrue to all other enterprises ranging between the fanners and the final consumer, from handling, processing and marketing and, profits of all enterprises from supplying goods and services tor the increased *farm* purchases for family living and production expenses.

1.2.3 Productivity:

Irrigation has the potential to increase agricultural output Whether or not the individual cultivator benefits from any such increase depends mostly on the style of irrigation management Cultivators may be tenants, land owners or simply landless labourers. They may get fixed wages or share in the total profits. Comparison of productivity between irrigated and unirrigated lands in a given area demonstrated that irrigated lands had a larger increase in productivity (Vaidyanathan A, 1987, P.510). For example, in the Dantiwada project of Gujarat, the output per hectare of gross crop area is estimated higher in irrigated lands, produce are almost nearly twice the per hectare of gross crop area compared to unirrigated lands. There is ample evidence to show that "individual crop yields are considerably higher under irrigated than under rain-fed conditions and that irrigated areas grew high value crops which cannot be raised under rain-fed conditions" (Ranade, 1980, pp.85-114). It has also been shown that differences in the progress of output per hectare as well as crop intensity across space are significantly and positively associated with the irrigation ratio. The positive correlation between growth of irrigation and growth of agricultural production, mainly crop production can be gleaned. Public investment in irrigation is seen to be a significant determinant for agricultural growth (Rao, S.K, 1971, pp. 1333-53). This study found that that relative stagnation in agricultural growth rates during the carry sixties was mainly due to declining public investment

The production function approach was used by Nadkarni to analyse the effects at different levels and types of irrigation on output, treating irrigation as one of the explanatory variables. The micro-survey deduced that the productivity impact of irrigation varies between projects and across regions. The survey in Karnataka found mat different types of irrigation showed variation in productivity : the areas irrigated by wells have higher cropping intensity and higher yield than tank-fed areas (Nadkarni, *etal,* 1979: pp.50-70). This study reported even larger differences ranging from five-fold to twenty-fold of higher yields, and indicates the volume of output per unit of gross sown area and net sown area is significantly higher in the command areas man in the non-command areas.

Estimates regarding the impact of irrigation, source-wise, on yields, the stability of yields and their regional variations were prepared by Dhawan (Dhawan, 1983, pp. 109-16). The direct estimates of productivity differentials between irrigated and unirrigated lands are widened due to the cropping pattern explains the major part of the differential rather than differences in yield and also witnesses, important inter-regional differences. Dhawan also found that the productivity differentials between irrigated and unirrigated lands were wider in the low rainfall regions than in the high rainfall regions. High rainfall regions are generally higher in productivity than low rainfall regions.

While the benefits of irrigation are widely recognised, their very nature, stemming from simultaneous changes in technology, input use and resource allocation makes them very difficult to quantify and attribute to any one factor such as irrigation. The study by Abbie quantified me benefits from irrigated and unirrigated areas and there are more benefits much more in irrigated areas. (Abbie, etal, 1982, P. 14). Thus, me investment in irrigation influenced the conditions of production, not only through its technological impact, but through the shaping of the process of development, with differential consequences on the economic position of different classes of people. Irrigation improved the relative economic position of the users and generated a dynamics of sustained growth and productivity.

1.2.4 Employment and Income:

The use of irrigation facility increases employment opportunities in primary sector in more man one way. Firstly, irrigation operation itself needs labour. And increased employment depends on the number of waterings applied to the crops and the actual area covered under different crops. Secondly, irrigation facilities had increased the use of strategic inputs like fertilizers, insecticides and pesticides which needed labour use at the farm level Thirdly, assured water supply diverts cropping pattern of a region from inferior crops to more remunerative crops which raises the employment potential on account of increased labour intensity of such crops. Empirical studies confirmed that reliable and adequate irrigation had directly raised the volume of employment Some studies revealed mat me volume of employment was more in irrigated lands man those with rain-fed conditions. It is reported to have been 61% of employment increased on the Dantiwada canal irrigation project in Gujarat (Patel and Patel, 1984, P. 538) and more than 100% of employment increased under me Kakatiya canal of me Sriramsagar project in Andhra Pradesh (Adinarayana, S.1984, P.543), and 135% of employment increased in a village under the Damodar valley canals in West Bengal (Ghosh, MG.1984, P.549). Another study with empirical evidence from 45 micro studies, (25 of them from India) found that, with few exceptions, they confirmed the positive relationship between irrigation and employment (Silliman and Lenton, 1985, P. 16). For small and marginal farmers, irrigation means increased productive work spread throughout me year. For landless labourers, irrigation means work available on most days of the year, especially where there are a second and third crops. A comparison of an irrigated village with a largely unirrigated village in West Bengal showed how sharp the contrast could be for labourers. In the irrigated area there was virtually no dead season and also mat a large number of migrant labourers could find work in the peak seasons (Ghosh, M.G., 1984, P. 549). Wages also were high when mere was a sharp peak in labour demand. With a continuous demand for labour throughout the year resulting from irrigation, employers took on to semi-permanent or permanent labour (Wood, G. 1985, P.24). Thus, development of irrigation helps to stimulate the growth of non-farm employment of a region. The activities like rice miffing, cotton ginning, repairing and maintenance activities of improved agricultural implements and other activities of agricultural sector generate additional employment opportunities in the economy.

1.2.5 Environment:

Irrigation projects affect the environment. Some have adverse effects on it, while others have beneficial effects. In India, the projects tike Ujjaine and Jayakwadi on both of which more than Rs.500 crore each have already been spent are classic examples to show how projects are planned ignoring basic socio-economic and environmental considerations (Dasarda, 1994, p. 181). The deep black soils in planned command areas of both projects are the most ill-drained soils. And as the drainage components are conspicuously missing in the project design itself, even with a few trail irrigation rotations the soil is getting spoiled on account of salinity and alkalinity. Environmental damage caused by construction of reservoirs submerges valuable forests and displaces people (Vaidyanathan, 1987, p.525). But the study also finds that the reserviors helped to increase *output* of agricultural produce including the basic foodstuffs.

1.2.6 Irrigation and Investment Allocation:

Increasing the government revenues was one of the objectives of irrigation development in India. This has been emphasized by a number of studies. The donor agencies such as the World Bank and other financial agencies and India herself had invested crores of rupees in the past five decades in irrigation and are planning to invest crores of rupees more in the coming years. But research on the socio-economic and institutional issues involved in the development and distribution of investment on irrigation through public investment programme have started receiving serious attention from many of the studies only recently (N.C.A.E.R, 1959, P.65; Prasad and Rao, 1985, P. 17). The rise in the quantum of investment in irrigation sector induced several additional economic activities in the economy. These in turn, enhanced production, employment opportunities, and trade.

the cost escalation and the delay in the completion of the major irrigation and multi-purpose projects comes under various heads, such as rise in prices, inadequate investigation, inadequate provision, change in the scope and design of additional requirements, acquisition of lands, rehabilitation measures, paucity of funds, poor performance of equipment, and management of water resources projects, these not only pushed up the cost of the project but also resulted in the postponement of the completion of the project owing to the inability of the states to provide additional funds to commensurate with the rise in costs (GOI, 1980, P.24). In such a situation, where the State is investing enormous amounts of public money, largely borrowed, without recouping any part of it, increases the burden on the already severely strained budget and is bound, in course of time, to affect adversely the ability of the State to maintain or to continue to expand and improve irrigation. This gives room for enhancing the recovery costs through proper pricing of irrigation mechanism.

III

Water Rates

1.3.0 Introduction:

The effects of financing policies depend mainly on the organization of responsibilities for the four processes of allocating resources to irrigation, using these resources to implement irrigation services, obtaining resources from irrigation beneficiaries, and controlling the resources obtained from the beneficiaries.

1.3.1 Water Rates and British Period:

Irrigation policy of the colonial administration between 1860-1900, was a revenue oriented policy. Irrigation land in the Madras Presidency was assessed in a consolidated payment which represented in one sum the assessment of land revenue and the charge for its irrigation (Government of Madras, 1865, pp. 131-133). Further, the colonial government left the less endowed regions where the rate of return was low, to the private companies and kept the better endowed regions, where the profits were much higher (Rama Reddy, 1990, pp. 1047-54). The colonial rulers discouraged fanners in maintaining irrigation systems whenever there was a surplus revenue to be realised.

The irrigation policy of the native rulers before the British advent was marked primarily by the non-commercial and general welfare considerations (Atchi Reddy, 1992, pp. 1-14). The native rulers used to help the owners of the irrigation sources with finances that were not expected to be directly returned in any form and at any time. There was an apparent change in mis policy during the colonial period as the rate of the expected profits increased their revenues. It was due to the consideration of commercialization. The initial stages of this change gave rise to a number of water conflicts and tensions. The main reasons were the increased yields after the construction of anicuts and control of floods particularly in the command areas of these anicuts.

1.3.2 Ground Water Markets:

The phenomenon of market for ground water has been widely documented in the context of both Indian and Bangladesh agriculture. The available literature pertains to the markets in areas where the availability of ground water is relatively abundant and where the rates for water are competitive. During the first round village level survey in me Vaigai basin, 27 villages were surveyed, and rate was fixed for water sale in mis basin for wet and dry lands separately. A few well-owners depended on their wells and who had surplus water to sell, by this to earn income (Shah and Raju, 1988, pp.A.23-28). In fact, many well owners who had a shortage of water purchased it in this region. Water charges are collected in cash and they do not vary in respect of wet and dry lands, but one finds variation in water charges from village to village. The water rates vary depending upon the quality of water and the type of energy used. Poor quality water, in general, has low charges. If a diesel pump is used for lifting water, rates are high, irrespective of the quality of water (Janakarajan, 1993, pp.65-67). Another study, by Maria reveals mat relative significance of various factors influenced the ground water purchasing decisions of the fanners in the five Indo-Gangetic states, viz., Bihar, Haryana, Punjab, Uttar Pradesh and West Bengal The farmer buying ground water depends upon his attributes like farm-size in acreage, number of farm fragments, soil fertility, percentage of his farm area under canal irrigation, water payment (per acre) irrigation expressed in rupees, timeliness of rain, adequacy of rain, fertilizer applied in kg/acre, and the adoption of high yielding crop varieties. The study concluded mat the failure of climate i.e delayed rainfall has been the major factor contributing to the decision of fanners to buy ground water in all the five states (Maria Saleth, 1991, pp.349-54). The structure and performance of water markets in North Coastal Andhra Pradesh were studied by Raju and Rao. According to them, all the selling farms were medium farmers and all the buyers were small farmers, because small farmers were not in a position to afford to introduce the diesel pump systems. (Raju and Rao, 1991, p.376). This kind of water market system is still in vogue in the North Coastal Andhra Pradesh,.

Pricing of irrigation, with emphasis on cost of producing unit quantity of water at the water point and charging economic water rates was studied by Sangal (Sangal S.P, 1991, pp.2645-51). This study stated that in two states namely Gujarat and Maharashtra, water rates of these minor irrigation projects had fully covered the operation and maintenance charges, yearly component of loan along with its interest after accounting for subsidy for the assets created.

1.3.3 Assessment of Irrigation Revenues:

A distinction may be drawn between situations of full or partial financial autonomy and those of financial dependence. With financial autonomy, an irrigation agency has at least partial responsibility for allocation, implementation, fund collection and controlling of finances of irrigation (Nickum, 1979; pp.169-86; Bergman, 1984; pp.9-13; Bottrall, 1983; pp. 102-13; and Khan, 1981; pp.55-66). These studies on financial obligations revealed mat financial autonomy and control over the resources is obtained from the water ways, and thereby over the allocation of all or a major portion of the resources devoted to irrigation operation and maintenance.

Another study regarding financial autonomy were analyses both de-centralized implementation agencies or a centralized irrigation agency. With financial dependence, an irrigation agency has no control over any funds collected from the water users, and is thus dependent on resources allocated to it through the general government budgetary process. Decentralized financial autonomy is found in a number of countries where control of irrigation operations is vested in local irrigation authority in the USA, Mexico and China, companies in France, land improvement associations in Korea, and irrigation associations or co-operatives in Taiwan and Greece (ADB and IIMI, 1986, P.8). They concluded that one of the potential advantages of decentralized financial autonomy is that it may create financial accountability linkages between the managers of irrigation projects and the water users. The centralized irrigation agencies may also be financially autonomous, although this appears to be relatively uncommon. In the Philippines, where semi-governmental corporation, viz; the National Irrigation Administration is responsible for the construction and operation of national irrigation systems throughout the country. Further, they observed that a common alternative financial arrangement was that of financial dependence, whereby a government line agency responsible for operating irrigation projects depended solely or primarily on government budgetary procedures for its revenues. This approach prevails in a number of countries including Nepal, Indonesia, India, Pakistan, Bangladesh and Sri Lanka. In these countries, the amount of water charges collected from fanners have little or no relationship to the amounts spent on the operation and maintenance of the irrigation systems (ADB and IIMI, 1986, P.9). This means that the revenue in the name of water charges are not sufficient to meet the expenses of maintaining the systems.

Assessment of financial obligations is usually based on me cost benefit principle. When the cost approach is used, it is common for the government to provide subsidies that cover some specified portion of me irrigation costs. Typically, the subsidy involves a portion of the capital costs, (either for initial construction or for major upgrading or rehabilitation), but no portion of me operation and maintenance costs. The cost principle is some times modified to accommodate considerations related to the amount of benefits received. Considerations of ability to pay appear to have been incorporated into policies on water charges in the U.S.A, Taiwan and Korea, where the government has set a maximum amount which farmers can be charged for water by the irrigation associations. In some cases, if the costs of the irrigation association cannot be met by these maximum charges, special subsidies may be provided by the government Some studies observed that there were a number of problems connected with me cost principle (Kimura, 1977 : pp.248-66; Bottrall, 1983; pp. 102-13; Small and Carruthers, 1991: pp.39-71; Young, 1986 : pp.151-175; Nickum, 1979 : pp.169-86; and Khan 1981 : pp.55-66). It has been argued that, because of corruption, inefficiency and other leakages, officially reported cost figures for irrigation, in several countries may be as much as double the appropriate or real level mat the users should be expected to repay.

The benefit principle is consistent with financing mechanisms that place some financial obligations on the indirect beneficiaries of irrigation. In India, it is reported that betterment levies had been tried in various states, but without much success. The Planning Commission studied the pricing of irrigation water under which the Commission reviewed different procedures for the cost-benefit analysis of irrigation projects (GOI, 1992, pp. 58-91). The water charges should explicitly be the function of the volume of water used and the season of use. The amount paid by the users of irrigation water should be linked to the quantity used and the quality of service received. A shift to volumetric pricing which measures water in quantity delivered would remove the need for fixing crop-specific rates.

Finally, it is not possible for a centralized agency to efficiently administer the use of water at thousands of points across a large irrigation system without the help of user farmers, without building up strong and effective fanner's organizations which can take up the responsibility of receiving bulk supplies of water from the irrigation department and distribute the same among the member farmers. This may bring about a substantial reduction in the costs and responsibility of the government agency.

The relation between costs and benefits has a direct bearing on the economic viability of irrigation as well as the rational allocation of irrigation outlay across regions and me recovery of revenue from these benefits.

IV

Research Gaps and Methodology

1.4.0 Gaps in the Knowledge of Irrigation Rates :

The studies discussed did not give much importance to water rates. Some studies had noted the benefits from irrigation, i.e., improving production and productivity levels (Vaidyanathan (1987), Dhawan (1983), and Nadkarni (1979). Others stressed on the investment allocation and financial obligations, i.e., allocation of funds and financial autonomy of irrigation systems (GOI (1993), ADB and IIMI (1986), Nickum (1979), Kimura (1977) and Khan (1981). Most of the recent studies dealt with the ground water markets (Shah and Raju (1988), Janakarjan (1993), and Raju and Rao (1991). The canal irrigation and water rates are not analysed at length. Only irrigation development and water rates under canals only are noted by some of them. The studies reviewed did not give much importance to development of canal irrigation. Economic analysis of irrigation pricing hardly attracted the attention of irrigation researchers in recent times. No study had clearly analysed the setting and collection of water fees. There is no detailed study on any aspect of irrigation pricing in Andhra Pradesh.

The reason is that the large-scale irrigation system is a high cost proposition. The exploitable capacity of irrigation potential of large-scale projects covering nearly 58.5 million hectares of crop area in India is more than that of minor irrigation works standing at 17.4 million hectares. Large amounts are spent on major and medium irrigation projects. This capital outlay is entirely on public sector account, mostly spent through Irrigation Departments of the State governments. The corresponding public sector outlay on minor surface irrigation development is obviously less and not known precisely. Thus, bulk of the public sector outlay allocated on surface irrigation works was for the development of major and medium irrigation projects and mis had been enhanced in all the Plans since 1951.

1.4.1 Objective and Hypothesis :

The objective of the study is to analyse the trends in the water rates in Andhra Pradesh from 1865 to 1990. Different methods of price fixation of irrigation water of the major and medium irrigation sources are analysed to project the price fixation of irrigation systems, and for the future development of irrigation.

The hypothesis of the study is that the share of water rates has been steadily decreasing as a percentage of the total crop output of me area irrigated in value terms.

1.4.2 Methodology:

The present study investigates the economic effects of water rates. The purpose is to capture the all possible effects - direct and indirect Primary and secondary sources of data dealing with irrigation in general and water rates in particular arc collected Chief explanatory variables involved in this study are the productivity of crops, the prices of crops, the cost of cultivation, the cost of providing water, and the cost of maintenance of irrigation. There are other and minor variables whose effects are brought into focus whenever possible through the medium of the above variables.

The cost recovery issue is concerned with the level and structure of me prices to be charged against the benefits from a project so as to maximize *Us* net economic benefits to the economy. The scope for efficient pricing of irrigation water is limited, especially in case of those projects serving numerous small plots of land. Metered sale of water is costly to implement and administer. It is rarefy practised in the developing countries. The most suitable means of recovery is a production benefit tax. Crop-wise or area based rates, which are an attempt to tailor such a tax to a particular service, need to be supported by heavy rates of recovery. Otherwise, they may induce distortions to cropping patterns and water use.

However, mere are no uniform water-rates over different areas over different projects oroverthe regions in the states of India. Hence, the fixing of water rate by a general frame work or method is difficult For the analysis, projects from three different regions of Andhra Pradesh are chosen. There had been different modes of rates in different projects. In this way the study attempts to analyze a comprehensive and much wider impact of economics of water rates on irrigation development

A comparative analytical approach is adopted in tint study. It begins with the adoption of water rates by the British Government in 186S. The study noted the changes adopted by the British government in the later years. It takes into account me water rates levied by the Indian government after Independence.

1.4.3 Area of the Study:

The study concentrates on the present Andhra Pradesh as there was no significant study which highlighted water rates of irrigation. The area of study consists of three different geographical entities, viz., Andhra, Rayaiaseema and Telangana. While selecting the area of study the advantages of the case study and the availability of data were taken into consideration. Since the three regions consisted of numerous large and small irrigation projects, Andhra Pradesh is selected as the area of study. Another reason is the existence of different types of wet areas and a substantial percentage of area under irrigation. However, all the wet areas of the three regions do not form the part of study. For a deeper analysis of the impact of water rates on irrigation, selective projects namely, Godavari, Krishna, and Nizamsagar anicuts are chosen.

1.4.4 Period of Study:

The study begins with the year 1865 for the reason that me introduction of separate water rates on irrigation by the British Government were proposed in mat year. Prior to 1865, Andhra region witnessed the completion of Godavari, Krishna and Pennar anicuts. It was on these projects, the British Government for the first time applied separate water rates. This process of application of water rates by the British continued tin the end of their rule. After Independence, a similar policy was adopted by Andhra Pradesh government, though there is a clear distinction between the two. Thus, the study continues up to 1991, when the Government of Andhra Pradesh introduced an Act regarding water rates whose impact is altogether a different phenomenon.[4]

1.4.5 Sources of Data:

The sources are numerous and varied. They included Government reports and records. Caution has been taken to avoid extremes while referring to the British Government records. The colonial attitude in general was to justify the policies of the British Government There is an Act on me irrigation cess/water rate in the Madras Presidency called the Madras Irrigation Cess Act of 1865.[3] It noted the existence of various kinds of irrigation systems and methods of levying water rate in different regions and under different projects of the Madras Presidency. The Board's Consultations and the Proceedings have been a wealth of information regarding the individual projects and water rates in different regions. Apart from these primary sources, numerous and selected secondary sources like books and articles are consulted Annual data on irrigation charges payable to the government in lieu of water supplied to the fanners from the government owned canals and other means of irrigation are collected from me Board of Revenue Proceedings of the Madras Presidency, Central Water Commission Reports, Ministey of Irrigation and power and Agricultural Reports.

1.4.6 Organization of the Study:

The work is presented in the sequence of Chapters. The first chapter is an Introduction mat has delimited the problem. Review of available literature, the area and period of study, objective, hypothesis and methodology of the study are noted here.

The economic theory of irrigation pricing, the role of government in irrigation development, and the different available pricing principles are discussed in Chapter Two. In the Third Chapter, the economics of water resources of major as well as medium irrigation projects in India in general and Andhra Pradesh in particular, the uses and users of water resources and their consequences are examined. The capital cost, operation and maintenance, cost of major and medium irrigation schemes and cost recovery are dealt with in Chapter Four. The Fifth Chapter critically analyses the fixation of irrigation rates from the British rule tin the present times (1991). The benefits of irrigation are noted and the productivity, prices and water rates are analysed in Chapter Six. Chapter Seven briefly discusses the subsidies. The study is concluded with a comparison and contrast with other studies on irrigation matters.

Notes

1. It has crossed 100 crores recently according to the electronic media information.

2. The Madras Presidency occupied the southern portions of the Peninsula from latitude 20°18' on the eastern coast and latitude 14° on the western coast to Cape Comorin with latitude 8°4'; the longitude ranges from 74°9' to 85°15'. The extreme linear length of the Presidency, from North-East to South-West, is about 950 miles, its extreme linear breadth is about 450 miles. The coast line on the east commences North at the confines of the large salt lagoon called the Chilka lake in the Bengal district of Cuttack, and gives a boundary successively to the Ganjan, Vizagpatnam, Godavary, Kistna, Nellore, Madras, Chingleput, South Arcot, Tanjore, Madhura, and Tinnelvelly districts, and a small portion of the Travancore state. This makes about 1,250 miles of coast washed by the Bay of Bengal, Palk strait, and the Gult of Mannar. The coast-tine on the West commences Norm at the village of Shiroor a few miles south of Bhatcal near the Ilonore estuary, being the boundary between the Bombay district of North Canara and the Madras district of South Canara, and gives a boundary successively to the South Canara and Malabar districts and the Cochin and Travancore States. This makes a coast fine of about 450 miles washed by the Arabian Sea. On every side but the North, the Presidency is washed by me open sea. The irregular northern boundary has been formed by accidents of history.

From a physical point of view, the Presidency may be roughly divided into three portions, the long and broad Eastern Coast, the shorter and narrower Western Coast, and the high table land in the interior. These divisions are determined by the two great mountain ranges of the Eastern and Western Ghats which give the key to the configuration of all Southern India. The Eastern Ghats, which fie entirely within this Presidency, a continuation of the hill system of Chotanagpur. They run in a South-Westerly direction almost through the entire length of Madias, until they lose themselves in the Neilgherries, and there joins with the Western range. Their fine is pierced by the Godavary, the Kistna, and the Cauvery rivers, as well as by minor streams, so that they do not perform the part of a watershed. The Western Ghats on the other hand, which stretches south wards continuously along the shore of the Indian ocean from the norm of Bombay, satisfy all roe characteristics of a mountain range. The peculiar physical geography of the Peninsula with a large mountain chain running from North to South along its Western boundary, is of importance with regards to climate and the productions of the various portions of the country. The Western hills have the effect of arresting the lower strata of rain clouds brought up from the Indian ocean by the periodical winds of the South-West monsoon, and of causing excessive rain precipitation on the narrow strip of the coast-line on the Western side of the Peninsula. To the physical barriers of the Western Ghats must be attributed not only the vast differences of climate, but also those of the nature of the productions, in the Eastern and Western divisions of the Peninsula. In the former division the uncertainty and capricious character of the rainfall has taught the cultivators of the soil the necessity of making provision for the storage of water for irrigation purposes, and in memorable tanks of reservoirs scattered throughout the country. On the Western side of the mountains, however, the necessity for such works has never arisen. The chief staples of the Presidency are rice; cholam, cumboo, raggy, and varagoo, gingerly; chutes, tobacco, sugarcane and cotton (Maclean, CD., 1987, pp. 1-20).

3. According to Small, L.E., MS. Adriano, E.D.Martin, R.Bhatia, Y.K. Shim, and P.Pradhan, have been set objectives include stabilisation of production, food self-sufficiency, famine protection and land settlement (International Irrigation Management Institute, 1989, P.I).

4. In the Andhra Pradesh Water Tax Act, 11 of 1988, me government have rationalized the levy and collection of water rates in the state by introducing uniform water rates on all lands by treating all lands whether classified as wet or dry in me Revenue records, as dry. In levying uniform water rates all major and medium irrigation projects are classified in the Act under category - I and other Government Irrigation Sources which supply water for a period of 5 months and

above are classified under category - II and to collect the water rates from 1.7.1986 (Government of Andhra Pradesh, Order No. 11, Revenue Department, dt24.08.1989).

5. Act N0.8 of 1865. A bill to enable the Government to levy a separate cess for the use of water supplied for irrigation purposes in certain cases. Whereas in several districts of the Madras Presidency, large expenditure out of Government funds has been and is still being made in the construction and improvement of works of Irrigation and Drainage, to the great advantage of the country and of proprietors and tenants of land, and whereas it is right and proper that a fit return should, in all cases alike, be made to Government on account of the increased profits derived from lands irrigated by such works. It was enacted as follows :

"Whenever water is supplied or used for purposes of irrigation from any river, stream, channel, tank, or belonging to, or constructed by Government, it shall be lawful for the Government to levy, at pleasure, on the land so irrigated, a separate cess for the use of the water, which cess shall be additional to any land assessment that may be leviable on the said land as unirrigated or punjah and the government may prescribe the rules under which, and the rates at which such water cess as aforesaid shall be levied, and alter or amend the same from time to time" (Government of Madras, 1865, Order No.986, pp.361-64).

CHAPTER-II

ECONOMICS OF WATER RATES: SOME CONCEPTS

2.1.0 Introduction:

Efficient management of water resources requires the recognition of the fact that the water resources are linked to the national economy. Equally important is the understanding of how alternative economic policy instruments influence water use across different economic sectors as well as between local, regional and national levels and among households, farms and firms. Macro-economic and sectoral policies that are not aimed specifically at the water use may have significant impact on resource allocation and aggregate demand in the economy which in turn affects the water use. A country's overall development strategy, use of its macro-economic and trade and fiscal policies, government expenditure on irrigation, flood control and building of dams affect the demand and investment in water- related activities directly and indirectly (F.A.O, 1995, P.256). Therefore, the important economic attributes of water in use need to be analysed. Further, the type of management of water resource projects may determine the nature and extent of charges for project outputs.

There is a limitation in reconciling water as purely economic good with the traditional idea of water as a basic necessity for humanity. Like fresh air, water was once considered a free asset, but now it is becoming scarce. Scarcity is one of the most important issues in considering the various socio-economic trade-offs in allocating water for different uses. Developing effective water use policies is difficult for a number of reasons. They include the physical and administrative issues as well Water has got unique physical properties, complex economic characteristics and important cultural features mat distinguish it from other natural resources. Management of water resources is administratively complicated because it involves legal, environmental, technical, economic, and political considerations. The interdependence of the economy and the environment in respect of water necessitates the formulation of long-term perspectives. To cany through such a task, the concept of sustainability is of the most vital significance. "Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs"(W.C.E.D,1987,p.43). The sustainability principle states that water resource management for a sustainable society should seek protection of the hydrocycle; purification of water from domestic, agricultural and industrial effluents; conservation of species and natural habitats in all their fresh and coastal water environments; husbandry of fresh water sufficient to meet the biological ,cultural and economic needs of the human population; and finally, the need for proper drainage of storm water alongside the protection of rural and urban communities against floods.

In most societies, immediate economic and political considerations dominate decisions on water resource use. The most visible aspects are the policies of government which set for the bureaucracy the objectives of irrigation management For example, how much effort should the system managers devote to regulating water use in head-end areas in order to have sufficient water to give to downstream areas? Assessments win be affected, for example, whether government leaders are (a) stressing food self-sufficiency as a production goal, (b) minimising expenditures to reduce a budget deficit, or (c) enhancing opportunities for the disadvantaged to create a more equitable society. The implementation of cost-recovery programme would be quite different under each of these three policy conditions (Uphoff.N, et al, 1991, pp.98-99). So, the consumption of water is a fundamental condition for human existence. Water utilities' financial costs in supplying water services can be met either from a fixed charge or from water pricing.

II

Economic Attributes of Water in use

2.2.1 Introduction:

The economy focuses on the substance of the fundamental processes involved in providing necessary goods and services for mankind. For hydro-economics, a key concept here is the hydro-social cycle. This comprises water abstraction, its storage, freshwater treatment, its distribution to users, their consumption of the product the collection of waste water treatment, and its disposal into the oceans or, through recycling, into surface and groundwater sources.

Economic benefits provided by water may be conveniently put under four heads. Benefits are from commodities, waste assimilation, aesthetic and recreational, fish and wild life habitats (F.A.O, 1995, P. 259). Individuals derive commodity benefits from water by using it for drinking, cooking and sanitation. Farms, business and industries obtain commodity benefits by using water in their production activities. These commodity benefits represent private good uses of water which are rivals in consumption. One person's or industry's water use precludes or prevents its use by others. Government policies and regulations that concentrate on improving market access and competition are important means for improving me productive and allocative efficiency of the commodity uses of water.

The second and increasingly important economic benefit of water in waste disposal. Water bodies have a significant but ultimately limited assimilative capacity to process, dilute and carry away wastes. The surface water flows into large channels, poods, lakes and rivers while some of it carries waste disposal into the sea. Thirdly, recreation, aesthetic benefits and fish and wildlife habitats were once regarded as luxury goods outside the concern of governments[1]. Waste assimilation, recreational and aesthetic values are closer to being public goods than private goods (F.A.O, 1995, P. 259). Pubic goods are non-rivals in consumption, - one person's use does not preclude use by others[2]. The quality of water from different sources varies widely. Precipitation absorbs gases from the atmosphere and removes particles from the air. When the precipitation strikes the ground it becomes surface water run-off or enters the ground.

However, along with these benefits, many pressing irrigation issues reflect me various economic, social and political influences affecting economic conditions. At times, irrigation related problems are the result of a distorted macro-economy, which, despite providing operating subsidies, render farming unprofitable and result in repeated underinvestments on farms over long periods. Total public expenditures for irrigation for many countries in Asia declined significantly during the 1980's. Annual expenditures in China and Sri Lanka were cut nearly by one- half between the late 1970's and me late 1980's. In the Philippines the annual expenditures on irrigation in the late 1980's were only one-third the level of the early 1980's. Declines in the late 1980's from peak expenditure levels in Bangladesh, India, Indonesia and Thailand range from 15% to 40%. The main reasons for declining investment are the decline in world prices and the increasing real costs per hectare of new irrigation development (Mark W. Roscgrant and Mark. Swendsen, 1993, pp.20-21).

The overall performance of many irrigation projects is disappointing. The cost and time overruns, poor management, the non-realization of full cost recovery and planned benefits, adverse environmental and health impacts, and the exacerbation of inequalities in the existing social and economic distribution of assets among farmers are some of the issues.

2.2.2 Economic Organization and Water Allocation :

Most countries rely on a mix of market policies and direct government interventions to manage water resources. Each system has its own advantages and disadvantages. The term market system is used by economists in two senses. It may refer, in one sense, to an actual functioning system, meaning the set of institutional and cultural arrangements mat serves to allocate resources through the price mechanism (Young R.A, 1986, P. 152). In another sense, it refers to an intellectual idealisation, which has been studied to determine how apparently unrelated sets of activities achieve economic order, such that goods and services are provided to consumers at the place, time, and form desired, and capital, labour, and natural resources are organized through the productive system to provide these requirements. Real costs of water are pre-eminently the domain of the engineer, the chemist and the hydrologist, through land sites, infrastructure such as reservoirs and works', roads, treatment plant, the distribution and collection networks, electric power, materials and the human labour required to design, build, operate and manage the whole system(Stephen, M,1997, p.30). So, on the basis of market prices,the economist represents these real costs in money terms.

Any market system has to provide answers to some basic questions. What goods and services are to be produced ? What technologies arc to be used in producing them ? And who is benefiting from the use of the products ? (Hey, J.D, (eds), 1993, P.264.). The answers for these questions, are based on the premise mat the personal wants of individuals should decide the employment of resources in production, distribution, and exchange and the individuals themselves are the best judges of their own wants.

A competitive market system has many producers and consumers who are well informed, motivated by individual self-interest, and individually owned and controlled resources can be shown to have certain desirable properties. One such desirable attribute is that the system would produce the maximum valued bundles of goods and services to consumers, given the endowments of resources such as the available technology level, me tastes and preferences of consumers depending on their income(Young, R.A., 1986,p.l53). Individual producers and consumers, acting within their own self-interest will, in accordance with Adam Smith's invisible hand, arrive at an allocation of resources which cannot be further improved upon. Producers, encouraged by prospective profit, buy inputs as cheaply as possible, combine them in the most efficient form, and produce those things which have the highest value relative to cost (Smith, Adam., 1925, pp.419-421). Consumer's tastes and preferences influence their expenditure patterns, thereby encouraging firms to produce the commodities most desired, and producers allocate resources in the direction of the large profits. The firms most successful in the process of producing desired goods most efficiently are rewarded by profit, and the unsuccessful are eliminated, so that production occurs at the feast cost

The second desirable property of the competitive market system is its ability to accommodate changes in the conditions of production and patterns of consumption. New knowledge and technologies are rapidly reflected in the prices which producers are willing to accept for their products. On the consumer side, changes in income and preferences soon show up in the expenditure patterns. Hence, a market system yields maximum satisfaction in not only a static, but in a dynamic context (Young, R.A., 1986 P. 153). The actual market system may not always meet the precise preconditions of the competition. The principal problems arise with public or collective goods which are non-rival in consumption, external or spill-over costs and un-compensated side effects, such as environmental degradation, pollution and economics of large size. Mixed capitalistic systems are based on the presumption mat for most goods and services, the allocation resulting from market processes sufficiently approximates the competitive market system. Where mis is not the case, regulatory processes or pubic production are provided to allocate resources. Farmers are generally aware of the benefits of collective goods and services. They would vote for politicians who promise to provide them. But in some situations, the public may be unaware of the real benefits of an investment In this case, a wise government may choose to promote the production of some goods above the level the market would dictate. Such goods are said to be merit goods, and to reflect merit wants(SmaIl and Carruthers.,1991, p.28)[3]. Merit goods are usually reserved tor items such as health care education services where consumers may not fully appreciate the potential benefits. In the irrigation field drainage is an area that may deserve merit good status.

2.2.3 Obstacles to Market Allocation of Water:

Competitive markets in water, desirable from a conceptual point of view, are not yet common anywhere in the world as a means to the full productive use of resources. Several reasons may explain the relative lack of water markets. These may be the physical, economic and conflicting social values (Young, R.A; 1986; P. 154). The physical obstacle arises due to the nature of the source of water and how it is used in production and consumption activities. The economic problem arises from the fact that, until recently, water has been in relatively plentiful supply, and the conflicting obstacle caused is that the material well-being is not the only yardstick used by society to measure success in water allocation, but deciding who win have access to water if there are to be restrictions may be done in a variety of ways. There may be a desire to recoup costs, so priority goes to those who can pay; water may be regarded as 'aid' and be allocated to a particular under privileged group or to those growing a particular crop favoured by authorities. Being selected as a user is no guarantee of being allocated water if supplies are short or interrupted(Barrow,C.,1987,pp.222-228). Physical barriers in water stem from its mobile, and flowing nature, which is seldom fufly 'used' by me consumer, and which has the potential for absorbing and carrying pollutants. Water losses are high. The amount of water which reaches a plot of land is usually less than 70% of that received at the turnout on *farm*. Generally it is a mere 20% or less. The ratio of the amount of water applied to the crop to the amount of water delivered at the turnout, well or other point of supply is turned me farm conduit efficiency. Still more water is lost after conveyance to the cropped plot; evaporation or leaves takes place from the ground surface and water may run away without infiltration. There is, therefore, to a considerable extent wastage and loss of water.

As water changes from solid to liquid and to gas throughout the seasonal and hydrological cycles, it is relatively difficult to identify specific units of water. Hence, water presents unique problems in me establishment and enforcement of property rights, which are the essential foundation of any market allocation system (Young, R.A, 1986, P.154). Most users of water consume only a part of it even within one phase of the hydrological cycle, the remainder being available to subsequent producers or households.

Finally, the potential for water quality degradation is another problem difficult to deal within market exchanges of water rights. The economic reasons for the heretofore limited development of water markets stems from both the varied nature of water use and me relative plentitudc of water, i.e., compared to demands. Water consumption is most often thought of in terms of the consumptive and diversionary uses, such as irrigation, and household and industrial uses. Recreational demands for Sows, hydro-electric power generation and waste land dilution are also increasingly in demand The general paucity of quality coal and mineral oil in India is somewhat compensated for by the vast hydro-electric power resources. In potential water-power, India comes after the Republic of Zaire, the Russia, Canada and the United States. Based on the normal flow of water, India's water-power potential has been estimated at over 40 million kilowatts. Nearly 60% of India's potential water power resources He in the Himalayas. A little over half of these resources fall within the basins of the Brahmaputra, Manipur and Tayo in the north-eastern part of the country. Over a quarter of the potential water-power resources of the Himalayan region belong to the Indus and its tributaries within the Indian Union, the rest being within the Ganga-Brahmaputra Basin. About 20% of the potential water power resources of India tic within the basins of the cast-flowing rivers of South India. The remaining 20% are equally shared by the west flowing rivers in the western Ghats and by those of Central India. Although mere are several sources from which power is generated, hydroelectricity is by far the most significant Unlike coal, mineral oil, natural gas and atomic minerals, running water is the only major source of energy at present which is replenishable (Prakash, B.S., 1988, pp.60-62). A number of these uses represent collective consumption demands, which are partially non- rival in consumption. Such commodities are likely to be under supplied in a market economy (Randall, 1983, PP.131-148). Most societies have therefore chosen non-market administrative mechanisms for allocation of water. The second economic reason for the rudimentary development of water markets lies in the apparently paradoxical assertion that water has not been particularly scarce. Even in exceedingly arid climates, additional supplies from mountain run-off or extensive ground water supplies have often been relatively inexpensive. New uses did not strongly conflict with the interests of the established water-consuming groups.

Water is also a bulky commodity, in the sense that the value per unit weight tends to be relatively low. Therefore, costs of transportation and storage tend to be high compared to be economic value at the point of use. Hence, only in limited cases it is economical to transport water, and the extensive rail, truck, and pipeline network mat the market system has developed to transport high value liquids is absent for water since the market system seeks profit while developing the related infra-structural activities.

The third major force inhibiting the adoption of market institutions for water allocation can be identified as conflicting social values. The sacredness of water as a symbol of ritual purity, exempts it in some degree from the dirty rationality of the market (Bouldmg, K.E., 1980; P. 302). Water is so holy and valuable to use as a symbol that it is apt to carry the production and transportation of it far beyond the point of rational economic returns (Bouldmg, K.E, 1980, P. 309). Some religious teachings may explicitly or implicity prescribe against market allocations of water[4].

Where markets are absent due to any of the above causes, government regulations may be established to provide for regularity of water use and to protect the given use against their present and future competing demands[5]. This type of protection may preclude economically efficient resource allocation, if demands for alternative uses outweigh the economic value of protected uses. The efficiency of such irrigation must he improved, to obtain value for money and to ensure that the development is sustainable and not temporary.

2.2.4 The Rote of Government in Allocation of Water :

The role of government in the development and allocation of different agricultural inputs varies a great deal, from virtually nothing in the case of rural labour to virtually everything in supplying irrigation water from the medium and large surface irrigation projects in India. This diversity raises the obvious question as to the need for a major government involvement in surface irrigation development in market oriented agricultural systems of the developing countries. So this question is related to the socio-economic, engineering, and institutional aspects of irrigation development (Sampath, R.K, 1992, P.968). The characteristics of surface irrigation water necessitate these aspects since it is being a publicly supplied intermediate input The substantive mission of water resource policy of the government is to reduce and eliminate water-driven conflict between the farmers as well as between the regions. So mat it should takes the role of equitable distribution of irrigation water.

For the free market to determine fully the development and allocation of surface irrigation water, there should be a system of pure private property rights[6], that seldom exists in the real world. The existence of such a system is contingent on certain requirements such as certainty, transferability, externality and competition being met The meaning of the terms, is important Certainty refers to the well defined property rights in terms of quantity, quality, location and time of use. Transferability refers to be ease and low-cost transference of water through purchase and sale. Externality assumes that spillover effects on other people's property from water use would be absent or insignificant. And competition assumes the existence of competitive focus at both me demand and supply sides of the market respectively. In most countries, water rights are based on one of the three current systems, riparian rights, public allocation, and prior allocation (Sampath, R.K, 1992, P.968). In the first, riparian rights link ownership of or reasonable use of the water to ownership of the adjacent or overlying land. This system is used primarily in humid areas with no water shortages. The second is based on priorities of use in which the government allocates water. The third is based on the appropriation doctrine, under which the water right is acquired by actual use over time. None of these systems fulfills all the requirements of pure private property rights. In the riparian rights system, with no allocation priorities, there may be constant court battles over water ownership with the poor losing out to the rich, owing to the high costs of litigation. The conflicts may lead to the need for public or government control or ownership of water, which would enable the government to sell the rights through pricing mechanisms or distribute the rights through administrative rules.

The second reason for the involvement of the government in the development and management of surface irrigation projects is me significant economics of scale which can be gained in the storage, conveyance, and distribution of large quantities of irrigation water. Government management may therefore reduce uncertainty resulting from supply which is highly variable in time, space and quality (Young, R.A, 1986, pp. 1143-51). These solutions usually involve benefits that are non-rival in consumption and therefore in a sense exhibit the character of public good.

The third reason is the need to effectively deal with externalities, particularly those affecting the environment which arise from the development and management of water resources. For instance, the most promising institutional arrangements are ones in which those in charge made decisions regarding both environmental services and the resources to be spent on them. At the lowest level, this means letting households choose the services they want and are willing to pay for. At the highest level, it means that the stake holders in a river basin decide what level of environmental quality they want and are willing to pay for (U.N.O, 19%, P. 5). The fourth reason for the involvement of government in the irrigation sector is the attainment of certain social objectives, such as income re-distribution, food self-sufficiency, and sustainable agricultural production. The composition and importance of these objectives could vary a great deal across countries and across projects and regions within a country.

The overall objectives behind government intervention and involvement in the development and management of irrigation in general, and of medium and large-surface irrigation projects in particular, are to achieve economic efficiency in the use of scarce irrigation water resources both at a point of time and over a period of time. And intervention is necessary to attain the specific equity objectives such as redistribution of income and wealth among individuals, social classes and regions and merit wants such as self-sufficiency in food grains production and sustainability (Sampath, R.K., 1992, p.968.) Economics of irrigation has an important place in the process of planned economic development. Development of irrigation is evaluated according to the efficiency and equity objectives. A comprehensive plan of water development becomes essential in view of the fact that water resources, available in any economic system, are generally limited and are insufficient in meeting the long-term water requirements of various kinds. In most of the cases, they are unevenly distributed resulting in seasonal abundance or devastating floods in some areas and chronic drought and famine in the others. The competition for the use of water resources is likely to increase in the coming years. It is essential mat wastage of water resources are minimized, beneficial uses are assured and the efficiency of utilization of available utilizable water resources is improved. The development of modern irrigation system has become costly. The large irrigation projects transcend river basins and envisages the tapping and harnessing of great rivers for an integrated and optimum exploitation of their irrigation potential. This naturally involves large financial outlays. The feasibility of irrigation projects, therefore, remains conditional to the economic soundness. Hence, the necessity of pricing of irrigation water is considered as financially productive and economically sound. Therefore, the necessity arises for an appropriate pricing of irrigation water.

III
Economics of Irrigation Pricing

2.3.0 Introduction:

The fundamental role of prices is to help to distribute the limited goods and services to consumers and to determine the allocation of limited resources among competing uses and users. Pricing of irrigation water influences the efficiency with which the water is supplied and used. It also affects the equity of distribution in terms of income, and cost recovery. A necessary condition for an irrigation pricing mechanism to improve the efficiency of water use is that there should be some influence on farmers' decisions affecting water use, administration rationing the irrigation water to the limner and *to* the society (Sampath, R.K, 1992, P. 969). Another condition for an irrigation pricing mechanism is to establish systems of revenue generation mat are efficient in me sense that the ratio of funds raised to the costs incurred is reasonably high. Efficiency of resource-mobilization is not the only objective, but minimization of administrative and economic distortion should be maintained. Irrigation pricing mechanism raises equity issues that are concerned not only with the magnitude of the distribution of irrigation benefits, but the distribution of income and wealth in general and fairness among individuals.

2.3.1 Efficiency:

For practical purposes, one can discuss the efficiency aspect of pricing irrigation water under four situations, the first two pertaining to the short-run, the third pertaining to the medium run and the fourth pertaining to the long run (Small and Carruthers, 1991, pp. 109 - 118). In the first situation, having limited availability of irrigation water, the objective is to maximize the net benefits to society. The social marginal value of irrigation water across different groups of users would be the same. If not, re-allocation of water can increase net social benefits[7].

In the second situation, the problem is to decide whether to increase the supply from the given physical system. The increased variable cost win increase the supply at the margin, but not available for use elsewhere in the economy. This situation is justified by increasing the supply if the additional social benefits exceed the additional social costs[8]. ID fact, it will be appropriate to increase the supply up to the point at which marginal social benefit equals marginal social cost

In the third situation pertaining to the medium term, it is the question of expanding the supply system by allocating capital resources to bring in new irrigation projects. Such additional investments are warranted if the social returns exceed the social costs of those investments at the margin to expand the given resources for further development.

And in the fourth situation pertaining to the long-run, it is the problem of deciding the optimum level of investments in the irrigation sector vis-a-vis investments complementary to or substitutes for the use of water such as water conservation projects. When water is very scarce, or if marginal cost is very high, water losses are reduced by carefully preparing the land and maintaining the field channels[9].

In all of the above situations, water pricing can play a critical role in determining me levels of demand and supply and the amount of resources invested. Market systems clearly show that if perfectly competitive conditions are satisfied and externalities are absent, the market prices win reflect social values. And if the long-run marginal cost pricing is followed in the pricing of irrigation water, then the corresponding levels of investment in irrigation projects and the resulting social benefits will an be optimal. Marginal cost pricing would not be optimal if there are externalities or increasing returns to scale in the irrigation sector, or there is monopoly in a sector with which irrigation is closely linked, or other imperfections and distortions are present in the market The pricing structure mat can be adopted depends on the nature of the delivery system since the method by which water is delivered will affect the certainly, adequacy, timeliness and quality of water, and consequently the feasibility of different pricing systems. The four common methods of delivery are continuous flow, rotation, demand and closed pipe systems. Volumetric pricing is feasible under the demand and cloned pipe systems. These methods are applied in Indonesia, Japan, Malaysia, Nepal, Korea, Sri Lanka and Singapore. It is extremely difficult under a rotation system and almost impossible under me continuous flow system(Zafarul Hasan, 1996,pp. 49-50). In general, demand and closed-pipe sprinkler systems are expensive and their usefulness in irrigating paddy crops is yet not fully utilized The rotation and flow systems are maintained efficiently *to* some extent through command area development mechanisms especially in India, Bangladesh, Pakistan and China.

Although efficiency is an useful concept, its focus is on producing a package of goods in an optimal fashion, ignoring the question of how the goods or the income associated with their production are distributed. This bongs us to the second broad criterion of the economics of equity.

2.3.2 Equity:

It is worth noting here that there are different concepts of equity used in the literature. First mere is the equity in income distribution in terms of inter-regional, inter-personal and inter-class categories, and then equity in the sense of equitable system of charges with regard to the services received and costs imposed on consumers and producers (Small and Carruthers 1990, pp. 119-134). There are issues relating to using different criteria such as the ability to pay principle in terms of wealth or income basis, the benefit principle in terms of the value of water to the consumer, the supply cost principle in terms of the economic costs that their demands impose on the system and thus on the society. And finally, the historic cost principle based on cost as they were incurred rather man as they are incurring . Which of these concepts is used in any particular context win have implications for efficiency in the use of irrigation water at a point of time as well as over a period of time. In addition, there is no unique way of choosing from among these concepts since objectives vary across regions, crops and users and over time. So in any country, more than one concept may be used simultaneously in different projects and regions for valid reasons. The conventional notion is that the equity objective always conflicts with the efficiency objective owing to the political power of the various interests. But mere are conditions under which the promotion of efficiency will in fact improve equity. Sometimes policies introduced to promote equity resulted in not only decreased efficiency but also, worsening of the degree of equity (Sampath, R.K., 1992, P.970). The situation where it has found the overall per hectare productivity of land is inversely related to the size of operational holdings because of the more intensive are of land, labour and other inputs per unit of land by small holders.

The empirical information shows that irrigation development and distribution based on the proportional equality principle not only decreased efficiency but also resulted in worsening the inequity problem. In situations where small-holders do have higher productivity per unit of land, allocation of water based on efficiency criteria would help small forms to gain a greater share of water than allocation based on the proportional equity principle through water user associations. Thus, under certain conditions, mere may not be any conflict between efficiency and certain kind of equity objectives. Under these conditions, setting price levels may play a key role to achieve these objectives. Water pricing methods vary considerably across developing countries and within a country they vary from one project to another and from one region to another. For example in India, the system of irrigation water rates in various states of the country is as diverse as the culture and the people. Rates have been fixed considering a number of factors, sometimes without any rational or objective consideration, and are seldom revised. This has led to considerable divergence, inter-state and even intra-state. Major factors leading to variation of water rates are geographical unit, system of irrigation and crop and season (Zafarul Hasan, 1996, p.49). Mostly, these pricing methods are based on financial rather man economic considerations. This leads to the setting of price levels that will accomplish the most efficient use of scarce irrigation water.

2.3.4 The Level of Irrigation charges :

Prices are charged for two reasons. One is financial Enough money must be raised to pay the costs incurred in providing the goods or services. The other is economic. The quantity of goods people buy depends on me price. If the price exceeds the marginal cost, full economic utilisation will be prevented. If the price is less man the marginal cost, an apparent demand will suggest an expansion which can not be justified on economic grounds. Only if price equals marginal cost will market forces encourage the economic level of production.

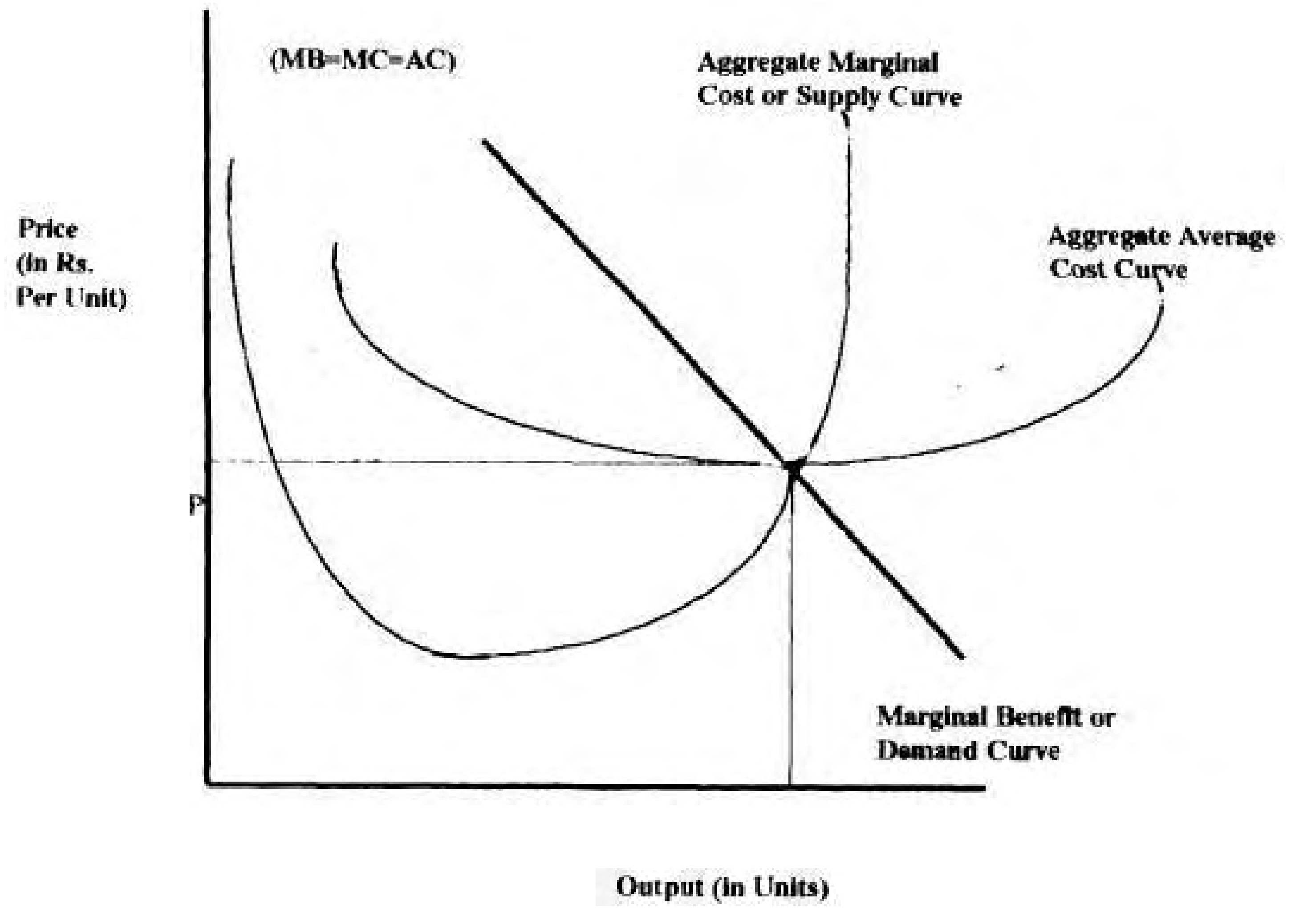
In a broader sense, pricing also has a social function related to the multidimensional nature of social welfare. In addition to affecting economic efficiency, price levels influence income distribution, economic stability, the foreign trade balance, and other social goals(Marglin, S.A,1966,pp.88-92). Prices can be reduced to effect income redistribution, encourage more rapid utilization of project output during the buildup period, encourage substitution of project output for imports to improve the trade balance, and encourage reinvestment by project beneficiaries.

The financial and economic functions of charges are satisfied simultaneously under pure competition[10]. The market reaches an equilibrium point where the long-rum marginal cost equals the marginal benefit (see figure 2.1) to fix the price P and the output Q. Because of this intersection marginal cost equals average cost, the product of P and Q equals the total cost and the financial requirement is satisfied. Because the marginal cost equals the price, the economic requirement is also satisfied.

Where the economies of large-scale production are large, or total demand is small, the optimum scale[11] of plant may be almost as large as the total market demand (see figure 2.2). The optimum Q is still determined by the point where marginal costs equals marginal benefits. The price satisfying the economic requirement is P_1. However, only the average cost P_2 of producing Q need be charged to satisfy the financial requirement Marginal cost pricing win produce a profit equal to $(P_1 - P_2)$ Q, which if large enough, may justify additional production unite. If the demand is smaller man the optimum production - unit size, then the marginal-coat curve exceeds the average cost (see figure 2.3). The price P_1 will satisfy' the economic requirement However, the price would have to be P_2, or the average cost, for the financial requirement to be satisfied.

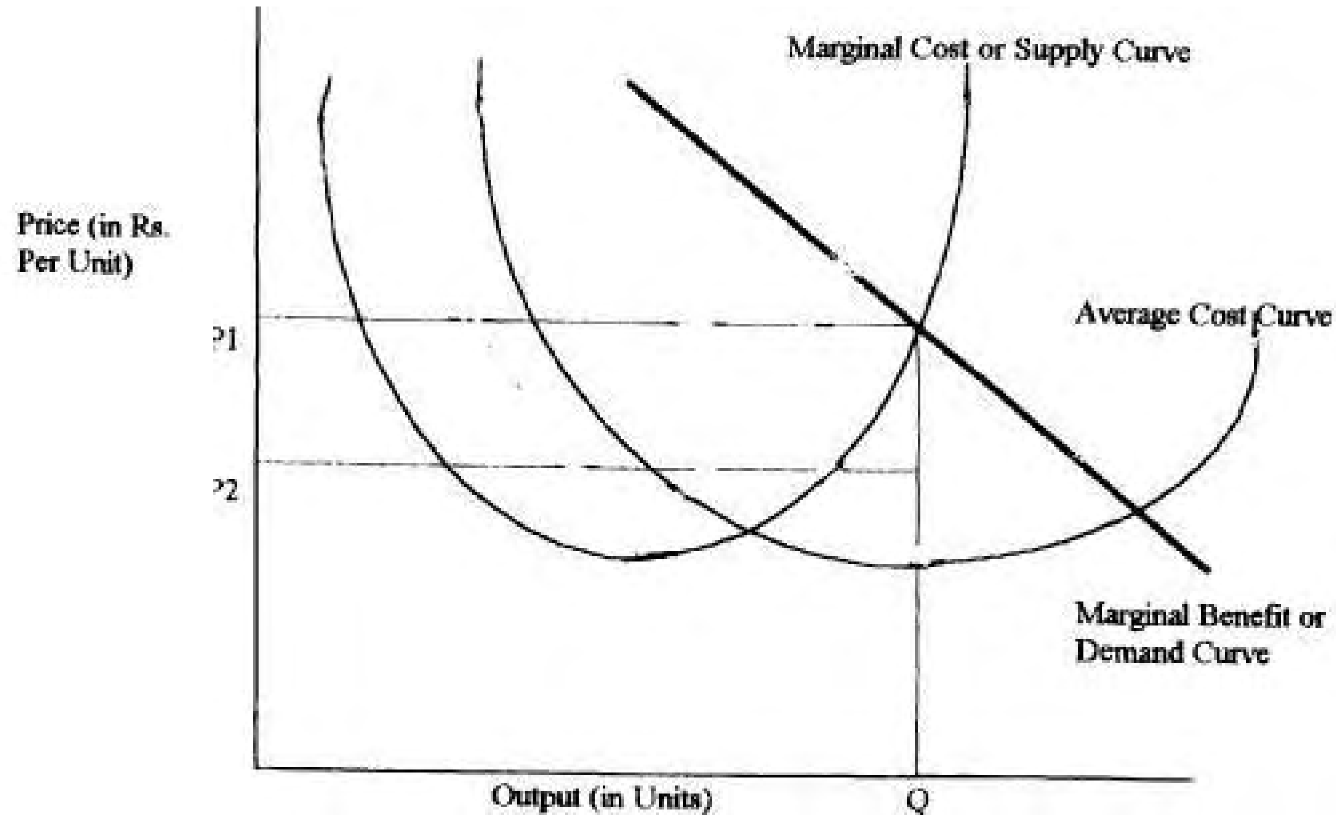
Under conditions of increasing average cost (at the market - determined level of production), a charge fixed by the economic requirement more than satisfies the financial requirement Under conditions of decreasing average cost, mere is a dilemma (Hirshleifer, 1960, pp.88-93). Marginal cost pacing P_1 does not raise enough revenue and average - cost pricing P_2 restricts economic use. Some compromise between the conflicting requirements is required.

FIGURE – 2.1



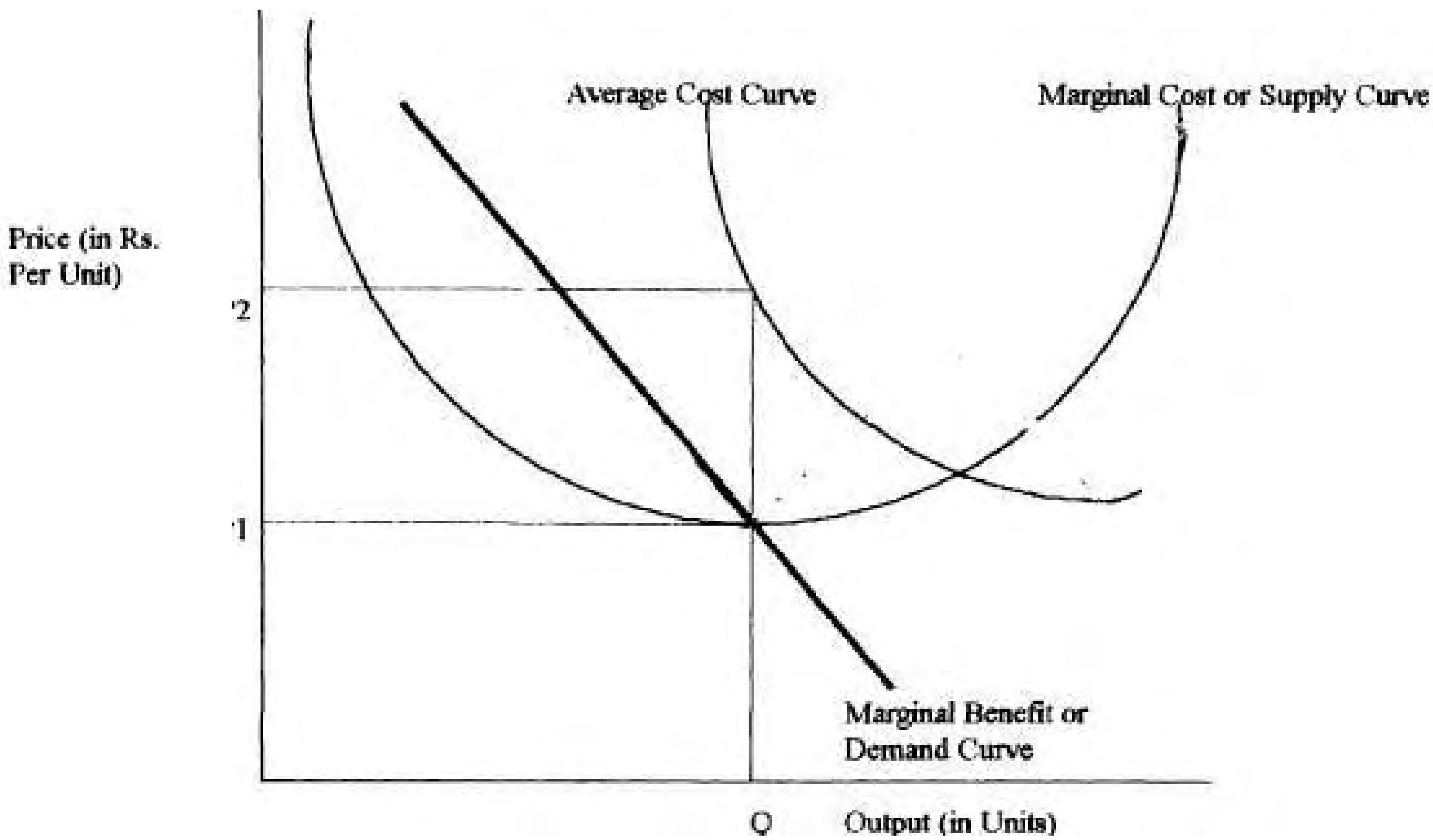
Source: Eckstein, Otto, 1958, p. 542

FIGURE – 2.2



Source: Based on Eckstein, Otto, 1958, p. 543.

FIGURE – 2.3



Source: Based on Eckstein, Otto, 1958, p. 543.

2.3.5 Reconciling Economic and Financial Requirements:

Three alternative approaches are available for reconciling the economic and financial requirements. One possibility is to employ price discrimination to capture some of the consumer's costs, the total benefit may exceed the total cost P_2Q even though only P_1Q can be recovered by the marginal cost pricing. The goal in the price discrimination is that those benefiting by an amount exceeding P_1 be charged an extra fee in order to satisfy the revenue requirements. The result is a marginal cost fee p his a surplus fee which varies with the value the consumer derives from use of the output. In practice, it is difficult to discriminate among individual users, and the result is price discrimination by user group. A typical price discrimination is to charge industrial users more for water than agricultural users. Although such price discrimination produces economic inefficiency by restricting economic marginal industrial development while permitting full economic agricultural development It is a reasonable compromise between the economic and the financial requirements.

The second approach is to find an outside benefactor willing to subsidise the project by the amount (P_1-P_2) Q. In water resources planning, the benefactor is usually the government While this approach satisfies the revenue requirement, it distorts economic resource allocation by diverting, to the project, tax funds which may have greater value in other uses. It redistributes income from those paying the taxes to those receiving the subsidy.

The third approach used to raise the revenue (P_1-P_2) Q while maintaining marginal cost pricing is to levy a non-marginal charge or tax on those using the output Each user would pay a flat fee independent of the quantity used plus a charge per unit used. The unit charge would be equal to the marginal cost, while the fiat fee would be set to raise the balance of the required revenue. The non-marginal levy may be assessed in various ways. In the case of irrigation water, an equal sum can be charged to each user, a charge could be made proportional to the farm size, or a charge can be made proportional to farm value.

IV
Setting of water charges

2.4.0 Introduction:

Pricing policies are generally motivated by national objectives of achieving economic efficiency and income distribution. If the goal of a pricing policy is economic efficiency, then economic principles must apply. In a strictly economic sense, a water user can afford an irrigation tee as long as that fee is smaller man his or her additional net income (prior to paying the fee) that is attributable to irrigation. If the goal is to redistribute income to particular groups, the the principle of subsidised (socio-political) pricing is used.

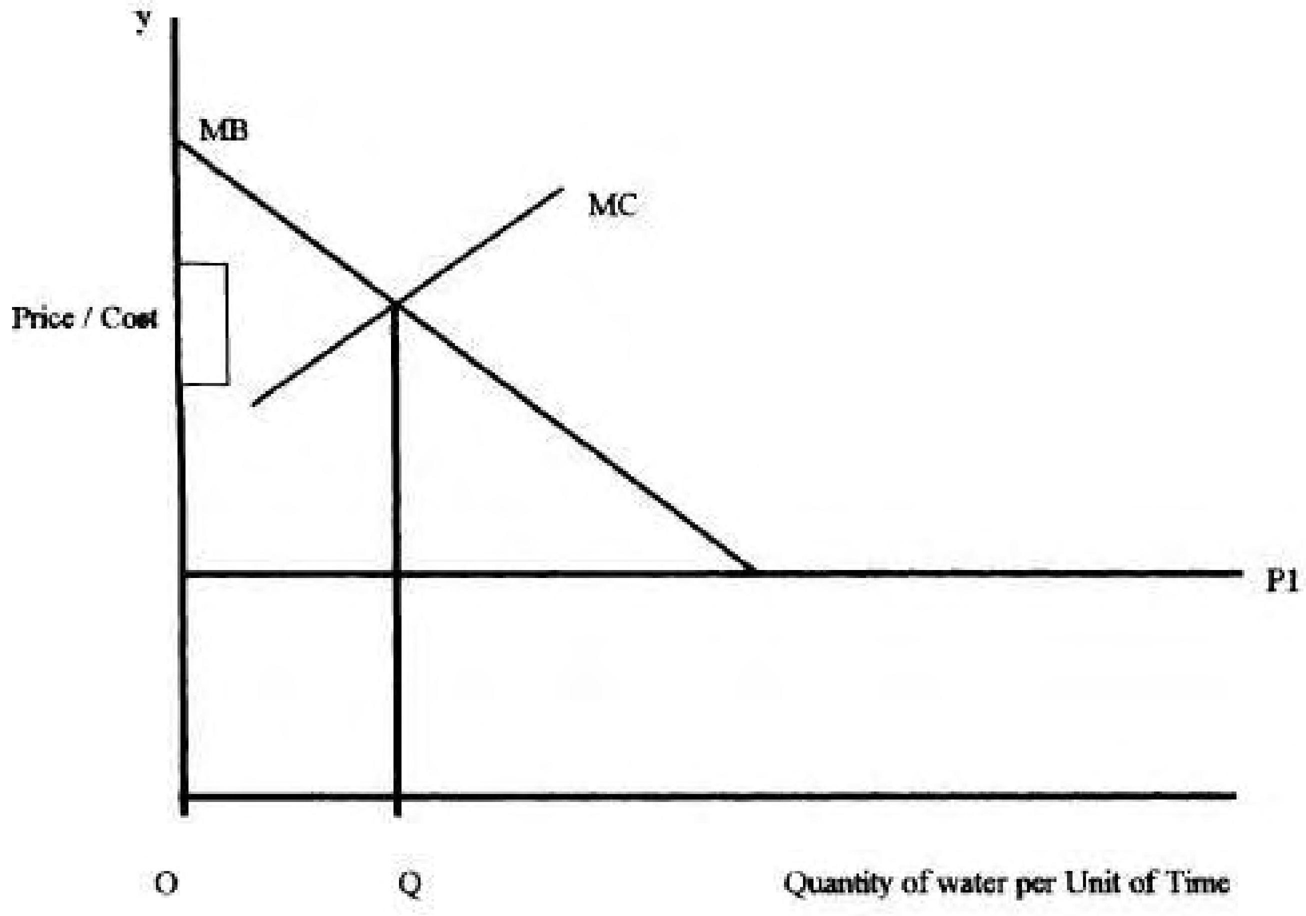
The economic efficiency goal is generally pursued in countries which subscribe to the policy that water should be treated as an economic good(UNO,1996,p.5). These countries include, Indonesia, Japan, Malaysia, Nepal, Papua New Guinea, the Republic of Korea, Sri Lanka and Singapore. Income distribution remains an important goal in countries where water is defined as public property; such as Bangladesh, China, India, Myanmar. Pakistan, Philippines and Thailand.

The rates or prices set have both resource allocation efficiency and equity impacts and influence the level of agency revenues. For a belter appreciation of the problems involved in the fixation of water rates, a discussion of the pricing policies of public enterprises is imperative (see figure 2.4). The curve MB represents marginal benefits or demand for water reflecting marginal willingness to pay. Marginal cost (MC) represents the incremental cost of supply. The Parcto optimal pricing policy, as is known, would use MC as the price schedule.

$$P = Mc$$

The optimal quantity to supply and consume is found by equating marginal cost with marginal benefit (or) marginal value.

FIGURE 2.4



Source: Based on Yourng. R.A., 1986, p. 157

MC = MB

At the point, labeled Q* in above figure, the willingness to pay for the marginal unit exactly equals the opportunity cost (willingness to pay for foregone opportunities). Any consumption greater man the optimal level will involve marginal units whose worth to the user is less than the incremental cost of supply. Conversely, price policies which constrain use below Q* win create a situation in which me value of additional unite exceeds the cost of supplying them. A principal theorem of micro economics shows that, in a properly functioning competitive market, prices will equal marginal cost

Following a marginal cost pricing policy from an economic efficiency point of view, conflicting revenue and income redistribution objectives often dictate alternative solutions (In perfect competition alternative solution is profit maximization, and in imperfect competition it is taxation or regulation). The allocative impacts of two broad alternative classes of rate-setting rules can be analyzed. Consider the tine P1, which represents a volumetric price set below marginal cost line P1 can be set at any level, the only constraint being that it can not exceed the maximum willingness to pay, represented by me vertical intercept of MB. Allocative efficiency losses are incurred to the degree that P1 differs from MC. The box labeled 'A' in above figure, represents a non volumetric rate system which is the most commonly observed method of charging beneficiaries. This approach charges for access to water supply but does not measure or collect for incremental consumption units. Consumption of water by their own intention, fully informed water users under such a system would be predicted to occur at the horizontal demand intercept. Water use would be rationed only if the charges exceeded total willingness to pay, measured as the area under MB. (Young, R.A. 1986, p.157). Most legal systems set in greater or less detail the basis for payment for water. Usually only the general principles are given in the statues and the details are left to regulations or by-laws of the organisation supplying water. Several principles of setting of water charges may be noted.

2.4.1 Cost of service:

Cost of service is the traditional method of pricing of utilities, including water utilities. In each system, price is related to the cost of providing the specific service is the cost of capital, administration and operation and maintenance, costs properly charged to water production. Where as investor-owned utility is the supplier, a return on investment is also included in the price structure. Cost recovery is usually through water tariffs and taxes. Where public agencies raise capital for the construction through, the issuance of bonds, securities and even the source of bond repayment, is likely to be the property tax base of the issuing authority (UNO, 1996, P.8). In such cases, the price of water paid as a tariff by the user may cover only the operation and administration costs. Where large capital investments arc required and a long build-up period for water use occurs, the combination of taxes and tariffs tends to equalise the annual unit water charges.

2.4.2 Ability to pay:

Pricing of water on the basis of ability to pay is a method intended to redistribute the income. Prices are set at less than the cost of supply for a class of user or a specified purpose of use. Revenue shortfall in such situations may be subsidised or provided from other classes of users. This method of pricing water is applied only to users who cannot meet the full cost of service (Small and Carruthers, 1991, P. 162). For many public irrigation projects, an investment is made only after analysis has shown that a proposed project can be expected to provide a satisfactory economic return. For goods and services where market prices do not reflect the social opportunity costs, shadow prices (estimates of their opportunity costs to society) are used in the calculation of the economic return. Where these shadow prices differ sharply from the market prices, it is possible that the water users could not afford to pay for the total cost of irrigation even though investment shows a favourable economic return to the irrigation. Typically, the per-hcctare irrigation benefits received by individual tanners within a single irrigation project win vary considerably both from year to year and for any given year and from place to place within the project It is generally not possible for a public agency to determine what benefits each individual fanner receives, and to adjust the irrigation charges accordingly. Rather, some general fee structure is established and applied to all the water users. Therefore, the ability to pay principle is a method for society's stressing need to redistribute income.

2.4.3 Opportunity cost:

Opportunity cost is a method of pricing sometimes proposed when public investments are made for water development projects. Under this concept, the charges for water are set to recover the "true" cost of the investment, which is the value to society that could be achieved if the same investment were made elsewhere, or benefits realisable from alternative opportunities that must be foregone. This assumes that the benefits can be quantified. By pricing water at rates to recover the opportunity costs, the real value to the consumer is tested in his willingness to pay and the quantity consumed (UNO, 19%, P.8). Although the pricing of private goods may be driven by opportunity costs, this mechanism has not been used for public water development projects. An exception might be where an investor - owned utility is a water supplier and the return on investment in water supply facilities is sufficient to preclude alternative investment especially in the Philippines and Thailand. Rates charged by the investor-owned utility are usually regulated by the government, which generally allows tor a fair rate of return by the utility on its capital investment

2.44 Incremental or marginal cost:

Incremental or marginal pricing sets the rates equal to the cost of producing the last unit of water supply. The lowest cost for a supplier is usually developed with increasing costs for additional developments (Small and Carruthers, 1991, P.90). This method places the burden of increased demand on those mat cause the increase. However, this mechanism is usually not practical as the consumers are not separately identifiable. In practice, the supplier moulds the costs of water from sources into a uniform rate. Exceptions may occur where facility of extension is involved to meet the needs of a particular user. The general use of marginal cost pricing throughout the economy would require large government subsidies in many sectors. This is because the marginal costs is often below average costs a situation that occurs when the average costs of a firm (or of an irrigation agency) decline as the size of the firm increases. This would probably be the case in much of the distributive sector of the economy. Full adherence to marginal cost pricing would thus require a considerable expansion in the scope of activity of the government.

2.4.5 Market-driven pricing:

Market-driven water pricing is based on the argument that a decentralized market system allows actual users to balance the value of their use against the value of potential uses by others. Prices arc allowed to fluctuate, reflecting supply and demand. A full market pricing system requires that water rights laws be restricted such that the right to use the water may be sold or transferred to others at an amount sufficient to provide an incentive to forego their current use.

2.4.6 Cost Benefit Analysis:

A conceptual framework for the evaluation of investment projects in the government sector, although it can be extended to any private sector project It differs from a straightforward financial appraisal in that it considers all gains(benefits) and losses(costs) regardless of to whom they accrue. A benefit is then any gain in utility and a cost is any loss of utility as measured by the opportunity cost of the project in question(Pearce,D,1986, p.23). In practice, many benefits(which may be positive or negative) win not be capable of qualification in money terms. While the costs will be measured in terms of the actual money costs of the project Where money measures are secured, however, they should be corrected for any divergence between the shadow price and the market price if possible. Cost-benefit analysis should also be 'timeless' in that all costs and benefits which occur and which are due to the project in question must be counted regardless of when they occur .

In practice, future costs and benefits may not get counted if the 'discount rate' is relatively high. Cost-benefit practitioners therefore tend to ignore any costs and benefits which occur at far distant dates in me future. The discount rate used should be me Social Discount Rate which need bear no specific relationship to market rates of interest. It does not enable us to recommend outright acceptance of since capital rationing may be present.

2.4.7 The Net-benefit principle:

Sometimes turned the rent principle, the net-benefit principle seeks to employ charges to capture part or all of the economic surplus accruing to the user. It is consistent with me view that water and its fruits are the property of the state. According to this principle, the rate should form some fixed portion of the difference between the additional yield resulting from the irrigation and the additional expenditure other man irrigation charges incurred in the process (National Council tor Applied Economic Research, 1959, pp.71-2). In other words, irrigation rates should be based on the additional net benefits available to the cultivators from the use of the water supplied. The logic behind this criterion is that since the demand for water depends on the willingness of the cultivators to make use of it, amount of net profits of the newly added farm products available to the cultivator can only be charged in me form of water rates.

2.4.8 Policy of free of services by the Government:

Provision of the Government services free of any charge can be justified in case of the basic and essential services. However, education, sewerage and garbage disposal etc., come under this category. But services like irrigation, if water is supplied free of cost, there is every chance of mis-utilisation by the cultivators. Therefore, the advocates of this principle call it promotional policy and they recommended a concessional water to promote agriculture through irrigation. The arguments run at length. **Firstly,** the direct beneficiaries of irrigation are the poverty stricken terming millions of peasants with legendary low capacity to pay taxes and as such, they should be made to pay at lower rate or no water rate at all Secondly, irrigation creates externalities in the economy besides benefiting the irrigators directly. It is no profitable saying that irrigation by facilitating the adoption of both intensive cultivation and improved agricultural technology has helped agricultural productivity to increase (Ansari, N. 1968, pp.40 - 73). Therefore, this principle contend that the entire economy should make some contribution towards the cost of irrigation by subsiding it from general revenue and as such, irrigators should be charged only concessional water rates. Under this approach, however, there is no specific basis for the fixation of water rates, such as the cost of supplying the water or the quantity of water supplied. This system enables the irrigation to take as much water as possible. The result may be over- irrigation and misuse of water.

Economists normally address the question of right price for water mainly from the efficiency point of view and conclude that as long as excess capacity exists, the price of irrigation water should equal the marginal cost of providing it, but whenever a capacity constraint exists the price should be allowed to rise above the marginal cost to the point where quantity demanded just equals the available supply (Small and Carruthers, 1991, pp.90-95). This is nothing but marginal cost pricing, i.e., setting the price of a product equal to incremental cost associated with incremental production. Economic theory clearly states that in a situation (irrigation project) where marginal cost is continuously falling with the size of the unit it will remain below the average cost throughout and any price fixed on the basis of marginal cost under such condition will not cover the full average cost and win thus necessitate subsidization.

Financing the subsidies by the state may bring about inefficiency in the economy which it is argued, may not be overcome by meeting the subsidies through income tax owing to the likely distortion in the allocation of time by the tax payers. Under the circumstance, average cost pricing with no subsidy appear to be a better alternative to me marginal cost pricing. It is however, argued mat a marginal cost pricing incorporating two part tariff, one based on marginal cost and the other a lump-sum charge levied, would also eliminate the need for subsidy. In any case, marginal cost pricing may not increase the economic efficiency of allocation of irrigation water if other prices in the public / private sector of the economy are not set at the marginal cost of production. Because there are indirect beneficiaries such as the consumers who benefit as much or even more man the direct beneficiaries of irrigation. Marginal cost pricing has other practical problems too, apart from the theoretical considerations. Firstly, it will change with the nature of irrigation decision the with which the irrigation agencies are concerned. Secondly, marginal cost of irrigation generally varies over both space and time which will result into different prices being charged at different areas and at different times. For instance, seasonal differences in me availability of water may create differences in marginal costs, the marginal cost to society to delivering one unit of water to the farmers at the tail end may be higher than the same to me farmers nearer me source of water supply. Price based on marginal cost, under these circumstances, would necessitate charging varying prices within a single irrigation system and also over lime. This would violate the requirement of equaling marginal benefits to all users, and since other things are not equal, such spatial and temporal price differentials would lead to economic inefficiency (Small and Carrumers, 1991, pp.39-56). Thirdly, marginal cost pricing will require volumetric measure of water delivered to the farmers. This practice is no where in the country, due to the extra cost escalation problems.

V
Conclusion

The consumption of water is a fundamental condition for human existence. Financial costs in supplying water services can be met either from a fixed charge or from water pricing. The development of modern irrigation system has become costly. The large irrigation projects transcending the river basins envisages the tapping and harnessing of great rivers for an integrated and optimum exploitation of their irrigation potential. This naturally involves large financial outlays. The feasibility of irrigation projects is conditional to their economic soundness. Hence, the necessity of pricing of irrigation water is considered as financially productive and economically sound. Therefore, the necessity arises for an appropriate pricing of irrigation water.

Irrigation pricing mechanism rises the concepts of efficiency and equity so as to achieve their distribution of irrigation benefits, cost recovery, income and wealth in general to all. The level of prices are charged on the basis of both financial as well as economic considerations. Because marginal cost equals to the average cost, the product of price and quantity equals the total cost There are contrary pulls developed with regards to rate fixation. One emphasised the need to raise rates to recoup all the costs and the other pleaded for keeping down the level of rates to facilitate the full utilisation of newly created capacity. Water rates on the basis of value of gross product may be suitable for Indian projects because the marginal cost pricing, the average cost pricing and the net benefit principles are turning into problematic not suitable due mainly to the un-utilized potential capacity of irrigation projects and irregular supply of water that are still common in India.

NOTES:

1. In developing countries, more and more people are focusing their recreational activities around lakes, rivers and seas. In India, as incomes and leisure-time grow, water-based recreation is becoming increasingly popular and an adequate supply of good-quality water helps provide a basis for attracting tourist trade (F.A.O., 1995,pp.247-255).

2. For example, the enjoyment of an attractive water body does not deny similar enjoyment of resources to exclude other and unentitled consumers from using the good. Exclusion costs are frequently very high for water services such as flood control projects and navigation systems. Goods and services mat are non-rivals in consumption are normally better suited to public sector interventions, including ownership, provision and regulation (Food and Agricultural Organisation, 1995, p.259).

3. Farmers may not fully understand that the short or long-term yield is depressed by the impact of waterlogging and salinity in the absence of costly drainage facilities. Another example arises in the provision of public health protection on irrigation schemes, where the risks of water-related diseases such as schistosomiasis and malaria are not fully understood by beneficiaries. For this reason government may be satisfied in providing a level of medical protection above that which farmers would "purchase" for themselves (Small and Carruthers, 1991, P.28).

4. In India, the Hindus treat water as holy and take holy baths during the *pushkaras* of the twelve respective holy rivers with the belief to attain *moksha* by doing so.

5. Individual irrigation farmers generally recognise mat the collective interest is served by strong management mat enforces rules. Furthermore, they understand mat if all the users follow these rules, their aggregate individual benefits are maximised (E. Small and Carruthers, 1991, p.205).

6. In every country in the world, rights exist to abstract water from ground or surface sources and such rights are defined in law or by customary practices. Where land is privately owned, the rights are usually enjoyed by the landowner, often circumscribed by government licensing. Abstraction rights can be an important attribute of land reflected in its market price or its rental value(Stephen,M,1997, p.30).

7. Special benefit means the sum of the gains or benefits deriving from an activity or project to whomsoever they accrue. These are the relevant benefits for inclusion in cost-benefit analysis but should not include transfer payment (Pearce W.David, (ed.,) 1986, p.391).

8. The social cost of a given output is the sum of money which is just adequate when paid as compensation to restore to their original utility levels all who lose as a result of the production of the output The social cost is the opportunity cost to society rather than just to one firm or individual (Pearce, W.David, (ed.,) 1986, P.391).

9. For example, irrigation projects in parts of India and Pakistan operating under the *Warabandi* system of water distribution were designed to spread a limited supply of water which is meant for water losses are reduced (Small and Carruthers, 1991, P.81).

10. A market structure is perfectly competitive if the following conditions hold; mere is a large number of firms each with an insubstantial share of the market. These firms produce a homogeneous product using "identical share of the market These firms produce a homogeneous product using "identical production processes and posses perfect information. It is also me case that there is free entry to the industry, mat is, new firms can and win enter the industry if they observe that greater than Normal profits are being earned. The effect of this free entry is to push the demand curve facing each firm downwards until each firm earns only normal profits, at which point there is no further incentive for new entrants to come into me industry (Pearce, W.David, (ed.,), 1986, p.323).

11. The "best" situation or state of affairs, for example, the choices made by consumers are analysed in terms of attempts to obtain the optimal pattern of consumption (Pearce, W.David, (ed.,) 1986, p.311).

CHAPTER - III

WATER RESOURCES OF INDIA

3.1.0 Introduction:

Economic development of each region within a country is necessary to achieve satisfactory levels of living and to maintain national unity in vast countries like India. Development and management of water and the related land resources on a satisfactory level are essential for the achievement of the required rate of economic growth and development. Owing to the growth of population and economic activity, the demand for water has increased while the quality of water has often deteriorated. Good quality water has become a scarce resource in most countries across the globe.

I
World Water Resources

3.1.1 Introduction:

The globe consists of about one-third land and the rest, i.e, two-thirds water. The rich potential of the world which lies in the vast water resources is not fully exploited. Only small, though stray attempts are being made by technologically and economically developed countries for increased agricultural production (Shiklomanov, LA.1993, P.13). As such, land to be cultivated and irrigated remains only within the one-third area of the globe. The water resources in tins one-third land area consists of surface and ground water. About 97% of the world's water resources are in the oceans and are saline. Only 2.5% of the world's water is fresh and that a mere fraction is available to man. Fresh water for human use, found in lakes, swamps, and rivers, makes up only

0.008% of the Earth's water (Shiklomanov, LA. 1993, P.13). The water cycle renews the flow of rivers, ground-water, and glaciers; and the actual run-off from these sources might exceed 47,000 cubic kilometers per year. This shows me scarcity of the usable fresh water available on earth.

While the oceans of the world contain a seemingly unlimited supply of water, fresh water for human use is a finite and fragile resource. The demand for fresh water continues to grow with the human population. The diversion of fresh water to supply agricultural, industrial, domestic and municipal needs stretches the hydrological systems, bom natural and man-made to the limit The amount of water stored in the global hydrosphere is three orders of magnitude larger than the annual precipitation. Total fresh water and saline water (including water vapour) in the hydrosphere is estimated at 1,454 million km^3 . If the total 84.4 million km^3 of fresh water , approximately 60 million km^3 is ground water . 24 million km^3 is in sheets, 280,000 km^3 is in lakes and reservoirs, 85,000 km^3 is in soil moisture, only 1,200 km^3 is in rivers, and only 14,000 km^3 is in the atmosphere at any time. This means mat the entire amount of stored atmospheric moisture is recycled every ten days, and the storage in river is changed every eleven days(Repetto,1986,pp.255-298). Within a nation, these needs compete for a supply of fresh-water that may already be scarce and may vary drastically both seasonally and geographically (Shiklomanov, 1993; P.13). To modify such seasonal and geographical variations, thousands of large dams (36,000 or more over 15 meters in height) are built More than 5,000 cubic kilometers or about 11% of fresh water, are impounded and the total is expected to rise to as much as 7,500 cubic kilometers by the year 2000 if current plans for dam building are carried out

Fresh water is unequally distributed among the countries and people of the world. Although global renewable water resources average to about 7,420 cubic meters per capita per year, many countries have far more limited resources (sec Table 3.1). Asia accounts for over large amount of renewable water resources followed by South America and North and Central America. Asia accounts for over one-half of the world's annual water withdrawals. This reveals the importance of irrigation which consumes large amount of fresh water.

Table-3.1: FRESH WATER RESOURCES OF THE WORLD AND THEIR WTTHDRAWALS-1992

CONTINENT	Annual Internal Renewable Water Resources		Annual Withdrawals			Sectoral Withdraws (%)		
	Total (Cubic KM)	1992 Per Capita ('000 Cubic Meters	Total (Cubic KM)	%of Water Resorce -CCS	Per Capita (Cubic Meters)	Dom estic	Indus try	Agricul ture
AFRICA	4,184	6.14	144	3	245	7	5	88
ASIA	10,485	3.24	1531	15	519	6	8	86
NORTH AND CENTRAL AMERI	6,945	17.31	697	10	1861	9	42	49
SOUTH AMERICA	10,377	34.06	133	1	478	18	23	59
EUROPE	2,321	4.53	359	15	713	13	54	33
U.S.S.R (FORMER)	4,413.11	15.51	357.60	8	1280	7	27	65
OCEANIA	2,011	73.05	23.00	1	905	64	2	34
WORLD TOTAL	40,673	7.42	3240.00	8	644	8	23	69

Source : Water Resource Institute, 1995; pp.345-47

3.1 .2 World Water Scarcity

Most countries facing chronic water scarcity problems are in the North Africa, the near East and sub-Sahara Africa. Countries with less man 2000m^3 per-capita face a serious water scarcity situation, with major problems occurring in the drought years. In many countries, where scarcity is not a problem at the national level, serious water shortages are causing difficulties in specific regions and water-sheds. They include, northern China, western and southern India and parts of Mexico. Under-utilisation of irrigation potential leads to unequal distribution of water across canal commands. With plenty' of water resources available at national and regional level in a particular country, inter-state disputes of water arise for untapped and potential utilisation of irrigation water. Inter-state dispute over the river waters of South India are the best examples.

Men regulate surface and groundwater uses for different purposes. Human actions may bring about water scarcity in three ways: through population growth, misuse, and inequitable access (F.A.O., 1995, P.236). Population growth contributes to the scarcity simply because the available water supply must be divided among ever increasing number of people. Every country has a more or less fixed amount of internal water resources, defined as the average annual flow of rivers and aquifers generated from precipitation- Over time, this fixed internal renewable supply has to be divided among more and more people, eventually resulting in water scarcity. Thus, the increasing population may induce undue demand on water sources in most of the Asian countries and African Countries.

3.1.3 World water use :

The early civilizations of Asia, Africa and Latin America organized co-operative efforts to develop river valleys for irrigated agriculture. Through irrigated technology, societies controlled and manipulated the natural water supplies to improve crop production. The result was often reliable and ample food supplies which led to the creation of stable agricultural villages, the division of labour and economic surpluses(Shiklomanov, I.A., 1990, pp.41-43). In today's world, agriculture still accounts for the major portion of the water use. (see Table 3.2). Domestic and industrial uses consume the remaining 31%. Water uses differ greatly depending on its access, quantity, quality and socio-economic conditions.

Table- 3.2: Sectoral water withdrawals of the World, and its Income group.

Country Income Group	Annual withdrawals per capita (m3)	withdrawals by sector (percentage)		
		Agriculture	Industry	Domestic
Low-income	386	91	5	4
Middle-income	453	69	18	13
High-income	1167	39	47	14

Source : *World Bank*, 1992. P.83.

Global water consumption has increased almost tenfold between 1950-1980 (see Table 3.3). Share of Agriculture which was 90% in 1900, is likely to be dropped to an estimated 62% by 2000. During this period, industrial consumption may grow from 6% to 25% While consumption by cities may be increased from 2% to nearly 9% by 2000 A.D, around 35% of the available water supplies win be in use compared to less than 5% at the beginning of the century (Shiklomanov, I.A, 1990, p.20). Quantity and quality of water requirements also differ widely depending on the type of use. Therefore, meet agricultural requirements are especially large in relation to other uses.[1]

Table-3.3: GLOBAL WATER CONSUMPTION BY 1900 TO 2000 (CUBIC KILOMETERS)

YEAR	AGRICULTURE (%)	INDUSTRY (%)	DOMESTIC (%)
1900	500	40	60
1950	1200	200	75
1980	2250	700	200
2000	3400	1300	400

Source: Shilklomov, A.I., 1993, p.20

3.1.4 Status of Irrigation :

The continent-wise status of irrigation shows wide ranging fluctuations in the percentage of arable land available and the percentage of irrigated area to the total geographical area. The arable land and the irrigated area of the world form 10.25% and 1.73% respectively (see Table 3.4). Of the arable land in the world, the area covered under irrigation is 16.95% with the highest proportion of 93.2% in the former U.S.S.R and the lowest 4.36% in Australia subject to the wide regional variations within these Continents.

Table- 3.4: Continent-wise Geographical Area, Arable land and Irrigated Area -1989 *(Unit* - Area in '000 lia)

Name of the Continent	No. of Countries	Geographical Area	Arable Area	Irrigated Area	%of 4-3	%of 5-3	%of 5-4
1	2	3	4	5	6	7	8
Africa	55	3030675	168162	1186	55.49	0.37	6.65
S.America	14	2240694	226981	25920	10.13	1.16	11.42
N.America	35	1781870	116102	8835	6.51	0.49	7.61
Europe	31	487657	126014	17240	25.84	3.84	13.68
Australia	24	851045	49618	2161	5.83	0.25	4.36
Asia	43	2757400	420334	146422	15.24	5.31	34.83
USSR	1	2240220	22600	21064	1.01	0.94	93.20
Grand Total	203	13389561	1373311	212828	10.25	1.73	16.95

Source: F.A.O, Vol. 44, 1990, pp.31-32

The demand for fresh water has continued to climb as the world's population and economic activities have expanded fast Increased irrigation and , to a lesser extent industrial uses of water have been the largest sources of this growing demand. At the same time, contamination by pollutants has seriously degraded water quality in many rivers, lakes, and groundwater sources, effectively decreasing the supply of fresh water. The result has been increased pressure on freshwater resources in most regions of the world and a lack of adequate supplies in many localities.

Water is often wasted because it is underpriced. Direct and indirect subsidies(especially for agricultural uses) are still common in both developed and developing countries. Removing such subsidies and letting water prices rise can provide incentives for conservation and for the investments needed to spread more efficient technologies. Thus, reallocating water administratively or through market mechanisms can also reduce distortions and inefficiencies.

II

Water Resources of Asia

3.2.1 Water Resources of Asia and the Peninsular India:

To compare the performance of India with the Asian countries, China stands out as the best example with 48.85% of irrigated area of its arable land and Indonesia in the second place (see Table 3.5) while India has only 26.03% irrigated area of the arable land. The percentages of the arable area to the total geographical area are being 9.67% and 50.29% in China and India respectively. Many of the important water basins of the world are shared by more than one country. Common basins make up *60%* of the total area of Africa and South America. The importance that nations attach to their water resources is reflected in the existence of treaties relating to common basins (Government of India, 1997. pp.33 5-36). The Indo-Bangladesh Joint Rivers Commission was set up in July 1972. Its objective is to initiate measures for mutual benefit in the fields of flood forecasting, flood warning, flood control and river basin development of Ganga, Tista and other major rivers. Under the Indus Water Treaty of 1960, India and Pakistan had created two permanent posts of Commissioner for Indus Waters, one each in India and Pakistan to monitor the flood management. Other treaties are Indo-Bhutan and Indo-Nepal projects for hydro-power development and establishment of hydro-meteorological and flood forecasting network on rivers common in India and Bhutan and Nepal.

Table- 3.5: Geographical Area, Arable Land and Area Irrigated (Unit - Area in '000 ha) in some selected countries, 1980's.

Name of the Country	Geographical Area	Arable Area	Irrigated Area	%of 3-2	%of 4-2	%of 4-3
1	2	3	4	5	6	7
China	*959696*	92825	45349	9.67	4.73	48.85
India	328726	165315	43039	50.29	13.09	26.03
Indonesia	190457	15800	7550	8.30	3.96	47.78
Thailand	51312	19000	4230	37.03	8.24	22.26
Philippines	30000	4550	1620	15.17	5.40	35.60

Source: F.A.O : vol 44, 1990, pp.31-33.

The annual internal renewable water resources of Asia are 13,206.7 km^3, while the annual withdrawals are 1,633.85 km^3. The sectoral withdrawals viz., domestic, industry and agriculture arc 6%, 9%, and 85% respectively (Shikldomanov, 1993, p.20). The peninsular India consists of the Bangladesh, Myanmar, Sri Lanka, Pakistan and India the annual internal renewable water resources are 6035.2 km^3. This was 54.3% of total Asia's total internal water resources. When it comes to the question of annual withdrawals it was very less. In sectoral withdrawals agriculture still dominates over by more than 90% in the peninsular India. Thus, the actual population subject to water shortages might be even larger than these estimates.

Physiography, climate and land resources of India

3.3.0 Introduction

India is a country of great geographical diversity[2]. The variations in its terrain, temperature, rainfall and soils have closely influenced the cropping patterns and agricultural practices.

3.3.1 Physiography:

There are fifteen agro-climate regions in the country (GOI, 1985, P.3). The North-West mountain region stretches over the states of Jammu and Kashmir and Himachal Pradesh and the Kumaun and Garhwal divisions (Uttarkhand) of Uttar Pradesh. Agricultural activities in this region are largely confined to the valleys of Kashmiri, Dun, Chamba, etc., River traces and gentle hill slopes of the 'Kandi' tracts are cultivated. Rice in the valley floors, and maize in the hilly areas dominate the kharif land use. The Suru and Nubra valleys (tributaries of Indus) of Ladakh grow wheat It is harvested in the month of July and August.

The Northeastern region sprawls over the seven stales, also known as the seven sisters of Northeast India, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. It has two natural divisions : one is the valley of Brahmaputra, and the second is the hilly' tracts of the seven states. Rice is the dominant crop in the region.

The Sutlej-Yamuna plain, is extensively irrigated by canals taken out of the Sutlej, Beas and Yamuna rivers. The greater parts of the states of Punjab and Haryana fall in the Sutlej-Ganga plain. Rice, sugarcane, maize, cotton, fodder and pulses are the major kharif (summer) crops while wheat, peas, barley, gram and oilseeds are grown in the rabi (winter) season.

The Upper Ganga Plain, stretches over the greater parts of the Ganga-Yamuna Doab, and Rohilkhand and Lucknow divisions. It is drained by the Ganga river and its tributaries. The region grows rice, sugarcane, maize, pulses and millerts (fodder) in the kharif season and wheat, oilseeds, pulses (grass, lentil), potato and vegetables in the rabi season.

The Middle Ganga Plain stretches over eastern Uttar Pradesh and the greater parts of Bihar, and north of the Chotanagpur plateau. It forms a transitional region between the upper and the lower Ganga plains. The region is ideally suitable for the cultivation of rice, maize, pulses, sugarcane and a wide variety of vegetables. Wheat, gram, and oilseeds are the dominant rabi crops. The Lower Ganga plain covers the lower portion of the West Bengal. Two to three paddy crops in a year is usual practice.

The Southeastern plateau, covers the whole of Chotanagpur plateau, Baghelkhand and Mahanadi basin. In other words, this region extends from Baster (Madhya Pradesh) in the South-West to Durnka and Salribganj (Bihar) in the North-West. Rice is the dominant kharif crop and in the rabi season is devoted to gram and lentil. The Aravalli-Malwa plateau upland stretches over the Western Madhya Pradesh and the Eastern parts of Rajasthan, and east of the Aravalli mountains. Cotton, soybeans, millets, maize and pulses are the dominating crops in the Kharif season, while wheat, oilseeds, gram and lentil are grown in the Rabi season. The Plateau of Maharashtra stretches over the Western Madhya Pradesh, the whole of Maharashtra to the East of the Western Ghats. This region is conducive for the cultivation of cotton, pulses, oilseeds, wheat, grams, and sugarcane. The Deccan Interior sprawls over the greater parts of the Karnataka. Andhra Pradesh and Tarnilnadu uplands from the Adilabad district in the North to Mudurai district in the South. Millets, ragi, rice, cotton, groundnut and pulses are the dominant crops in the region.

The Eastern Coast stretches over the entire tract of the Eastern Ghats. It sprawls from the district of Balasou in the North-East to Kanyakumari in the South. Covered with the alluvial soils deposited by the Mahanadi, Godavari, Krishna, Penna, and Cauveri, it is a humid region. Rice is the leading crop.

The Western coast sprawls over me Western fringes of the states of Maharastra, Goa, Karnataka and Kerala. Rice, coconut, coffee, and tea are important crops. The other regions are the Gujarat, Western Rajasthan, Lakshadwipas, and the

Islands of Andaman and Nicobar. Thus, the agro-climatic regions have been delineated with a set objective to prepare suitable agricultural strategy for each one of them.

3.3.2 Climate

The presence of the great mountain mass formed by the Himalayas and its spurs on the north and the ocean on the south are the two major influences operating on the climate of India with a great diversity and variety of climates, weather conditions. The climate ranges from the continental to the oceanic, from the extremes of heat to the extremes of cold, from the extreme aridity and negligible rainfall to the excessive humidity and torrential rainfall. It is therefore, safe to avoid any generalization as to the prevalence of any particular kind of climate, not only over the country as a whole but over its major areas (Central Water Commission. 1978, p.222). Thus, the climatic conditions influence, to a great extent, the utilization of the water resources of the country.

Rainfall in India is dependent in differing degrees on the South-West and the North-East monsoons, on shallow cyclonic depressions and disturbances and on violent local storms which form in the regions where cold and humid winds from the sea meet hot and dry winds from the land and occasionally reach cyclonic dimensions. Most of the rainfall in India takes place under the influence of the South-West monsoon between June and September, except in Tamilnadu where most of it is under the influence of the North-East monsoon during October and November. The rainfall in India shows great variations, unequal geographical distribution and frequent departures from the normal. It generally exceeds 1000 m.m in areas to the east of Longitude 78°E. It extends to 2,500 m.m along almost the entire West coast and the Western Ghats and over most of Assam and sub-Himalayan West Bengal, In some parts of the Western Ghats and Assam, the rainfall is as heavy as 6000 to 6750 m.m. In the West of the line joining Porbander to Delhi and thence to Ferozepur, the rainfall diminishes rapidly from 500 m.m to less than 150m.m in the extreme West (see Table 3.6). The Peninsular India has a large area of rainfall less man 600 m.m with pockets of even 500 m.m, per year.

Table- 3.6 : Average Annual and Seasonal Rainfall in different Meteorological Sub-divisions of the country (1989-90) (Unit: Millimeters)

SUB-DIVISION	ANNUAL AVERAGE RAINFALL	SEASONAL AVERAGE RAINFALL (JUNE-SEPT)
l.Arunachal Pradesh	2997	2085
2. Assam and Meghalaya	2497	1624
3.Nagaland, Manipur, Mizoram & Tripura	2314	2092
4. Sub-Himalayan, West Bengal &Sikkim	1429	1029
5.Gangetic West Bengal	1429	1079
6.Orissa	1484	1143
7.Bihar Plateu	1371	1125
8.Bihar Plains	1204	1023
9.Uttar Pradesh East	1014	893
10.Uttar Pradesh West	836	726
11. Hills of West Uttar Pradesh	1750	1409
12.Haryana	556	463
13.Punjab	611	467
14.Himachal Pradesh	1518	993
15.Jammu and Kashmir	997	458
16.Rajasthan West	310	275
17.Rajasthan East	700	647
18.Madhya Pradesh West	1043	945
19.Madhya Pradesh East	1398	1227
20. Gujarat Region	967	920
21 . Saurashtra and Kutch	515	479
22.Konkan	2881	2705
23.Madhya Maharashtra	940	788
24.Marathwada	794	660
24.Vidarbha	1102	960
26.Coastal Andhra Pradesh	1008	572
27.Telangana	931	759
28.Rayalaseema	676	367
28.Tamil Nadu	1007	301
30. Coastal Karnataka	3292	2886
31. Interior Karnataka North	685	447
32.1nterior Karnataka South	1271	868
33.Kerala	2978	1998

Source: GOI, Report of Annual Rainfall, India; Meteorolegical Department, New Delhi, 1989-90, p.4.

The highest average annual rainfall areas are the coastal Karnataka, Kerala, Konkan, and the North Eastern states due to South-West monsoon. The lowest average annual rainfall regions are Rajasthan West, Saurastra and Kutch, Haryana, Punjab, Rayalaseema and Interior Karnataka(see Table 3.6). This shows great variations, unequal seasonal distribution of rainfall and stregthens the need for the development of water resources in the low rainfall areas. The variations in the rainfall within the state are, however, very considerable while Srikakulam and Vizayanagaram districts received a maximum rainfall of 1250 m.m. Anaatapur district in Rayalaseema received only a 544 m.m in a year which is slightly higher than the lowest rainfall in Thar desert in Rajasthan. India being a country of continental size, the annual rainfall, which is the ultimate source of both surface water and ground water, is highly variable across its land mass. While peninsular and the north-western India have large areas of about 1150 mm rainfall a few states in the far eastern India and the narrow strip of western coast (Konkan down to Malabar) have more than twice the national average. Thus the picture of abundance of water is confined mainly to these high rainfall traits. Southern peninsula, mainly the Deccan trap suffers from insufficient rainfall.

The variations in temperature are also marked over the Indian sub-continent. During the winter season from November to February, the temperature decreases from South to North due to the effect of continental winds over most of the country. The mean maximum temperature during the coldest months of December and January varies from 29° C in some parts of the Peninsular to about 18° C in the North whereas the mean minimum varies from about 24° C in the extreme South to below 5° C in the North. March to May is usually a period of continuous and rapid rise of temperature. The highest temperature occurs in North India, particularly in the desert regions of the North-West where the maximum may exceed 48° C. With the on set of the South-West monsoon in June,there is a rapid fall in the maximum temperature in me central portions of the country. The temperature is almost uniform over the area covering two-thirds of the country which gets copious rain. There is a marked fill in temperature in August and

September when the monsoons retreat from North India. The mean maximum in North-West India, is below 10°C. in the month of November. It temperature drops below freezing point In the extreme North, (Central Water Commission, 1978). Thus, variations in the temperature and the direction of the monsoon winds bring different amounts of rain to different climatic regions of India.

Evaporation rates closely follow the climatic conditions and reach their peak in the Summer months of April and May especially in the central areas of the country. With the onset of monsoon, there is a marked fall in the rate of evaporation. The annual potential evaporation ranges between 150 cms. and 250 cms. over most parts of the county. Monthly potential evaporation over the Peninsula increases from 15 cms in December to 40 cms. in May. In the north-east it varies from 6 cms. in December to 20 cms. in May. It rises to 40 cms. in June in West Rajasthan. After the onset of monsoon potential evaporation decreases generally all over the country. Location, rainfall, nature of terrain, temperature and the availability of irrigation determines the land use pattern of the country.

Table- 3.7 : Land-use Classification 1988

	CLASSIFICATION	AREA (In Million Hectares)		
A.	Area under forest Area not available for cultivation			67.16
i.	Land put to non-agricultural uses		20.41	
ii.	Barren land and uncultivable Land		20.07	
	Other cultivated land including follow land		31.06	
i	Permanent pastures and other grazing land		11.93	
ii.	Land under misc. tree crops and grows not included In the net sown area		3.39	
iii.	Cultivable waste		15.74	
B.	Fallow land			24.91
i.	Fallow land other than current fellows	9.55		
ii.	Current fallows	15.36		
C.	Net Area sown			140.72
D.	Total reporting area			304.72
E.	Total cropped area			175.96
F.	Area for which no returns exist			1 24.41
G.	Total geographical area			328.73

Source **:GOI, Statistical Abstract,** Directorate of Economics and Statistics, Department of Agriculture and co-operation, Ministry of Agriculture, 1988, P.7

3.3.3 Land-use Pattern :

The net sown area is 140.72 million hectares(see Table 3.7). Only 304.72 m.ha of this total area is accounted for in the latest available land use. Area under forest is 67.16 m.ha. Area for which no returns exists is 24.41 m.ha and it largely consists of mountains,deserts and forest and inaccessible areas (Government of India, 1991, pp. 1-13). More man 53% of its total area is cultivated. Thus, India is one of the intensively cultivated regions of the world.

IV

Water Resources of the Indian River Basins

3.4.0 Introduction

Based on the catchment areas, the river basins of India are broadly divided into three groups. River basins of 20,000 sq.kms catchment area and above constitutes the first group which are 14 in number. River basins with catchment areas between 2,000 sq.kms to 20,000 sq.kms are classified as medium river basins, and those with catchment area below 2,000 sq.kms are called minor river basins. There is yet another fourth category where a few desert rivers flow for some distance and men are lost in the deserts. Their flow is uncertain (Rao, K.L, 1979, pp. 54-89). The bulk of the inflow into the rivers can thus be considered as derived from the upper portions of the river catchments, which lie mostly in India.

3.4.1 Catchment Areas of Rivers:

The reported catchment area of India is 3.05 million Sq.km against the total geographical area of 3.28 million Sq.km. The difference is due to areas for which statistics are not available[3] (see Table 3.8). There is also a difference of 0.16 million Sq.km between the geographical area and aggregate of the catchment areas of all the rivers.

Table - 3.8: Catchment area for the four groups of River systems :

River Basins	Catchment (Million Sq.Km	Total Area (%)	Run-off (1000 M3)	Run-off (%)	% Of Population in the Basin
Group I Major River basins					
North	1.44				
South	0.72	83	1.406	85	80
Central	0.42				
Total	2.58				
Group II Medium	0.24	8	.112	7	
Group III Minor	0.20	9	.127	8	20
Group IV Desert Rivers	0.10				
Total	3.12	100	1.645	100	100

Source : Rao, K.L. 1979, P.55-56.

The major river basins form 83% of the total drainage area(see Table 3.8) and including the medium river basins they cover practically 91% of the total drainage area.

3.4.2 Sources of water supply :

The river basin systems in India and the sources of water supply arc significant. Major river basins like the Ganga, the Indus, the Godavari, and the Krishna have a number of canals, tanks, and wells (Rao, K.L, 1979, pp.58-59). It is interesting to observe that the storage capacity is the largest in the Ganga basin because of its vast size. Even the Krishna, the Godavary and the Indus basins have large storage capacities (see Appendix - III-i). Given the assessment mat only 38% of our surface flows can be tapped for irrigation purpose, the ultimate irrigation potential from this source would suffice for crop area to the tune of 74 million hectares only. This potential can rise if me exploitable fraction can be enhanced somehow, say due to inter-basin transfer of surplus river waters (Dhawan, 1989 p.34). Irrigation schemes in India are usually designed on 75% dependability. There is scope for enlarging our ultimate irrigation potential by constructing irrigating works of low dependability as there is an increased relation between dependability and volume of water flow available in a river.

3.4.3 Availability of Water:

The average flow in the 20 river systems of the country has been estimated to be 66371 t.m.c[4] (see Appendix III-ii). But the amount of water that can be actually put to beneficial use is much less due to severe limitations imposed by physiography, topography, inter-state issues and the present state of technology to harness water resources economically (Rao, K.L, 1979, pp.58-60). There is a big challenge to planners and technologists to lap the available potential water in river basins through irrigation. Conservation of water by storage system is important in India where the rain water flows into the rivers to the extent of 80% in the four monsoon months (Rao, K.L, 1979, P. 57). For the rest of the year, there is only inadequate or no water supply or to the rivers (see Appendix-III-iii). Therefore, storage of water is very essential for agriculture in India, It is also necessary for producing power.

3.4.4 Present status of Water Resource use :

India will have an estimated population 102 crores by 2007 A.D. With this population and given improvements in consumption levels associated with growth in incomes, the estimated foodgrain requirement for the year 2007 A.D will be around 276 million tonnes. The foodgrain production has to match this level of demand. The required production levels of foodgrains by the year 2007 A.D. will be 282 million tonnes as against 198 million tonnes in 1996-97 (Water Management Forum, 1992, pp. 816-844). The required development in agriculture can, in the long run, be achieved only through a regionally broad-based pattern of growth by devoting sufficient facilities of irrigation and maintaining a continuous flow of economically viable and improved techniques.

The ultimate irrigation potential of the country has been estimated to be 113.50 million hectares. It includes 58.50 million hectares from major and medium irrigation schemes, 15 million hectares from surface minor irrigation schemes and 40 million hectares from groundwater exploitation[9]. Irrigation development in India is classified into three categories, viz., major irrigation, having cultivable command area (CCA) of more than 10,000 hectares for each scheme; medium irrigation having CCA more than 2,000 hectares but less man 10,000 hectares for each scheme and minor irrigation, having CCA of 2000 hectares or less for each scheme (Central Water Commission, 1992, P. 7). However, the national perspective for water resources development has two components viz, development of the Himalayan rivers and the Peninsular rivers for the inter-basins transfer of waters. It envisages the additional benefits of 25 million hectares by surface water and 10 million hectares by increased use of ground water, which is expected to raise the ultimate irrigation potential from 113.5 million hectare to 148.5 million hectare. Further, the Central Ground Water Board provisionally puts the revised estimate of ground water at 80 million hectares as against the previous estimate of 40 million hectares

Out of an average annual flow of 66371 t.m.c, India can develop a live storage of 5185 t.m.c. The irrigated area in the country was only 22.60 million hectares in 1950-51. As compared to this, the cumulative irrigation potential as created upto 1989-90 (the end of the Eighth Five Year plan) was 78.12 million hectares (out of which ground water potential was 38.95 million hectares) and the utilization is estimated to be 70.89 million hectares comprising 38.39 million hectares from surface water and 32.50 million hectares from ground water. The quantum of water issued for irrigation these areas would be of the order of 31.12 million hectares of surface water and 12.8 million hectares of ground water(see Table 3.9). The actual utilization up to the 7th plan (1989-90) under various uses is just 25% of the total water resources (188 million hectares).

Table- 3.9 :Irrigation Uses (Supply of Water) 1990

USES	UTTLIZABLE WATER AVAILABILITY (Unit - million hectares)
Irrigation using surface waters	31.12
Irrigation on using ground waters	12.80
Community water supply (Urban and rural area)	2.50
Industrial use	1.50
Energy	0.45
Total	48.37

Source: Central Water Commission, 1992, pp. 1-23

The Eighth Five Year plan envisages creating additional irrigation potential of 5.09 million hectares from major and medium irrigation and another of 10.71 million hectares from minor irrigation (G O I, Planning Commission, 1992, draft). This would mean that at the end of me Eighth plan (1992-97), 99.19 million hectares of irrigation potential would have been created, out of which 48.14 million hectares would be from surface sources and 51.05 m.ha would be from the use of ground water. The level of foodgrain production by the year 2007 A.D will have to be around 282 million tonnes. This has to be viewed against the backdrop of the fact that the net sown area being almost stagnant at 140-141 million hectares since 1970-71, and the pressure on land use is increasing due to fast developing industrialization and urbanization. The future of increased agricultural production lies with more intensive agriculture, especially by increasing the efficiency of the existing irrigation systems as well as spreading irrigation facilities to other hitherto un-irrigated.

The latest estimates indicate mat by the year 2000 and 2025, the water use for irrigation will be increased to 63 million hectares and 77 million hectares respectively. The requirement of drinking water is at present only 7% to 10% of the available surface water and 4% of the ground water potential The country has not yet been able to provide sustainable source of clean drinking to all the people, particularly in rural areas. There are a large number of villages which are only partially covered and a large number of habitations which have no source at all or have an inadequate supply of drinking water. It is estimated that 1.5 lakh villages get the drinking water supply lew than the one stipulated by norms. Similarly in urban areas also, the 50% of population get the water supply less than the normal.

Against this backdrop, it is roughly estimated that by the year 2000 and 2025, the community water supply requirement may go up to about 3.3 million hectares and 5.2 million hectares respectively from the present use of 2.5 million hectares (see Table - 3.10). The industrial demand may also go up to 3 million hectares and 12 million hectares by the year 2000 and 2025 respectively, from present use of 1.5 million hectares. The total requirement of water in the year 2000 and 2025 would be around 75 million hectares and 105 million hectares respectively.

Table- 3.10 : Total Requirement of water (Demand) Units = million hectares)

Sector	year		
	1900	2000	2025
Domestic	2.5	3.3	5.2
Irrigation	43.92	63.0	77.0
Energy	0.45	2.7	7.1
Industry	1.50	3.0	12.0
Others	2.63	3.0	3.7

Source: Central Water Commission, April, 1992, pp.5-10.

V

Development of Irrigation in India

3.5.0 Introduction:

There is considerable evidence to show that in ancient India irrigation was practiced extensively. The fact that big cities like Harappa and Mohan-jo-daro were flourishing in the dry areas, points to the existence of extensive irrigation systems in ancient India. In 300 B.C Magasthenes, the famous Greek Ambassador to the court of Emperor

Chandra Gupta, recorded that the district officer used to "measure the land and inspect the sluices by which water is distributed into the branch canals (water sources) so that every one may enjoy his fair share of the benefit" (Rao, K.L, 1979, P. 114). Some of these ancient works are found even today. The most famous one, however, is the still functioning Grand Anicut which was built by the Chola rulers in the first century A.D. on the Cauvery. This river divides into two branches, the Cauvery on the right and the Coleroon on the left.In order to prevent the water flowing into the Coleroon branch, which is at a low level, the Grand Anicut was constructed to enable the water to pass through the Cauvery and irrigate the fertile Tanjore delta land. Besides this, there are a number of ancient earth dams constructed long ago and still existing. The principal masonry work undertake during the native period is the unknown as the Grand Anicut, re-built in the eleventh century, and situated just below the island of shreerungam, where the Cauvery and Coleroon come into close contact with each other (Maclean,C.D.,1987,pp.339-40). At this point the bed of the Coleroon is nine or ten feet lower than that of the Cauvery and Grand Anicut was therefore built across a outlet of the Cauvery to prevent its water being wholly drained off into Coleroon. These works were beneficial, but did not check in any way the evil resetting from the unequal distribution of the volume between the two main streams. In 1836, under the advice of Sir Arthur Cotton, the upper Coleroon anicut was built across the head of the Coleroon branch, and was completely successful in its object of throwing into the Cauvery branch a fair distribution of the water supply by the simple expedient of placing the crest of the *anicut* at such a height as to ensure, in the average state of the river, a proper distribution of the entire volume of the mainstream between the two branches during the irrigation season. In 1848, the construction of a regulating dam to the first principal offshoot from the Cauvery branch was began and subsequently regulating dams were provided for the other principal branches, thus completing the general system of regulation and control of the water required for the delta irrigation.

Ferozshah Tughlak (1351-1388) built in the Western Yamuna canal in 1355 A.D to carry the Yamuna waters to his hunting ground at Safidom in Hissar district

Similarly, the Eastern Yamuna canal was constructed during the reign of Emperor Mohammed Shah (1719-1748), Emperor Shahjahan built a canal from me Ravi river through the Shalimar Gardens at Lahore (Rao, K.L, 1979, P. 115). But most of the development of the existing irrigation took place during me British regime.

Irrigation works were undertaken during the 19th century principally to overcome me devastating famines that raged in several parts of the country. Two of me most notable British engineers, who did splendid work and built magnificent canal systems, are Proby T. Cautley and Sir Arthur Cotton. Sir Arthur Cotton constructed the Cauvery delta system. He built a major weir at the head of Srirangam island in 1834 where the Cauvery branches off into the Cokroon and the Cauvery. Sir Aurther Cotton also constructed the Godavari Anicut and the canal system. This diversion system started in 1846 prove to be the most valuable work in times of drought and famine, irrigating the nearby 0.4 million.ha. Similarly, in the Krishna delta, there were a number of scarcities and famines. The weir was branched in 1952, and later was replaced with a barrage just up stream of the anicut and commissioned in 1957. It irrigates about 0.5 m.ha. Cautley began the construction work on the Upper Ganga canal in 1836 and completed it in 1854.

In the latter part of the 19th century the important irrigation works constructed were the Sir Hind Canal, the lower Sohang and Para Canals, the Lower Chenab Canal in Punjab and the lower Ganga Canal, the Agra Canal, the Betwa Canal in Uttar Pradesh, the periyar system of canals in Tamilnadu, the Duma Canals in Maharashtra (Rao, K.L., 1979, P. 116). Irrigation works in the 20th century witnessed an important event in India's history, namely the appointment of the Irrigation Commission. The Commission toured the country extensively and based on its findings submitted its report in 1903 (Government of India, 1903, P.66-68). It stated mat, as regards new works,the main question was not whether they will be likely to prove directly remunerative, but whether the net financial burden which they may impose on the state in the form of charges for interest and maintenance will be too high a price to pay for the protection against famine.

Important projects undertaken in the country were the Tribeni Canal project in Bihar, the Pravara Canals, the Godavari Canals, the Nira Right Bank Canals in Maharastra, the Sarada Canal project in U.P and the Weinganga and the Mahanadi Canals in Madhya Pradesh. Between 1921 and 1935, a number of notable irrigation works were constructed, among them being me Krishnarajasagar project in Karnataka, the Nizamsagar project in Telengana (Andhra Pradesh) and the Mettur project in Tamil Nadu. In 1935,after the passing of me Government of India Act, irrigation was transferred from the control of the central Government to that of the respective provincial or state Governments (Central Water Commission, 1978, P.6-7). This made a significant change into governing irrigation projects and their administration, as irrigation became a state subject and central Government was concerned only when disputes arose between the neighbouring states.

It is really in the second half of the century that the gigantic projects were built. The First Five Year Plan emphasised on the development irrigation and agriculture. However, much effort was not made in the irrigation front. The emphasis in the Second Plan was on irrigation along with industry. It was from the Third Plan onwards that adequate emphasis was laid on the development of irrigation in the country. Till the end of the Seventh Plan (1985-90), an amount of Rs. 45191.49 crores has been spent, of which Rs. 26,133 crore has been spent on major and medium projects (see Table 3.11). The remaining amount has been spent on minor irrigation, command area development and flood control.

Table -3.11: Magnitude and Composition of Investment on irrigation and Flood Control in the Plans (1950-1990) (Rs. in crores)

Plans	Major & Medium	Minor Irrigations			C.A.D.	Flood Control	Total
		Public	Institutional Financial sector	Total			
FIRST(1951-56)	380	66		66.00-		13.77	459.77
SECOND (1956-61)	380	142	19.15	161.15	-	49.15	59030
THIRD (1961-66)	581	328	115.29	443.29	-	86.00	1110.29
ANNUAL (1966-69)	434	326	234.74	560.74	-	43.61	103835
FOURTH (1969-74)	1237	513	661.06	1174.04	-	171.78	2582.84
FIFTH (1974-78)	2442	631	780.24	1411.24	122.49	298.61	4274.34
ANNUAL (1978-80)	2056	497	490.40	987.40	88.20	228.47	3360.07
SIXTH (1980-85)	7516	1802	1437.55	3239.55	520.07	596.07	11872.40
SEVENTH (1985-90)	11107	3115	3311.95	6426.91	1427.64	941.58	19903.13
TOTAL	26133	7420	7050.34	14470.34	2159.11	2429.04	45191.49

Source: GOI, 1993; The Eighth five Year Plan (1992-97) May, 1992, P.51

In the pre-Plan period, the potential and utilization of the major and medium irrigation systems was 9.70 million hectares. The minor irrigation sources was 12.90 million hectares. The Gross irrigation areas as per land utilization statistics was 22.56 million hectares. From the First plan onwards, the development of irrigation has been taking place. The potential and utilization of major and medium irrigation systems at the end of Seventh Plan were 31.52 m.ha. and 27.77 m.ha. and the minor irrigation potential and utilization were 46.83 m.ha and 43.53 m.ha respectively (see Table - 3.12). This indicates that there is a considerable gap between the potential and utilization.

Table -3.12: Development of Irrigation Potential through in the Plans (1950-1991)(m-ha.)

Plans	Major & Medium Irrigation		Minor Irrigation		Total Irrigation		Gross Irrigated Area
	Potential	Utilisation	Potential	Utilisation	Potential	Utilisation	
PRE-PLAN	9.70	9.70	12.90	12.90	22.60	22.60	22.56
FIRST (1951-56)	12.19	11.00	14.06	14.06	26.25	25.06	25.64
SECOND (1956-61)	14.33	13.30	14.79	14.75	29.08	28.05	27.98
THIRD (1961-66)	16.57	15.20	17.00	17.00	33.57	32.20	30.90
ANNUAL (1966-69)	18.10	16.80	19.00	19.00	37.10	35.80	35.43
FOURTH (1969-74)	20.71	18.70	23.50	23.50	44.21	42.20	40.28
FIFTH (1974-78)	24.72	21.20	27.30	27.30	52.02	48.50	46.08
ANNUAL (1978-80)	26.61	22.70	30.00	30.00	56.61	52.70	49.21
SIXTH (1980-85)	30.01	25.33	37.52	35.25	67.53	60.58	54.67
SEVENTH (1985-90)	31.52	27.77	46.83	43.53	79.74	71.42	N.A

Source: GOI, 1992; Report of Working Group on Eighth Five Year Plan on Major and Medium irrigation, Minor Irrigation. Planning Commission, 1992, p. 5.

Since the inception of the First Five Year Plan up to the end of the Seventh, an amount of Rs.45,191.49 crores has been spent on major, medium and minor irrigation (see table 3-12). The Command Area Development Agency (CADA) and flood control and the potential created is 446.85 million hectares. The expenditure during the above period on irrigation alone was Rs.42,762.45 crores.

3.5.1 Position of the States in India :

Andhra Pradesh occupies sixth place in the Seventh Plan as far as allocation is concerned (see Table 3.13). As regard the ultimate irrigation potential, a few states like Haryana and West Bengal will exceed the ultimate irrigation potential by 147.61% and 158.17% respectively. Andhra Pradesh when compared to these states, is far behind to achieve targeted ultimate irrigation potential Unequal distribution of water across canal command in its different reaches, the losses in conveyance and field applications under each type of systems are much higher actually than what are assumed, the physical control devices are inadequate and crude.

VI

Irrigation Development in Andhra Pradesh

3.6.0 Introduction

The economy of Andhra Pradesh is largely dependent on agriculture. The state is rightly called 'a River State' as it is blessed with major River systems like the Godavari, the Krishna and the Pennar and 37 others. The major irrigation development have been taken place since the British regime. In 1844-45 the Godavari Anicut was built across the river which served the area 6,13,518 acres(1882-83). Another major anicuts were the Kistna (1852), the Pennar(l853-55), the K.C. Canal(1858) which served the area 2,86,613 acres,2,24,969 acres and 72,358 acres respectively as on 1882-83(Maclean, C.D,1987,pp.387-420). Thus, the state is blessed with a vast scope of developing irrigation potential (Hanumantha Rao.V, 1998, PP. 1-10). The state has a mean annual rainfall of 858 m.m and about 670 m.m or 78% of the total rainfall contributed by the South- West monsoon.[6]

The state has a geographical area of 275.07 lakh hectares, and a population about 683 lakhs. The net area irrigated in the state is around 44.7 lakh hectares, representing 40.6% of total irrigated area as per 1988-89 Agricultural census. The total surface water from the entire river systems of the state is estimated to be in the order of 7.7710 million cubic metre (2,746 tm.c) at 75% dependability (Hanumantha Rao.V, 1998, pp. 1-10). The ultimate irrigation potential is assessed as 87.80 lakh hectares, under major and medium and minor irrigation projects including 23.00 lakh hectares, under surface water major irrigation schemes.

The physical features of the river systems, the soil, the rainfall and the climatic conditions are suitable for agriculture and the pattern of crops is dependent on the agro-practices, dating back to times immemorial Around 81% of the population is by and large dependent on agriculture and other allied occupations. This leads to the logical conclusion that the economic development is dependent on the creation of irrigation facilities considering the historical background and the age old know-how of water and land resources. This encourages establishment of agro-based industries and helps in the all round development of the State's economy.

Table- 3.13: THE STATE-WISE PERFORMANCE IN THE VII PLAN

STATE	ALLOCATION (RS. IN LAKHS)
Gujarat	1,46,909
Uttar Pradesh	1,42,000
Madhya Pradesh	1,37,592
Maharashtra	1,32,000
Bihar	1,28,580
Andhra Pradesh	1,18,230

Source: Government of India, 1992, Eigth Five Year Plan (1992-97), Planning commission, Vol. I & II, New Delhi.

3.6.1 Irrigation Sources and their utilization in Andhra Pradesh :

Some irrigation projects were constructed during the last century and the pre-Independence period. Some of the major works are the Krishna delta canals, the Godavari delta canals, the Pennar system, the Nagavali, and the Vamsadhara schemes (see Table- 3.14). The Godavari the Krishna,and the Tungabhadra the three inter- state rivers,and the Pennar and 37 other meduim and minor river systems are estimated to cany a total dependable annual yield of 2746 t.m.c, (i.e.7.771 million cubic metres) for use by Andhra Pradesh, (see Table 3.14). The irrigation potential created before the pre-plan period under major and medium irrigation was 16.76 lakh hectares.

Table - 3.14: Water Resources for Andhra Pradesh

River Systems	Drainage area in the state in 1000 sq.km	% of Drainage area to the total area of the state	Assessed annual Yield in state (M3)
Godavari	73.201	26.45	4.2308
Krishna	74.382	26.88	2.2951
Pennar	48.111	17.39	0.2763
Nagavali	4.833	1.75	0.1369
Vamsadhara	1.934	0.70	0.0440
Other minor rivulets draining into the sea	74.239	26.83	0.7879
Total	276.700	100.00	7.7710 (2746 tmc)

Source: Government of Andhra Pradesh, 1992; National Watershed Management Plan Phase II, Vol.I, Project Profile, A.P. State, 1992, Annexure-I.

Table-3.15: Irrigation Potential created and amount spent:1951-90

		Irrigation Potential Creation		
Plans	Amount Spent (Rs in Crores)	Major & Medium (Lakh Hectares)	Minor (Lakh Hectares)	Total
PRE-PLAN	-	16.76	13.71	30.47
FIRST (1951-56)	40.99	0.79	0.25	1.04
SECOND (1956-61)	61.81	1.81	0.16	1.97
THIRD (1961-66)	110.12	3.68	0.50	4.18
ANNUAL (1966-69)	71.67	0.78	0.37	1.15
FOURTH (1969-74)	134.74	1.90	0.63	2.53
FIFTH (1974-78)	307.92	2.13	0.92	3.05
ANNUAL (1978-80)	281.48	1.54	0.57	2.11
STXTH (1980-85)	770.68	3.05	0.82	3.87
SEVENTH (1985-90)	1436.44	0.89	0.67	1.57
TOTAL	3215.85	33.33	18.60	51.93

Source: Government of Andhra Pradesh, 1992; Booklet on Irrigation Development in Andhra Pradesh, Engineer-in-Chief, Irrigation & CAD, Government of Andhra Pradesh, October, 1992, Annexures-I & II

The ultimate irrigation potential contemplated from the major and medium schemes for the state as a whole has been assessed as 64.80 lakh.ha. The total potential created from the projects of pre-plan schemes and the projects extended during me First to Seventh Plan is 33.49 lakh hectares and the potential created from minor irrigation is 18.34 lakh hectares (see Table 3.15). Their total expenditure amounts to Rs.3215.85 crores.

(Government of India, 1992, P. 9). The plan efforts of Andhra Pradesh has been so far based on the strategy which had laid emphasis on building up the bask infrastructure both for agriculture and industrial development viz., development irrigation and power.

VII
Conclusion

The globe consists of one-third land and two-thirds water. The water resources in this one-third land consists of surface and ground-water. Fresh water for human use found in lakes, swamps, and rivers makes up only 0.008% of the Earth's water. This shows the scarcity of the usable fresh water. Globally, most water is used for agriculture (about 69%). This reveals the importance of irrigation development which consumes large amount of fresh water. India is a country of great geographical diversity. There are fifteen agro-climatic regions in the country. Andhra Pradesh region stretches over the Deccan interior and Eastern coast covered with alluvial soils deposited by the Godavari, Krishna and Pennar. The river basin systems in India and the sources of water supply are significant These basins have large storage capacity.

The future of increased agricultural production lies with more intensive agriculture, especially by increasing the efficiency of the existing irrigation systems as well as spreading irrigation facilities to other hitherto unirrigated areas.

The gap between the potential created and utilized(10.43 million hectare) and the lag between them is the first of fee efficiency related problems. This is attributed to many reasons ; the delays in the extension of the canal systems during which the farmers in the upper reaches raised more water intensive crops like rice and the inability of farmers To invest in land development and field channels and deficiencies in the structures. The second relates to the inefficient, wasteful and harmful use of water. The traditional method of over flow of water from one field to the next results in use of more water than required for a crop, raising crops with higher requirement of water with me resultant problems of wastage, water logging and salinity and the third relates to the most common conflict occurs between upstream users who claim sovereign rights to that originates or flows through their territory (including right to use, store, direct or pollute) and water course be maintained in its natural state. Given the constraints of public financial resources and the demand for irrigation out- pacing its growth, there have been too many projects competing for the few resources, a thin spread thereof with the consequence of time and cost overruns. These aspects of inefficiencies led to the realisation of the need for optimising output per unit of water per unit of crop land and applied on the unit of time through efficient management of available water resources.

APPENDIX-III.i

SOURCES OF WATER SUPPLY (UNIT : THOUSANDS OF Hectares.)

Basin	Govt. & Private Canal	Tanks	Other Sources	Total Surface Water	Tube wells	Other Wells	Total Ground Water	Grand Total (Col. 5+8)
1	2	3	4	5	6	7	8	9
Major River Basins								
INDUS	3462	5	464	3927	1545	862	2407	6334
GANGA	7462	1205	1767	10590	4244	4662	8906	19496
BRAHMA PURTRA & BARAK	328	3	305	636	-	130	130	766
SABARAMATI	89	15	3	107	11	200	211	318
MAHI	98	31	4	133	12	125	137	270
NARMADA	11	53	9	73	11	200	211	284
SUBARNAREKHA	92	10	24	126	-	11	11	137
BRAHMANI	125	79	74	278	-	30	30	308
MAHANADI	1117	216	167	1500	-	60	60	1560
GODAVARI	1137	501	64	1702	28	609	637	2339
KRISHNA	2143	393	112	2648	28	775	803	3451
PENNAR	97	120	17	234	12	230	242	476

CAUVERY	1110	270	12O	1500	5	330	335	1845
TOTAL	17599	2901	3135	23635	5900	8414	14314	37949
Medium And Minor Basins (Unit : Thousands Of Ha.)								
RIVERS OF N.E. REGION	-	-	36	36	-	-	-	36
Luni And Rivers Of Saurashtra & Kutch	177	77	5	259	81	1029	1110	1369
BETWEEN TAPI & MAHI	10	10	3	23	6	6	12	35
Between Kanyakumari & Tapi	543	167	204	914	2	120	122	1036
Between Ganga & Vaitharni	47	23	20	90	33	3	36	126
VAITHARNI	60	40	35	135	-	13	13	148
Between Mahanadi & Godavari	247	180	53	40	12	28	40	520
Between Godavari & Krishna	-	30	5	35	12	10	22	57
Between Krishna & Pennar	26	75	5	106	12	70	82	118
Between Pennar & Cauvery	164	404	37	605	37	535	572	1177
Between Cauvery & Kanya Kumari	112	243	6	361	10	263	273	634
Total For Medium & Minor Basins	1386	1249	409	3044	205	2077	2282	5326
TOTAL FOR INDIA	18985	4150	3544	26679	6105	10491	16596	43275

Source :Water and Related Statistics, Central Water Commission-1992, (April) Statistical Directorate.

APPENDIX-III.ii

Water availability Potential in the River Basins of India

Basin	Drainage area (sq.km)	Average annual run-off (M3)	Population 1991 census (Millions)	Cultivable area (1000 hectares)	Average run-off percapita	Average run-off per hectare of cultivable area
Indus Ganga Brahmaputra Meghna	321289	73305	41.73	9638	1757	7600
a) Ganga	861404	525023	356.33	60161	1473	8727
b)Brahmaputra	193313	537240	29.17	12146	18417	44232
c) Barak & Others	41723	59800	33.00	1114	9447	53680
Godavari	312812	118982	54.54	18931	2182	6285
Krishna	258948	67790	59.52	20299	1139	3339
Cauvery	87900	21358	32.14	5797	665	3784
Subarnarekha	29196	10794	8.91	1898	1262	5687
Brahmani & Baitarani	51822	36227	10.57	3201	3427	11317
Mahanadi	141589	66879	26.28	7994	2545	8366
Pennar	55213	6858	9.72	3551	706	1931
Mahi	34842	11829	10.03	2210	1179	5352
Sabarmathi	21674	4079	9.02	1548	447	2635
Narmada	98796	41273	15.97	5901	2584	6994
Tapi	65145	18389	13.66	4536	1346	4054
West flowing rivers fromTapi to Tadri	55940	109010	27.36	3163	3984	34794
West flowing rivers from Tadri to Kanya Kumari	56177	89814	32.07	3146	2801	28550
East	74354	16948	24.48	4328	692	3916

flowing rivers from Mahanadi to Pennai						
East flowing rivers from Pennar to Kanya Kumari	100139	17725	43.07	6876	411	2678
West flowing rivers of Kutch & Saurashtra including Lumi	321851	15098	23.91	23447	631	644
Area of inland drainage in Rajas than	80017		7.11			
Minor rivers I drainage in Bangladesh & Burma	28400	31000	2.04		15196	
TOTAL	3292544	1879421 (66371 tmc)	843.96			

Source :Water and Related Statistics, Central Water Commission-1992, (April) Statistical Directorate.

APPENDIX - III. iii

Details of Storage of water in India

Basin	State	Project	Live storage (Million Cubic Meter)
	Major River Basins		
Indus	Himachal Pradesh,	Bhakra Nangal, Beas II(Pong)	14418.9
Ganga	Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal	Panchet Hill, Maithon, Tenughat, Gandhi Sagar, Rana Pratap Sagar, Matatila, Rihand, Ramganga, Tehri and others, Kangsabati, Mayurakshi	33476.1
Brahmaputra	Assam		141.5
Sabarmati	Gujarat	Dharoi and Others	1016.6
Mahi	Gujarat and Rajasthan	Kadana, Panam, Bajaj Sagar	4285.5
Narmada	Madhya Pradesh	Tawa and Others	2550.4
Tapi	Maharashtra and Gujarat	Guina, Ukai and Others	8148.5
Subernarekha	Bihar	Bihar	283.1
Brahmani and Baitarini	Orissa	Sulandi, Riensali	3952.8
Malianadi	Madhya Pradesh and Orissa	Satiara, Hirakud and Others	7926.1
Godavari	Andhra Pradesli, Maharashtra, Orissa and Madhya Pradesh	Nizam Sagar, Pochampadu, Mula, Jayakwadi I, Purna Pench. Jalaput Balimela and others	14858.2
Krishan	Andhra Pradesh, Karnataka and Maharashtra	Nagarjunasagar. Srisailam, Bhadra, Tungabhadra, Ghataprabha, Malaprabha, Upper Krishna I and others, Warna, Bhima, Krishna, Koyana, Tola Hydel works	29860.0

Pennar	Andhra Pradesh	Somasila and Others	1978.5
Cauvery	Karnataka and Tamilnadu	Krishnarajasagar, Mettur, Lower Bhavani and others	54477.9
Total Major Basins			128374.1
Medium and Minor Basis Iddiki	Rajasthan, Orissa, Gujarat, Goa, Maharashtra and Andhra Pradesh, Karnataka, Tamilnadu and Kerala	Damanganga, Shsravati, Kalinadi, Parambiteulam Aliyar Kallada, Edamalayar and others	18852.4
Total All Basins			146826.5 (5185t.m.c)

Source: Central Water Commission, 1992; Water and Related Statistics, Statistical Directorate, April.

Notes

1. In many countries the agricultural demand for water dominates the total demand. Hence, small changes in the agricultural demands can free large quantities of water for other uses. It is important that irrigation water be used efficiently (Repetto, 1986, pp.255-98).
2. It covers an area of 32,87,263 sq.km, extending from the snow-covered Himalayan heights to tropical drain forests of the South. As seventh largest country in the world, India is well-marked off from the rest of Asia by mountains and the sea, which give the country a distinct geographical entity. Bounded by the great Himalayas in the North, it stretches southwards and at the tropic of Cancer, tapers off into the Indian ocean between the Bay of Bengal on the East and the Arabial Sea on the West (Government of India, 1997, p.l).
3. The mean flow in the Brahmaputra and Barak rivers of the east amounts to about 59 million hectare- metres, about one-third of the combined flow of all the Indian rivers put together. As hardly *5%* of this flow is exploitable as per the present expert assessment. This brings down the over all utilisability of the Himalayan flows to 32%. Likewise, The exploitabilily of the short, coastal rivers originating from the high rainfall mountains of the Western Ghats is quite low, namely 16%. Thus the rivers, which are very beautiful because of either high rain or snow precipitation in their catchments (Himalayan and Western coastal rivers of the Western Gnats) have utilizable flows to the extent of about one-fourth only. On the other hand, the less beautiful rivers of peninsular India, because of the Rocki terrain through which they flow, have a comparatively high proportion of utilizable water (Dhawan, B.D, 1989, pp. 17-25).
4. Bansil had given the water resources of India *by* river basins that the average annual flow of all river basins in India was 178.0 million hectare metres, while utiliizable flow was 70 million hectare metres (Bansil, P.C, 1990, p.227).
5. Bansil presented data on irrigation potential of major and medium projects in India as 40.47 million hectares (Bansil, P.C, 1990, pp.223-29).

6. Bansil presented data on minimum and maximum water storage in reservoirs in 1985 of Andhra Pradesh were namely Nagarjunasagar (minimum 0.881 t.m.c. and maximum 5.504 t.m.c.), Sriram Sagar (minimum (-) 0.120 t.m..c. and maximum 0.777 t.m.c.) and Srisailam (minimum 1.188 t.m.c. and maximum 8.273 t.m.c.) respectively (Bansil, P.C. 1990, pp.223-29).

CHAPTER - IV

INVESTMENT IN IRRIGATION SCHEMES

I

Theories of Investment

4.1.0 Introduction:

The term investment is most commonly used to describe the flow of expenditures devoted to increasing or maintaining the real capital stock. Investment, in essence, is the present sacrifice for future benefits. But the present is relatively known whereas the future is always an enigma. Investment is also, therefore, a sacrifice for uncertain benefits (Hirshleifer, J. 1965. P.1). In otherwords, investment is the flow of expenditures devoted to the projects producing goods which are not intended for immediate consumption. Also investment means an addition to the supply of facilities provided to satisfy a specific demand. Supply implies the cost of bout construction, and operation and maintenance cost to keep the facility running. Demand implies that someone receives some satisfaction from the investment and its upkeep (Steiner H.M. 1980, P.2). The pattern of investment involves the process of innovation that reduces the cost per unit of output[1] (Chakravarty.S, 1987, P.35). Investment is a flow, the volume of an intended rate of return being greater than the interest rate.

4.1.1 Theories of Investment:

Classical theory defined capital in general to consist of prior accumulated commodity stocks which constituted the inputs into the production process. Classical capital consists of three main commodity groups; wage goods, raw materials and machines. The dominant classical tradition bracketed together the first two commodity groups (wage goods and raw materials) as circulating capital and referred to the third group (machines) as fixed capital. The role of capital in the Smithian sense is that while division of labour starts the growth process, it is capital accumulation that keeps it going. Smith's conceptualisation of capital is characteristic of his own position for it is the fusion of his ideas, where labour, division of labour and productivity of labour in the production process retain their primacy (Cannan, E, (1893) 1967, pp.575-586). Key elements in the growth process are the nature of accumulation and employment of stock. By stock Smith implied wealth in modem terms, a part (or all) of which is reserved for consumption and a part of which may be reserved for deriving further revenue through investment. The larger the last share, the greater would be the growth potential of any nation. Capital accumulation, enlarges the wages fund, which in turn allows a larger number of workers to be engaged in productive activity, thereby increasing the size of the national output. Workers exhaust the wage-fund over time as they draw advances from it for subsistence during the production process. At the end of the production period, however, the goods produced are sold, ordinarily at a profit, so that the stock of wage goods (capital) is replenished, and even increased by the amount of profit earned. In this manner the stock of capital grows over time through profit accumulation; thus supporting more workers and greater output in the next production period. There was a confusion or inconsistency in Adam Smith on whether capital was considered as an accumulated stock (stored up produce) or a part of annual produce spent on the productive employment of labour. It is not clear whether Smith meant capital as wage advanced in the wider sense or in a narrower sense. In the former case capital is wages for current period and also includes circulating capital It is thus heterogeneous bundle of goods. In the latter case capital is homogeneous wage-fund advanced for the current year. It is a single physical good such as corn, etc (Cannan, E, 1893. 1967. pp.575-

77). Referring to his theory of savings as the spending of the productive workers, the latter view seems to be a logical derivation.

According to Ricardo, capital is characterized by reproducibility, heterogeneity and usefulness to support labour. Thus, those material objects which are capable of accumulation and definite valuation constitute capital Ricardo distinguished between fixed and circulating capital as capital is rapidly perishable and requires to be frequently reproduced, or is of slow consumption. Value would therefore increase as the ratio of fixed to circulating capital increases and as the durability of capital increases (Hicks, J., 1983. pp.34-38). Marx noted the Ricardian distinction between fixed and circulating capital only to the extent that different proportions of both of them were invested in different branches of production. Marx arrived at the view that the genesis of capital lies in the surplus produced by labourer. But in Ricardian analysis the genesis of capital lies in the surplus of annual produce over annual consumption. Marxian argument looked at capital as a part of the social process rather than as something independently productive that earns its rate of return (Marx, 1885, 1956, pp.219-31). Thus, in distinguishing between fixed and circulating capital, Ricardo by ignoring the distinction between constant and variable capital vitiates his investigation of the rate of profit. The classical idea especially of Malthus, is that in the process of production, exactly enough income is generated to purchase the output produced and that barring hoarding all the income so generated would be spent on purchasing that output due to population pressure (Ekelund, Junior *et.al.*, 1988, pp. 137-38). Malthus argued consumption expenditures represented demand and savings represented potential demand (through investment), but that the latter by no means guarantees effective demand. In modern jargon, *ex-post* (actual) saving is always equal to *ex-post* investment, but *ex-ante* (desired) saving need not always equal *ex-ante* investment. Thus Malthus argued the possibility of a general glut.

In the classical tradition. Mill argued that, given Say's law that 'supply creates its own demand', employment and increased levels of output were dependent on the accumulation and investment of capital. Only part of the investment is capital, which is the result of savings, and is required to tide labour over a discontinuous production period Contrary to the Malthusian position, savings would automatically be turned into another form of spending (i.e., investment), and a general glut of goods due to under-consumption was impossible (Ekelund. B.Jr.. *et.al.,* 1988. pp. 165-167). Mill, in short never considered that there could be a lack of aggregate demand in the economic system. Miffs wage-fund doctrine held that at the end of the production period a given stock of circulating capital was advanced to labourers to tide them over the next production period. This slock of capital was determined by many variables, including the productivity of the labour and capital in previous periods, the amount of investment in previous periods, and so forth.

The new economics of the 1870s completely deleted the wage-goods component from the accepted definition of capital. For the Austrian school led by Carl Menger, wage-goods comprised the category of commodities that was not included in capital stock (Hicks, J., 1983, pp.96-100). According to the Austrian definition, wage-goods are goods of the first order - that is to say, commodities of final consumption which provide direct utility to the consumer. Capital comprises all other commodities, referred to as goods of higher order; the commodities that make up capital are intermediate products - raw materials, goods in process, active inventories and machines which are used in their commodity form as inputs in the production process. The conceptualisation of capital formulated by Leon Walras represents the sharpest break with the classical tradition (Hicks, J., 1983, pp.93-95). The Walrasian definition greatly reduced the commodity composition of the capital concept. From the classical definition only the machinery component was retained. Both wage goods and raw materials were excluded as commodity components of capital stock. Capital in Walrasian view, is fixed capital namely, all durable goods which are not used up or are used up only after a lapse of time. The distinction between capital and income hinges on the difference between a stock and a flow.

The tradition from classical to neo-classical economics brought substantial changes in economic doctrine as well as changes in methodology. With its focus on individual decision-making, the neo-classical theory, particularly its Austrian or Walrasian variations, is a more individualistic and subjective theory. Lionel Robbins asserts mat economics is not especially concerned with any particular social phenomenon e.g., the production, distribution, exchange and consumption of goods and services (Robbins, L., 1935, pp.9-16). It is concerned instead with a particular aspect of human behaviour. Thus, the behaviour of humans influences the capital or investment pattern. There is no certainty regarding future accumulation of capital

Another neo-classical approach assumes that there are no costs of adjustment so that firms can adjust their capital stock immediately. The firm is assumed to operate under conditions of perfect competition and faces exogenously given current and forward input and output prices. The financial capital market is assumed to be perfect so that the firm can borrow or lend at a constant rate of interest (Junankar, 1972, pp.52-53). Because of these assumptions, the maximization of utility can be undertaken into two stages; first maximize the present value and then maximise the utility by allocating the profits optimally on consumption goods. Finally, that the present value is maximised subject to a production function where the flow of output is a function of flows of labour and capital services. The flow of capital services are assumed to be proportional to the stock of capital and it is assumed that capital stock is always fully utilised. Thus, the demand in the rate of change of the flow of services is assumed to be proportional to the stock of capital.

Keynes's reaction to the classical approach was that, investment was negatively related to the interest rate. Because, among other reasons, the productivity of given investments declined with incremental increases in investment This declining marginal productivity of investment meant that lower rates of interest were required in order to increase the quantity of investment (Junankar. 1972, pp.20-27). The classical model could handle an increase in investment which might have resulted from inventions or innovations. The level of investment simply increased, and the amount of consumption decreased. Keynes viewed investment expenditures as by far the more volatile. Investment demands were determined by a host of factors besides the interest rate, including expected future returns. The marginal efficiency of capita] relates the cost of investment capital to the expected returns over the life of investment capital. Keynes viewed expectations, dependant upon capricious psychological factors, as having direct and important effects on investment. Beyond psychological effects on investment, however, lay a more fundamental problem for income determination, i.e., that investment expenditures have multiple effects upon income. A change in investment expenditures, for example, did not result in a change in income by the amount of the change in investment expenditures but, rather by some multiplier. Keynes followed a very conventional path in obtaining a demand function for capital which was negatively related to the rale of interest. Assuming that firms are profit maximisers, they would hire any input upto the point at which its marginal product was equal to its price. In the case of capital, a durable producer good which leads to a stream of income over a certain length of time. For a firm the cost of capital and the rate of interest can be taken as (given) parameters, while the expected net returns decline as the firm uses more capital. If the firm was operating under imperfect competition, an additional reason for declining net revenues would be that output prices would fall as the firm sold more. Rut Witte argued that firms would realise that, in a general expansion industry output would rise and they would expect prices to fall and hence expected net revenue would fall. If a firm finds its actual capital stock is less than its optimal capital stock it will try to make up the shortage immediately (i.e., the rate of land investment would be almost infinite). Thus, the rate of return is calculated on the basis of expected future net returns, changes in expectations would shift the marginal efficiency.

The element which is common to all the post-Kryneaian theories is the stress laid on demand factors as represented by output or sales and the under-emphasisation of the rate of interest Another feature is the recognition of the importance of expectations which these theories attempt to incorporate in varying degrees. These theories explain net investment on the assumption that firms are cost minimisers rather than profit maximisers. Eisner argues that the determinants of replacement investment are the same as those of net investment. The main assumption underlying the naive accelerator is that the optimum capital stock is some constant proportion of output The flexible accelerator is a generalisation of the naive accelerator. The flexible accelerator is also based on the assumption that there is some optimal relationship between capital stock and output But there are lags in adjustment process. Another theory i.e. the profit theory of investment, postulates that the optimal stock is some function of the level of profits. Klein assumes that entrepreneurs get utility from the size of their establishment. But this version of the profits theory is inconsistent with profit maximisation since the larger the profits the more the firm expands and accepts lower profits. An alternative version is that the optimal capital stuck is some function of expected profits. Expected profits in turn, are some function of actual profits in the past.

The neo-Keynesian approach, Eisner and Strotz, postulates that there are costs involved in adjusting the capital stock and that the more rapidly the firm adjusts, the higher are the marginal costs. Thus, if there is shortage (i.e., optimal capital stock greater than actual capital stock), the rate per unit time at which the shortage is removed depends on the costs involved. In Keynesian theory also, macro investment is determinate because of rising costs in the capital goods industry. In this approach the firm is aware of increasing cost in adjusting the capital stock and optimises subject to that constraint.

The main result that emerges from this analysis is mat the demand factors as represented by the accelerator are more important than relative prices in determing investment. The changes in rates of interest and other elements in the cost of capital (eg., tax rates) would, after a long lag, lead to a change in investment, wink changes in the aggregate demand would be a quicker and more potent way of affecting investment.

At the heart of investment theory He some empirical facts. The price of an installed investment good, i.e., demand price, market price or shadow price of an investment good differs from the price of a newly produced investment good supply price, replacement cost or reproduction cost (Marcel Savioz, 1992, P.3). When the demand price of an installed investment good is higher than the supply price of a newly produced one, this would instantaneously be followed by a large increase of production and installation of investment goods, so that these prices would almost instantaneously be brought to equality. But this is precisely not the case. The main problem of investment theory is thus to provide a theoretical explanation for the sluggish adjustment of these prices to one another.

Behaviour of investment is explained in the form of models. Three types of investment models can be distinguished with regard to the theoretical explanation they provide for the sluggish adjustment (Marcel Savioz, 1992, pp.4-8). First is " the time to build" model. It assumes that there is a lag between the time when the firm buys an investment good and the time when the investment good becomes productive. This lag, called time to build, is due to the installation process. It assumes that relative prices change so that it becomes profitable to the firm to increase its capital stock. If the change is expected, the firm, taking the time to build lag into account, will advance its order for new investment goods and the actual and desired capital stock will not differ. On the other hand, if the change is unexpected, the short-run supply of productive investment goods being in-elastic, i.e., determined by past investment decisions because of the time to build lag, the desired capital stock win differ from the actual capital stock. So also will the market value of investment goods differ from their reproduction value.

The second type of investment model is the adjustment costs model. It assumes that investment goods are productive only after being installed and that the installation process is costly. The installation costs are assumed to be convex (Marcel Savioz, 1992, pp.4-8). Therefore, a "quick" adjustment of the actual capital stock to me desired capital stock is costlier than a "slow" adjustment

Lastly, non-Walrasian models assume that the markets like the investment goods market not only generate "price signals" but also quantity signals. Such a quantity signal exists in the investment goods market if an upper limit to the quantity of investment goods that a firm can purchase exists, and if this constraint is binding (Marcel Savioz, 1992, pp.4-8). Interestingly, it can be shown that the mere expectation mat the constraint win become binding in the future (an expected quantity signal) is sufficient to bring about a divergence of the market value of investment goods from their replacement costs. This in turn activates the demand for investment goods.

None of the three approaches is fully satisfactory. The lag postulated in time to build model is technically given and is independent of the relative prices. This means that however strong the pressure for a quick adjustment of the actual capital stock to the desired capital stock may be (e.g., if the market value happened to be a multiple of the reproduction cost), these models assume that there is no incentive for the firms to shorten the time to build lag.

Adjustment costs models suffer from a quite similar weakness. They assume a long-run inelastic supply of investment goods. This means that these models unrealistically assume that no resources can be engaged to ease the installation process and thus decrease the adjustment costs, even if there would be sufficient time to do so.

Non-Walrasian models are even less satisfactory. First, they presuppose arbitrary the rigidity of at least one nominal *price* and provide no explanation for this nominal rigidity. The second and more striking fact is that wink time to build and adjustment costs models of investment try to establish the theory of investment some intrinsic characteristics of investment goods, this is not the case in Non-Walrasian investment models.

4.1.2 Critical Analysis of Investment Theory:

Most "classical" investment models can be recast within the "adjustment costs approach". This approach thus provides an integrative framework for the investment theory (Junankar, 1972, pp.3-7). The 'Keynesian approach' tackles this problem by introducing supply constraints in the industry supplying capital goods which then determine the aggregate realised investment. This method does not provide a determinate micro investment function (referring to the firm), nor does it provide an investment demand function (i.e., a function for planned investment). The 'post-Keynesian approach" discuses various accelerator theories which assume that the cost minimizing rather than profit maximizing and thus derive investment functions. 'Neco-Keynesian approach' provides a determinate planned micro investment function. It does this by introducing a cost adjustment function which makes it more expensive at the margin to adjust rapidly. The firm then chooses an optimizing path, given the adjustment costs, which takes it to its long-run equilibrium position. The 'neo-classical' approach is concerned with a completely different problem, which is one of comparative dynamics. This approach used marginal analysis to analyse the pricing of goods, services and factors of production in competitive markets. They emphasised that the market prices of goods and factors were related to their scarcity.

The above approaches reveal that investment demand theory requires both the flow and stock approaches. This is so because the demand price of an investment good is nothing but the present value of the present and future nominal product of capital When applied to concrete situations these theoretical issues present economic problems which influence both public and private investments. Public investments are largely infrastructural in nature. The private sector investments are normally analysed from the private point of view. They accept the working of the price system as a proper indicator of costs and benefits. Public sector investments, since they are made from the view point of the society as a whole, sometimes require adjustments to the prices indicated by the price system. In addition, public sector projects are usually subject to some sort of political judgement

None of these theories can fully explain the behaviour of private investment. Taken together, they emphasize all its major determinants. In a developing economy, investment is also influenced by other economic and non-economic variables. This is mainly because in many a developing country like India government plays a very important economic role under the mixed economic principles and national economic plans that have come to be the order of the day, and government's policies and programmes vitally affect economic activities in the country. That is to say. in a less-developed economy, government investment has to assume a dominant role in the process of industrialization. Infrastructural public investment (eg. irrigation, power, and transport,) increases the production potential of private sector to the extent the entrepreneurs take advantage of these social overheads (Pearce (ed.,), 1986, p.204). These social overheads are nothing but infrastructure of an economy which facilitate the flow of goods and services between buyers and sellers. Examples of these structural elements arc communications and transport roads, railways, harbours, airports, telephone, housing. sewerage, power systems, irrigation projects etc. These facilities arc usually, though not necessarily, provided by public authorities and may be regarded as prerequisite for economic growth in an economy.

Some special considerations of investment criteria in developing countries are also necessary because markets are so imperfect that many market prices of both commodities and labour are greatly out of line with their social opportunity costs or shadow prices. The use of market values may give the wrong indications of the relative social values of goods and factors of production and lead to a mis-allocation of resources especially in the irrigation sector in India, where the irrigation sector is largely funded by government through budgetary allocation, owing to its high cost nature and to achieve certain social goals

II

Investment in Irrigation Projects

4.2.0 Introduction:

A major determinant of growth in areas irrigated by surface irrigation is the volume of public investment in such projects. Annual expenditure in real terms and per hectare of irrigation potential created rose steadily throughout the period of time. The rise in real expenditure per-hectare of irrigation potential created is the result of three forces: a progressive increase in the number of projects under construction, meaning an increasing proportion of funds are spent on the early stages of projects, before they begin yielding benefits; a proportional shift to more difficult and high cost projects as the easier and cheaper opportunities for irrigation development were used up; and improved standards of design and construction in order to capture greater agricultural benefits.

As irrigation development in India has progressed over the decades, several problems have come up to the forefront. They are the problem of paucity of funds which not only restricts the taking up of new projects, but also puts severe restrictions on operation and maintenance of the existing surface irrigation systems and the completion of the ongoing and unfinished projects. Another problem is the poor performance, specially of the existing major and medium irrigation systems. The trends in real capital costs for new irrigation system in the developing countries show large increases in the costs per-hectare of investment over the past three decades. In India, the real cost of new irrigation have more than doubled since the late 1960s and early 1970s(In 1699-69 the real capital cost per-hectare was Rs.2,698 at 1988 prices). The result of these increases in costs and declining prices is low rates return for new irrigation construction (Mark W. Rosegrant and Mark Swendsen, 1993, p.21). This problem is largely a fallout of the first but that would be too simplistic an explanation. Even though adequate investible resources and working expenses are essential requirements of the management of the systems created, increased resources devoted to operation and maintenance alone cannot bring about desired changes in the efficiency of the systems.

Large-scale irrigation is synonymous with canal irrigation in India. This category of works have some salient features. These are in the public sector, they tap river flows with the help of barrages and large dams built across the rivers; the cultivable command area of any major irrigation project is above 10,000 hectares; and that of a medium irrigation work is between 2000 and 10,000 hectares (Central Water Commission, 1992. P. 4). Such large systems involved high costs of construction, but the returns are too low to allow for any expansion.

4.2.1 Inflationary Nature of Irrigation Investment:

Inflation means a sustained rise in the general price level. It is the proportionate rate of increase in the general price level per unit of time. This phenomenon is arising from an autonomous rise in costs. While one should look into the question of the increasing costs of construction, repairs and maintenance of irrigation sources, it is obvious that the costs of these items are bound to increase over time in an inflationary economy where the prices tend to increase year after year, and continuously. With economic development and improved standards of life, labour cost and cost of materials (cement, iron and steel and machinery and transport equipment) also tend to increase contributing to rising cost of construction, repairs and maintenance. In order to estimate the inflation rate relevant for capital outlay on major and medium irrigation schemes in India over time, the Central Water Commission *evolved* made a method to review designs for an major and medium schemes costs were classified into four broad categories: a) labour and miscellaneous items not included under other heads, b) cement, c) iron and steel and d) machinery and transport equipment. Their respective weights were judged to be 0.60, 0.20, 0.15 and 0.05, to estimate inflation rates for categories b, c and d. The Economic Adviser's wholesale price index series for cement, iron, steel and ferro alloys and machinery and transport equipment were used to estimate their respective inflation rates for the period 1950-51 to 1988-89. Annual rate of increase turned out to be 6.94% for cement 8.41% for machinery and transport equipment Data on agricultural wages have been used to estimate the inflation rate of labour and other miscellaneous cost hems. This gives an overall annual inflation rate for this cost category as 7.88% (Central Water Commission, 1989, pp. 1-39). The data show that wholesale prices of all commodities including food and non-food items, manufactured products have increased 8 times in the country between 1939 and upto 1970-71 at 1939-40 prices. This had further increased by 3 times at 1970-71 prices upto 1983-84 and 2 times at 1980-81 prices upto 1990-91 (see Table 4.1). This has obvious effects on the cost of construction, repairs and maintenance of irrigation sources. Thus costs have been increasing over time purely in monetary terms.

TABLE - 4.1: INDICES OF WHOLESALE PRICES (ALL COMMODITIES) IN INDIA: 1949 - 91

YEAR	I WHOLESALE PRICES INDEX
BASE YEAR 1939-40 = 00	
1949	381.1
1951	439.3
1956	403.2
1961	1 478.8
1966	698.4
1967	797.4
1969-70	836.6
1970-71	859.9
EASE YEAR 1970-71 = 100	
1971-72	105.6
1972-73	116.2
1973-74	139.7
1974-75	174.9
1975-76	173.0
1976-77	176.6
1977-78	185.8
1978-79	185.8
1970-80	217.6
1980-81	257.3
1981-82	281.3
1982-83	288.7
1983-84	316.0
BASE YEAR 1980-81 = 100	
1984-85	131.5
1985-86	139.1
1986-87	1464
1987-88	157.6
1988-89	169.2
1989-90	181.8
1990-91	200.5

Source: 1. Government of India, Statistical Abstracts, 1958, 1962, 1969.
2. Reserve Bank of India Bulletin, April, 1973
3. National Accounts Statistics, Central Statistical Organisation, Calcutta, Different issues.

III

Irrigation Investment in Colonial India: Madras Presidency

4.3.1 Irrigation Works in the British Period:

Irrigation works could be classified in order of technical complexity as diversion works, storage schemes and multi-purpose river schemes. In monetary terms, the cost of all the three categories have been going up. The works in the Madras Presidency classed under productive public works upto the end of 1883-84 were the Godavary delta in Godavary district, the Kistna delta in Kistna district, the Kunrool-Cuddapah canal in Kurnool and Cuddapah districts, the Nellore and Sangam anicuts in Nellore district, Baroor tank in Salem district, Cauvery delta in Tanjore district and Shreeuicoontam anicut in Tirneully district. They came under productive works. The capital expenditure per-acre irrigated from the commencement of the works upto the end of 1882-83, and the maintenance charges debited to revenue during the year 1882-83 for all works for which capital and revenue accounts were kept audited (sec Table - 4.2). The capital cost of Kurnool-Cuddapah canal, in proportion to its inrrigated area, far exceeded that of any other work, and the capital expenditure on the Palandoray anicut and Madras water supply works was disproportionately high as compared with the remaining works. The cost of maintenance of Kurnool canal was abnormally high owing to the serious accidents the works had received (Atchi Reddy. 1995. pp. 116-118). It is unfortunate mat the failure of this major project had discouraged forever the private investment in the major projects in India.

TABLE - 4.2: THE AVERAGE COST OF CONSTRUCTION AND MAINTENANCE OF WORKS FOR WHICH CAPITAL AND REVENUE ACCOUNTS ARE KEPT (PRODUCTIVE PUBLIC WORKS, 1883-84.

	Annual Expenditure Per-Acre	
	Capital account to end of 1882-83 (Rs)	Revenue account during 1882-83 (Rs)
Godavary Delta	18.23	0.64
Kistna Delta	22.50	1.06
Pennair Anicut	22.45	0.72
Kurnool canal	1189.36	8.95
Cauvery Delta	1.17	0.35
Shreenicoontam Anicut	63.34	1.48
Palandoray Anicut	104.41	15.77

Source: Maclean, C D., 1987, Vol.1, P.419.

Among the diversion works, storage schemes and multi-purpose river schemes, the last two were inherently costlier than the first (see Table 4.2). Irrigation works during the British period were mostly diversion works across rivers and streams. Ideal sites were used for construction of cheap diversion works in the British period making it obligatory in the recent years to go in for more complicated sites upstream for locating high dams capable of storing large quantities of water.

IV

Increasing Cost of Irrigation in Independent India

4.4.1 Irrigation Development and Its Costs:

Investment in irrigation started during the British era, although it was only in the post-Independent period that a concentrated effort was made in developing irrigation networks on a major scale. During the last 40 years of 1951-90 as much as Rs.262.22 billion (at historical prices unadjusted for inflation) has been spent by the country on the development of major and medium irrigation schemes (GOI, 1989, pp. 1-20). This investment increased the irrigation potential by 22.14 million hectares, from a pre-plan (1951) level of 8.62 million hectares to 30.76 minion hectares by the end of the Seventh Plan. However, many of the relatively cheap schemes required for developing irrigation in areas with comparatively easy access to water were more or less exhausted during the British period. The states of Andhra Pradesh, Tamil Nadu and Uttar Pradesh witnessed the development of a large number of major irrigation schemes during the pre-Independence period. By the time the Independent government of India took up construction of irrigation schemes with the beginning of the plan-period, the capital cost of building up such schemes had increased substantially (see Table 4.3). The working group on major and medium irrigation for the Eighth Plan (1990-95) found that at current prices, investment in irrigation had increased from Rs. 1,530 per hectare of irrigated area in the First Plan to Rs.34,924 in (he Sixth Plan and to more than Rs.36,800 in the Seventh Plan. A study of Gulati, etal.,(1994) on the development cost of irrigation takes into account the inflation rate as well as the gestation lag phenomenon to examine cost of investment for major and medium schemes. In this study, the concept of pure time preference has been used to account for the time gap between expenditure incurred and benefit obtained(Gulati etal., 1994,pp.l-23). The results indicate that, at constant prices(1988-89 price level) and at different rates of pure time preferencc(5%, 7.5% and 10% per annum), the average investment per hectare of irrigation potential lies in a range of Rs. 35,084 to Rs. 61,814.

Various factors have contributed to this escalation in the cost from the late 1970's. A large number of new projects were taken up in most states during the Fifth Plan (1974-78) (see Table 4.3). As many as 404 major and medium irrigation schemes were taken up in the Fifth Plan as compared to only 127 in the Fourth Plan, A large number of new projects were taken up in most stales, during the plan period (1951-1990), (see table 4.4) This sudden increase in the number of projects undertaken resulted in their spreading of me limited funds available for irrigation investment. Substantial sums continued to be invested, in The aggregate, but in many cases produced no output for long periods of time because funds were divided among many uncompleted projects.

TABLE - 4.3: NEW IRRIGATION SCHEMES TAKEN UP IN INDIA IN DIFFERENT PLANS 1951-1990

PLANT PERIOD	NO. OF SCHEMES
First Plan (1951-56	236
Second Plan (1956-61)	139
Third Plan (1961 -66)	101
Annual Plans (1966-69)	48
Fourth Plan (1969-74)	127
Fifth Plan (1974-78)	404
Annual Plan (1978-80)	68
Sixth Plan (1980-85)	182
Seventh Plan (1985-90)	47

Source: Based on Government of India, 1989.

Secondly, projects taken up in the later plans are often on relatively different terrain and involved more geo-technical problems and entailed higher costs. In addition, environmental and rehabilitation considerations which were of little or no consequence for projects taken up earlier, are now an integral and substantial part of the capital outlay of any irrigation scheme. Thus, rising prices, wages and cost of materials contributed to rising costs of construction, repairs and maintenance.

TABLE - 4.4: CAPITAL COST OF MAJOR AND MEDEIUM SCHEME DEVELOPMENT PLANNING COMMISSION ESTIMATES

Plan Period	Expenditure (Rs)			Potential Created (M.H)		Apparent per-hectare created	investment of potential
	Actual	1970-71 prices	Annual average	Plan-wise	Annual average	actual	1970-71 prices
1	2	3	4	5	6	7(=2/5)	8(=3/5)
First Plan(1951-56)	3.80	8.27	1.65	2.48	0.50	1,530	3340
Second Plan(l956-61)	3.80	7.06	1.41	2.14	0.43	1,780	3,300
Third Plan (1961-66)	5.81	8.83	1.77	2.24	0.45	2,590	3.940
Annual Plan(l966-69)	4.34	5.26	1.75	1.53	0.51	2,840	3,440
Fourth Plan(l969-74)	12.37	11.24	2.25	2.61	0.52	4,740	4310
Fifth Plan(1974-78)	24.42	13.92	3.48	4.01	1.00	6,090	3,470
Annual Plan(1978-80)	20.56	8.67	4.34	1.89	0.95	10,880	4,590
Sixth Plan (1980-85)	73.69	19.69	3.94	2.11	0.42	34,924	9330
Seventh Plan (1985-90) (anticipated)	113.43	16.82	3.36	3.13	0.63	36,240	5380

Source: G O I, 1989; Report of the Working Group on Major and Medium Irrigation Programme for the Eighth Plan, 1990-95.

Expenditure at 1970-71 prices (column 3) are taken from the Report of the Working Group on Major and Medium Irrigation Programme for the Eighth Plan (1990-95). It does not explain what sort of deflator it uses to convert annual expenditures at 1970-71 constant prices. Instead, it gives the source of the deflator as Perspective Planning Division in Planning Commission. Enquiries with PPD revealed that they had worked out only an overall GDP deflator, and not the one specific to irrigation costs of major and medium irrigation schemes. The figures m column 4 are annual averages of real expenditure (at 1970-71 prices) incurred on major and medium schemes within me relevant plan. The figure of irrigation potential created in the Sixth Plan (2.11 MHa) is the reassessed one, which is about 38 percent lower man me one relased earner (3.40 Mha).

V

Increasing Cost of Irrigation in Andhra Pradesh

4.5.0 Introduction:

The real costs increased due to complexities of construction of the modem reservoirs with high dams, the average per hectare costs of construction of different types of irrigation works executed in Andhra Pradesh over time had increased (see Table 4.5). It is interesting to note that the average cost of creation of potential for an hectare from the Godavary Delta system was just Rs.62 in 1890. The cost of Rs.1418 per-hectare in respect of Kurnool-Cuddapah canal in 1870 was considered abnormal so far as the period is concerned (see Appendix-Vl-i). The average cost in respect of 22 works executed upto the end of 1900 A.D. in the 19* century worked out to a mere Rs.84 (1931 prices) whereas for the State of Andhra Pradesh the average per-hectare cost of the 3 delta systems excluding Kurnool - Cuddapah canal worked out to jusl Rs.lll. During the plan period (1951-95) as much as Rs.54,044 million (at historical prices unadjusted for inflation) has been spent by the state on the development of major and medium irrigation schemes. This investment increased the irrigation potential by 2,335000 hectares, from a pre-plan (1951) level of 1,331000 hectares to 3,666000 hectares by the end of the Eighth Plan (1990-95) found that current prices, investment in irrigation had increased from Rs.4,870 per-hectare of irrigated area in the first Plan to Rs.40,682 in the Eighth Plan (sec Table 4.6). Various factors have contributed to this escalation in cost from the late 1970's the major chief reasons being time and cost over-runs and spill over projects. These factors are same when compared to India as a whole.

TABLE - 4.5: COST PER ACRE AND UNDER ANNUAL IRRIGATION FROM DIVERSION WIERS (1988-89 PRICE LEVEL)

Name of the project	Actual estimated cost (Rs. In Lakhs 1960-61)	Total area irrigated or to be irrigated (hectares)	Cost of project per-hectare of area irrigated (Rs)	Year of commencement	Year of completion
1	2	3	4	5	6
Kurnool-Cuddapah Canal	844.82	59,575	1418	1863	1870
Godavari Delta System	313.54	5,07,720	62	1878	1890
Pennar River and Land system	71.85	68,881	104	1860	1894
Krishna Delta System	824.75	4,94,350	168	-	1898
Muniyery System	11 47	5,668	203	1898	1901
Mahbubnagar System	15.85	3,147	504	-	1904
Kanigiri Reservoir	35.00	38,000	92	-	1906
Nagavali River System	18.13	3,644	499	1910	1913
Nizam Sagar	40.40	76,000	532		1930

Source: GOI,1975; Central Board of Irrigation and Power Commission, New Delhi, pp. 1-37.

TABLE-4.6: PLANWISE EXPENDITURE INCURRED, POTENTIAL CREATED, POTENTIAL UTILISED AND COST OF IRRIGATION OF MAJOR AND MEDIUM IRRIGATION PROJECTS IN ANDHRA PRADESH

Plan period	Expenditure (Rs in crores)	Potential created (1000 ha)	Potential utilised (1000 ha)	Cost per-hectare of irrigation potential created (Rs)
1	2	3	4	5
Pre-plan potential created and utilisation		1,331.0	1,331.0	
First Plan (1951-56)	375	77.0	59.0	4,870
Second Plan (1956-61)	574	1,810.0	129.0	3,171
Third Plan (1961-66)	915	368.0	91.0	2,486
Annual Plan (1966-69)	609	78.0	350.0	7,807
Fourth Plan (1969-74)	1,187	190.0	217.0	6,247
Fifth Plan (1974-78)	2,691	21.10	175.0	12,633
Annual Plan (1978-80)	2,577	154.0	149.0	16,733
Sixth Plan (1980-85)	7,296	305.0	173.0	23.291
Seventh Plan(l985-90)	13,980	184.0	159.0	75,978
Eighth Plan (1990-95)	23,840	585.8	497.9	40,682

Source: 1) GOI,1989; Report of the Working Group on Major and Medium Irrigation for the Eighth Plan, 1990-95, PP.A4- 8 to A-108.
2) Central Water Commission, 1989, water related Statistics. P.31.

4.5.1 Time and Cost Over-runs:

The surface water potential available for irrigation and other purposes in Andhra Pradesh is at 2746 thousand million cubic feet (TMC) for creating an irrigation potential of about 210 lakh acres, out of which 158 lakh acres including Rs..41.40 lakh acres under pre-plan schemes and 30.75 lakh acres under the plan projects (1951 to 1985), were for the major and medium irrigation projects working out to 35.77% of available area for cultivation (GOI, 1984-85; pp. 105-126). Talking of resources, one has to take note of the escalating cost of irrigation projects and consequent delays in their completion. The larger inequity of the beneficiaries from irrigation passing on the cost of maintenance of the sources and the cost of servicing the debt incurred to benefit them to the general tax payer has continued. The constraint of public financial resources, low recovery from irrigation sector, the demand for irrigation out pacing its growth, too many projects competing for the few resources, were the reasons for time and cost over-runs.

4.5.2 Spilled-Over Projects :

The Sixth Plan (1980-85) envisaged an outlay of Rs.747.30 crores (24.11 percent of total plan outlay) comprising Rs.658.30 crores on the 41 on-going projects (10 major and 31 medium and Rs.89 crores on the 20 new projects (6 major and 14 medium) for creation of an additional irrigation potential of 12844 thousand acres (GOI 1984-85; P. 105-126) also (see Table-4.7).

TABLE- 4.7: SPILLED OVER PROJECTS - PLAN PERIOD (1951-85)

ITEM	MAJOR	MEDIUM	TOTAL
Total No. of Projects taken up to March 1980	16	71	87
Number of projects completed up to March 1980	6	40	46
Number of projects spilled over to Sixth Plan	10	31	1 41

Source. GOI,, 1984-85: "Report of Comptroller and Auditor General of India", Work expenditures: Financial results of Major and Medium Irrigation schemes, 1984-85, pp. 105-126.

The other reasons for time and cost over- runs in the programme of completion of these projects along with the cost of construction, repairs and maintenance were mainly due to taking up of additional items of work not contemplated in the original estimate. Cost escalations, insufficiency of funds, procedural delays in land acquisition, stoppage of works by contractors, foundation problems, change in scope and design of works, non-receipt of clearance from government of India for de-reservation of forest area and non-completion of bridges *on* railways crossings or other reasons (see Table - 4.8). According to latest estimates (Audit Report, 1984-85) substantial investments of Rs. 1448.53 crores for the remaining 39 on going projects and Rs.2907.07 crores for the 7 new projects taken up during the sixth plan period were required for their completion.

TABLE - 4.8: COST INCURRED DUE TO SOME REASONS

REASON	COST (Rs. in crores)
1 . Price escalation	372.84
2. Change in Design and additional works	794.38
3. Inadequate provisions	145.80
4. Inadequate survey and investigation	52.00
5. Other reasons	887.80
Total	1452.82

Source: GOI, 1984-85; Report of Comptroller and Auditor General of India, Work expenditures: Financial results of major and medium irrigation schemes, 1984-85, pp. 105-126.

VI
Operation and Maintenance Costs

4.6.0 Introduction:

Effective operation and maintenance of the existing system is generally presumed to be one of the important determinants of the degree of utilization of the created potential and efficient use of water resources for irrigation. The gap between the created potential and its utilization has been increasing steadily, specially in respect of major and medium canal irrigation systems in Andhra Pradesh and this has been a matter of concern during the eighties and nineties. The operation and maintenance of the pubic surface irrigation systems (major and medium) arc Largely carried out by the government. The responsibility of the state irrigation departments lies in maintaining facilities and regulating water supply up to outlets which commands any where between 12 to 100 acres (Gulati, et al., 1994, P. 2). There are instances where the irrigation departments are found maintaining the structure below the out-let level also, say field channels etc. There are, however, instances of the users involvement in maintenance of the tertiary systems and below. The need for attending to and maintaining the physical structure which comprises irrigation system arises from the normal wear and tear which these structures and facilities are subjected to. These physical facilities are expected to give service over the entire life of the project. Maintaining the efficiency of the system through periodic repair and maintenance is a pre-requisite.

Apart from the main canal and its components, a number of branches, distributaries, minors and sub-minors taking off from the main canals, also have to be maintained. The department, concerned, is also required to construct and maintain an elaborate communication network and support infrastructure. Some of the hydraulic and engineering components of irrigation schemes such as embankments and gates need regular maintenance and repairs.

4.6.1 Operation and Maintenance Costs of Major and Medium Irrigation Works:

There are four components of the expenditure on operation and maintenance costs. : (i) direction and administration, (ii) machinery and equipment, (iii) extension and improvement, and (iv) maintenance and repair. Overhead expenses such as wages and salaries included in the component direction and administration consumes a significant part of the total amount available for operation and maintenance leaving very little for actual maintenance work. The share of wages and salaries have gone up from little under 30% in the early 60's to near 50 percent in the late eighties (Gulati, et al, 1994, P.2). Reports of various committees[2] and commissions had suggested from time to time that the operation and maintenance of the existing irrigation project is not given its due share resulting in under-utilization of irrigation potential and the reduced efficiency with which the systems are operated. Finance Commissions also had examined this issue often had allocated operation and maintenance funds for canal irrigation schemes on me basis of the area irrigated by each scheme. The working group on major and medium irrigation for the Eighth Plan found that most of the allocated money for operation and maintenance diverted to staff salaries. The central problems, as brought about by various studies including the working group are the inadequacy of funds available to carry out the operation and maintenance activities and to find out ways and means to ensure a moderately high level of resources for operation and maintenance so that the systems could operate more efficiency.

There-upon, the Eighth Finance Commission (1984) recommended the provision of a consolidated amount of Rs.40.5 per acre of gross irrigated area for purpose of maintenance in all the slates and an additional 30% for the hill stales tike Himachal Pradesh, parts of Uttar Pradesh, Sikkim and Jammu and Kashmir. A later committee set up by the Ministry of water resources upgraded this norm to Rs.72.88 per acre per annum of gross irrigated area for operation and maintenance grant taking the base year as 1988. The working group on major and medium irrigation, however, felt that a minimum of Rs.80.1 per acre to 101.23 per acre was required to keep the system in good order. The Tenth Finance Commission (1994) has adopted a norm of Rs.12.50 per acre tor the utilized potential and Rs.40.5 per acre for the unutilized potential (GOI, 1994. pp 1-40). The norm adopted for the hill states are higher by 30%. A recent study on operation and maintenance expenses found that in the period 1960-61 to 1986-87, the total working expenses (at 1988-89 prices) ranged between Rs.44.13 and 77.70 per acre. Thus, the operation and maintenance expenses are increasing year by year, due to rising prices of other related materials.

Progressive deterioration in the standards of maintenance of sources has been the result of several factors. Before Independence, the government were primarily engaged in the maintenance and operation of the existing irrigation works and took up only a few new works. After Independence, especially since the beginning of planned economic development in the country, systematic exploitation of water resources for purpose of irrigation was taken up on a large scale through construction of dams/storages(see Appendix-V). A substantial portion of the plan outlay is being spent in almost all the states on new irrigation works major and medium.

4.6.2 Operation and Maintenance Expenses in Colonial India: Madras Presidency:

One of the effects of colonial rule in India was the decline of community assets and habits of community working and living. Instead, they instituted individual ownership of productive assets including land, and began to collect all the taxes and charges accordingly. This change had adversely affected many old native institutions that had been ensuring a balanced distribution of the produce among the various sections of the society and protected the delicate ecological balance of the different natural regions. Irrigation tanks in Rayalaseema was one such victim (Atchi Reddy, 1995, P. 108). Neglect of the age old practice of kudimaramath, i.e., the customary practice of engaging village labour, consequent on the increasing realization of the government responsibility has also been responsible for the present state of affairs while the state was progressively assuming the obligation for maintenance, it was increasingly finding it difficult to discharge this importance it was attaching to new construction, and extension of area under irrigation (Government of Madras, 1883., P. 1-8). In the choice of investment between maintenance and construction, the state prefers to attach greater importance to construction rather than to maintenance. The remarks of the First Indian Irrigation Commission (1903) were: "It *is* the opinion of most of the local officers in both the Revenue and Public works departments that the grants hitherto allowed are insufficient for the purpose" (GOI, 1903; P. 112) The same opinion continued to obtain among the officers as also the ayacutdars even later also This is also one of the reasons for inefficiency in quality and quantity of water receiving at the tail end and even command area of the projects concerned. The cumulative effect of these factors over a period of years has been the neglect of the irrigation systems which is assuming serious proportions. The trend has changed after Independence. The planned economy allocated in its budget in sufficient funds for operation and maintenance of major and medium irrigation systems.

The responsibility for the proper upkeep and maintenance of irrigation sources is a obligation and drainage works in the ryotwari tracts of the then Presidency were according to local custom (kudimaramath) to be attended by me ryots (Government of Madras. 1863., pp.4482-84). The main functions of me kudimaramath were : (i) to fill up gullies or other inequalities caused by rain or the treading of cattle, etc., upon the bunds of tanks and river, channels, (ii) to check the growth on bunds of prickly pear or other similar rank and pernicious weed, (iii) to clear away such underwood from the bunds of tanks as may be considered by the Executive Engineers to be injurious, (iv) to clear out the deposits from tank sluices and from river and spring channels so as to afford a sufficient opening for the supply of water to flow to the fields, (v) to clear and repair the earth work of petty and branch channels, and clear away the accumulations in all channels issuing from tanks which obstruct the flow of water to the fields, (vi) to keep in order the supply channels of tanks to such extent as is sanctioned by local custom, (vii) to water the bunds of all tanks during rainy weather, (viii) to construct ring dams at breaches, and where necessary to temporarily strengthen the bunds of tanks and channels during the season of cultivation. These functions were met by the ryots for the smooth running of water from source to the fields.

Irrigation tanks were maintained in a tolerable condition by the poligars even though they were oppressive in many respects. The removal of the numerous poligars by the British Government resulted in a death blow to some of the tanks whose bends were cutout and the big trees on their bunds were fell down during their protracted struggles with the intruding armies of the East India Company. Private tanks were the main victims as many of mem were maintained directly by the poligars or by their relatives and subordinates in the villages concerned The old records of tanks with details of their irrigation and cultivation, their establishment and maintenance were all lost in these disturbances. The institution of kudimaramath which was closely maintained by the poligars had lost much of its force with their disappearance. The revenue officers appointed by the East India Company could not command the necessary hierarchical obligation for the effective maintenance of kudimaramath, nor could they find any immediate alternative. The British Government of the 19th century had notified a number of tanks in ruins in the Rayalaseema area including Nellore district and suggested some suitable measures of improvement (Atchi Reddy, 1995, P. 116). Formerly the cultivators had to depend entirely on themselves for the maintenance of these works. If a tank or river canal failed, assistance in restoring ft might or might not be attended sooner or later by the state, but no reliance could be placed on such assistance and the people had to rely on then-own efforts on kudimaramath. But this system itself was not sufficient to ensure the perpetual maintenance of the tanks and reservoirs. Some repairs were required which were beyond the power of the cultivator to carry out or the works were wrecked by disastrous floods, and in other cases even kudimaramath could not wholly prevent, however, much it might retard deterioration. It thus happened that Government should devote more and more attention and money to the restoration and upkeep of these works, even before the obligation was accepted, on the recommendation of the famine commission of 1880. as a part of its regular policy (GOT, 1903; pp. 111-115). The irrigation commission recommended that a systematic devotion of funds to the improvement and maintenance of tanks/river, channels, but they pointed out that, if the cultivators cannot be made to do their small parts. If the ryots are not in a position to do the Government has to meet such works to do.

4.6.3 Practice of Kudimaramath:

The traditional system of maintenance and repairs to the irrigation tanks kudimaramath and cheruvumaramath suffered a severe blow with the enfranchisement of the inams of various denominations in the new settlement introduced in Rayalseema during the period 1870-1880. About 99% of them were enfranchised at varied rates of assessment. The Inam Commission found that not less than 8,84,867 acres of land in Kurnool district was occupied as inam in 1860, About 8.75,790 acres were enfranchised in the new settlement at rates of quit-rent, varying from 1/8 to 1/2 of the ordinary assessment. Subsequently, the service of mams of red dies, curnams, those of revenue and police persons who revendered state service were compulsorily enfranchised at 5/8 in the rupee of assessment. A number of village servicemen who used to take care of the tanks as functionaries were consequently turned into pilfers of the soil and stones from their bunds often resulting in their breaches during the heavy monsoon downpours (Atchi Reddy, 1995, P. 117). But in those areas other than Rayalaseema practice of the system was somewhat different. The collectors such as those of Visakhapatnam, Ramnad and Salem were too vague in the matters of the description of the forms of customary labour performed in their district to permit an exact classification of the labour and in some districts, such as South Arcot and Anantapur (Government of Madras, 1917., p.279). It was reported that some forms of customary labour were sometimes contributed voluntarily while other items were not performed except under pressure. It could be generally seen in the collector's reports that in all cases in which the ryots were threatened with immediate loss of crops or damage they readily and voluntarily contributed such items of customary labour as were necessary to avert the loss. Where, however, the results of neglect were not immediate, neglect was found everywhere and things went from bad to worse till the heavy expenditure had to be incurred. The items of kudimanumath work can be classified into three : digging of channels in river beds, and repairs and maintenance of tanks irrigating ten acres and less.

In spite of such excellent advocacy of the practice by the Commission, the Madras Government found the enforcement of the practice cumbersome and unpopular and consequently chose to implement the recommendation of levy for a cess and enacted the Madras Irrigation (voluntary) Cess Act of 1942 to obviate these difficulties. This Act provides for the levy of voluntary cess for the maintenance of irrigation and drainage works of all kinds which are owned and controlled by the State Government and serving ryotwari tracts and also estate areas not taken over by the Government. There is provision in this Act for the levy of cess in lieu of kudimanunath only when the holders of two-thirds of the land served by the irrigation or drainage works so desire.

4.6.4 Operation and Maintenance Expences in India and Andhra Pradesh:

While the normal maintenance of sources has been traditionally the customary obligation of the ryots the government has been incurring progressively larger sums towards operation and maintenance of Irrigation sources. The Government earmarks every year, in the budget funds for extensions and improvements, flood repairs, pro-rata charges for tools and plant and superior establishment of maintenance and repairs.

Till the year 1965-66, maintenance amounts earmarked in the annual budget of the irrigation department remained at about Rs.1.50 per acre which was considered far too low for the proper maintenance of sources. The joint central team on Agricultural Programmes recommended increase in this rate to Rs.3.50 per acre citing the orders issued by the Panchayat Raj department, fixing the maintenance grants for sources under its control at Rs.3.50 per acre. Further, it was increased to Rs.4.00 per acre (Government of A.P, No. 48, 1966). Even this enhancement was considered inadequate for the proper maintenance of sources. In the present inflationary situation the salary of the work charged establishment have been increasing rapidly, with the receipts from farmer and grant from government remaining static and establishment cost increasing due to revision of wages and allowances, cost of labour and materials has also been going up from year to year.

TABLE - 4.9: WORKING EXPENSES AND GROSS RECEIPTS FROM MAJOR AND MEDIUM IRRIGATION SOURCES IN ANDHRA PRADESH (1988-89 CURRENT PRICES) (RS. IN LAKHS)

Year	Working Expenses	Gross Receipts	% Recovery Of Working Expenses Through Gross Receipts
1976-77	985.00	109.20	11.09
1977-78	930.00	99.20	10.67
1978-79	811.00	107.80	13.29
1980-81	1843.92	128.93	6.99
1985-86	3886.52	1435.30	36.93
1986-87	3424.45	341.74	9.98
1987-88	13463.58	1042.30	7.74
1988-89	49098.47	544.07	1.11
1989-90	31553.70	3520.79	11.16

Source: Report of Comptroller and Auditor General of India, 1984-85, pp. 105-126 and Eighth and Ninth Finance Commission reports, 1984 and 1989, pp. Ann. III-10-19

The operation and maintenance expenses in respect of major and medium river projects in Andhra Pradesh, shows that the gross receipts had been falling short of the total working expenses. From 1976-77 to 1988-89, the loss increased from approximately Rs.876 lakh to 48,555 lakh, and in 1980-90 it was Rs.28,032 lakhs (See Table - 4.9). The Table also shows the gross receipts as percentage working expenses find that the gross receipts from major and medium irrigation projects covered only on an average 10% for the whole period 1976-77 to 1989-90. During the year 1985-86 it was 37% which creating a mounting burden of loss to me government.

TABLE - 4.10: WORKING EXPENSES AND RECEIPTS IN RELATION TO IRRIGATION POTENTIAL UTILIZED BY THE MAJOR AND MEDIUM IRRIGATION PROJECTS IN ANDHRA PRADESH (1980-81 CONSTANT PRICES) (Rs. per acre)

ITEM	YEAR		
	1977-78	1979-80	1984-85
Receipts per acre of litigation potential utilized Major and Medium irrigation projects	2	2.1	10.12
Working expenses per acre of Irrigation potential utilized Major and Medium irrigation projects	23	23.2	38.41
Receipts per acre in relation to working expenses (%) per cent	8.78	903	26.35

Source: Central Water Commission, 1988, Ministry of Power and Water Resources, New Delhi.

Another way of looking into the irrigation receipts in relation to working expenses is to compare the per acre receipts from irrigation potential utilised with per-acre working expenses of the same in Andhra Pradesh (see Table-4.10). The data show out the poor recovery of revenue in relation to working expenses.

VII
CONCLUSION

The pattern of investment involves process of innovation that reduces the cost per unit of output. The theories of investment reveal that investment demand theory requires both the flow and stock approaches. This is so because the demand price of an investment good is nothing but the present value of the present and future nominal products of capital. When applied to concrete situations, these theoretical issues present economic problems which influence both public and private investments.

A major determinant of growth in areas irrigated by surface irrigation is the volume of public investment in such projects. In India, annual expenditure in real terms and per-hectare of irrigation potential created rose steadily throughout the period since Independence. This phenomenon is arising mostly from an autonomous rise in costs. The wholesale prices of all commodities increased and this has obvious effect on the cost of construction, repairs and maintenance of irrigation sources.

The analysis reveals that the widening gap between the receipts from irrigation and expenses on their operation and maintenance resulted in the paucity of fund: for reinvesting. To sustain me current and future expected levels of agricultural development, sufficient and timely water must be made available through the major and medium surface irrigation systems. These systems need to be operated well and maintained efficiently as well as to regular repairs. The data indicate that the gross receipts in general fell far short of the working expenses, and it is this widening gap which resulted in the paucity of funds for operation and maintenance, and not to speak of any sizeable new flows into the new investments. The results reveal a raising pattern of per - hectare capital costs over the period of 1950-1990.

APPENDIX-IV-i

TABLE SHOWING COST PER ACRE UNDER ANNUAL IRRIGATION FROM DIVERSION / STORAGE WEIRS IN ANDHRA PRADESH (MAJOR AND MEDIUM)

(RS. IN LAKHS)

Name of The Project	Actual or estimated Cost (Rs In Lakhs)	Total Area Irrigated or Utilised or To Be Irrigated (Acres)	Cost Of Project Per-Acre Of Area Irrigated (Rs)	Year Of Commencement Completion
GROUP (I) : WORKS COMPLETED UP TO 1900				
KC. Canal	844.82	147149	574	1863-1870
Godavari della system	313.54	1254068	25	1877-1890
Pennar River canal system	71.85	170135	42	1860-1894
Krishna Delta System	824.75	1221045	68	-1870
GROUP (ii) WORKS COMPLETED FROM 1901-1950				
Muniyeru system	11.47	14001	82	1898-1901
Mahboobnagar canal	15.85	7774	204	-1904
Kanigiri Reservoir	35.00	93860	37.25	-1906
Nagavali River system	18.13	9000	202.00	1909-1913
Nizamsagar	40.4	187720	215.20	1924-1930
Mopad Reservoir	24.37	9125	37.00	1899-1906
Wyra Reservoir	30.92	13680	266.00	1923-1929
Pocharam project	27.83	14646	190.00	1916-1939
Palair project	21.86	16102	13600	1923-1941
Dindi project	38.89	19502	200.00	1940-1943
GROUP (in) WORKS COMPLETED / COMPLETION FROM 1950-1951 ONWARDS				
Manair project	104.66	17014	61600	1944-1950
Rajoli Banda Division Scheme	565.00	117674	480.00	1947-1963
Rallapadu	105.39	6005	1755.00	1951-1957
Upper Pennar	159.18	9700	1641 00	1950-1958
Bairavanittipa project	145.00	17011	858.00	1953-1962
Musi project	250.00	52602	47500	1953-l964
Anicut Across Vedavathi	26.92	58000	46400	1954-1959
Krishna barrage	295.00	5931	4974.00	1954-1960
Paleru Bitragunta	29.77	5470	54400	1959-1964
Paidigam project	19.50	5500	35500	1959 - 1965
Denkada	28.19	6591	1569.00	1959-1965
Zurreru Project	31.41	2002	1569.00	1961-1964
Sahvagu	34.39	2800	122.00	1960-1965
Jutpalli	16.22	2199	737.00	1959-1965
Kaddam project	618.00	86004	"1900	1949-1966
Laknapur project	20.79	3000	69300	1959-1966

Swarna project	47.93	8632	555.00	1959-1966
Tungabhadra low levelcanal	1337.00	148.87	898.00	1951-1971
Tungabhadra high level canal-I	1964.77	119.12	1641.00	1951-1971
Sri-Ramsagm evised State-I Nagarjunasagar	4010.00 9110.00	128000 884000	1268.00 41700	1963 1955
Snsailam Right Branch Canal	22000.00	77000	11567.00	1981
Somasila project	1720.00	133000	524.00	1975
Vamsadhara Stage I	880.00	60000	594.00	1972
Jurala project	7640.00	41000	7544.00	1983
Telugu Ganga project	63650.00	223000	11556.00	1983
Pulivendula Branch canal	30.00	17000	72.00	1973
Tungabhadra High level	91.00	20000	184.00	1967
Tandava Reserviour	20.00	-		1959
Tamonihiru Reserviour project	27.00	-		1969

Source: Government of Andhra Pradesh, 1973., A.P. Irrigation Commission Report, 1973, pp.247 - 248 and Irrigation Department, Andhra Pradesh, Different Annual Plans.

NOTES :

1. Public investment will have a leading role to play in the form of providing infrastructure as well as in providing necessary research and development support. There is a significant relationship between public investment in agriculture and private investment undertaken by the fanners (Chakravarry. S. 1987, p. 75).
2. Irrigation projects until 1964 were approved on financial criteria, excepting the protective irrigation works such as famine relief works in areas exposed to chrome water scarcity. Later, when new schemes were undertaken, it was felt that the development of irrigation, essential for increasing agricultural production and productivity, was being held up by the rigid application of the financial criterion of rate of return, which was *6%* between 1921 and 1949. After Independence, irrigation development was stepped up. The minimum return on investment in the irrigation projects was reduced from 6% to 3.75% in 1949. As a further effort towards improvement, the use of opportunity cost of various imputs and outputs rather than their market prices to reflect their real value (Planning Commission, 1983, pp. 13-15). This Committee also suggested that in the economic analysis of irrigation projects, the Discounted Cash Flow (DCF) method be followed for the benefit - cost analysis, as it makes clear the advantages of quick implementation of the project and also a quick realization of benefits. The minimum expected rate of return was *9%* for general areas and 7% for drought-prone and flood-prone areas where 75% or more of the dependable flows of the basins had already been utilized. The National Conference on Irrigation and Water Resources Minister, 1986, remarked on the extremely low water rates that were prevalent in the country and the fact that they were not sufficient to cover even Operation and Maintenance costs (Government of India; 1986, pp.31-32). The Jakhade Committee (1987) remarked on the extremely low water rates that were prevalent in the country and the fact that they were not sufficient to cover even Operation and Maintenance costs. The National Water Policy (1987) emphasised the need that water rates should be such as to cover Operation and

Maintenance charges and a part of the fixed capital cost (Government of India, 1987, pp.45-46). This was reiterated by the various Finance Commissions and Public Accounts Committees. (Government of India, Public Accounts Committee, 1983, pp.52-53). Investment in irrigation resulted in enormous losses to me national exchequer. They opined that irrigation schemes should yield enough to pay for maintenance and operation and depreciation charges along with some interest on the capital invested. They recommended a five - yearly evaluation of projects to find the extent to which expected benefits have been achieved and to decide what has to be done in future in order to extract maximum benefits. The Fifth Finance Commission recommended that Operation and Maintenance cost plus 2.5% of the capital to be recovered. This rate of 2.5% was subsequently brought down to 1% proposed by Sixth and Seventh Finance Commissions. The Eighth Finance Commission brought this rale down to zero, a position which was reiterated by the Ninth Finance Commission.

CHAPTER-V

EVOLUTION OF THE WATER RATES IN INDIA : 1850 - 1990

I

Introduction

5.1.0 The irrigation policy of the British rulers was marked by an apparent change in the methods of fixing of water rates. This was mainly because of the strong commercial motivations of that government. The need for rationalisation of water ratal arose with the commencement of the irrigation under major river deltas in the early 1850's in the Madras Presidency. The basis of charging for water in the British period, when supplied by-Government works, was chiefly the area irrigated. But different systems of charging were in operation in different parts of the Presidency at different points of time. An attempt is made here to trace the origin, evolution and rationalisation of the water rates in the British period as well as in Independent India in general and Andhra Pradesh in particular.

5.1.1 Water Rates Policy:

There are basically two main considerations in fixing water rates, namely the consideration of me cost involved in the construction of an irrigation project, and the benefits accruing from irrigation to the users of water. Various principles have been laid down for determining the viability of individual irrigation projects. G.N.Taylor found in 1858 that the increased revenue collections of Government in specific areas were due mainly to the construction of the anicuts in the Godawi and Krishna districts (Government of Madras, 1858., pp. 19-20). Some concrete measurements were undertaken even before Taylor's Report chiefly in terms of the collection of revenue by the Government. Referring to the principle according to which the water rate was to be imposed, Mr.Taylor observed that it was simply a test by which to determine whether the assessment already levied was sufficiently high, or whether additions could fairly be made to the demand. The great objective was to ascertain what the land actually yielded when supplied with anicut water. And if it were found that the amount of gross produce and the generally improved circumstances of a village justified the levy of teerwajasty, to assess it accordingly that is to make an addition to the collective or joint rent of the villages, the distribution of which should be left to the ryots themselves. The water tax being determined on general data, and its amount discretionary and Wended with the assessment of the village, it can not be represented by a given sum. The irrigated products were viewed under two classes. Those that required a large quantity of water to bring them to maturity, and those for which a moderate supply was sufficient The farmer included paddy, sugarcane, and coconut plantations: and the latter included, turmeric, onions, and an ordinary garden produce. The quantity of water necessary to bring these products to maturity varied with their class, and all in the same class requiring almost the same quantity of water. To tax a given extent with reference to the product is the same thing as taxing it with reference to the quantity of water used (Government of Madras, 1858,pp. 166-67). The true mode of taxing irrigated land was that which has the sanction of immemorial usage, viz., to fix the assessment on a joint consideration of the quality of the land and of the quality of the irrigation. Two scales of rates for the different soils of a district were thus fixed; one for lands enjoying a full and certain supply of water, the other for lands, the irrigation of which was imperfect This rule applied equally to tanks and river channels. The measurement was mostly confined to the collection of land revenue. It was only in a few cases that it was extended to sources of revenue other than land revenue and water charges. As a matter of fact, mere seems to have been an undue emphasis on the revenue receipts from irrigation projects and most estimates and calculations in connection with the assessment of economics of irrigation development concerned themselves with the direct return of investment (Gadgil, D.R., 1948., p.2). Thus, during the 19th century the test for economic soundness of an irrigation project in India was baaed chiefly on the direct returns on the investment

Later on came into being the criterion of productivity of the projects. Irrigation projects were regarded as productive or unproductive accordingly as the yielded a *net* revenue above or below a certain fixed percentage (4%) calculated at the sum-at-charge, ten years after the completion. The sum-at-charge constituted the total capital outlay and the arrears of interest The determination of the rate of return was made by the Government of India from time to time. This criterion was also adopted by the Select Committee of the House of Commons in 1879 which stated that, "the financial results of irrigation are, in the opinion of the committee, the best test of their utility". The object of me Select Committee Report(1879) was to provide a formal criterion for allocating loan funds among the various canal projects. However, they masted mat a productive work should yield annually a given money rate of return, besides meeting the annual working expenses (Public Works Department, 1879, pp-III-XXI). This principle was followed since men and the rate of return required, before an irrigation project could be considered as financially productive and economically sound was fixed from time to time according to the prevailing conditions. There was a great dissatisfaction with this rate of return towards me close of the past century in India due to the realisation of the fact mat (here were many indirect benefits from irrigation to the community at large. And the financial test of economic soundness of an irrigation project was too rigorous to present a correct picture of the economics of irrigation.

In order to avoid such problems and to evolve an improved criteria, the Government of India, appointed the Royal Commission on Irrigation in 1901. The report of this Commission favoured the productivity test which was adopted by the Select Committee (1879). The Report stated mat it had been often urged that the indirect advantages of irrigation in India were so great and incontestable that the question of the direct financial returns which might be anticipated on the capital outlay was one of minor importance to which very tittle regard should be paid. But in the context of water rate on the productive works, it should include a charge for the supply of water which would cover primarily the debt charges and overhead expenses (GOI, 1903, p.27). This was again observed by the Taxation Enquiry Committee (1924-23), mat it was difficult to evaluate exactly the extra net income of land from irrigation and that this being so me simple thing to do would be to charge a fraction of grow produce of irrigated land at water rales (Government of Madras, 1926, pp.99-110). But the Committee held mat the direct returns from irrigation project were maintained.

II

Water Rates in the Madras Presidency, 1850-1953

5.2.1 The need of legislating in order to clearly define the position of the state in respect of irrigation was recognized as early as 1856 when the Governor-in-Council directed the drafting of an Act to set out what was clearly the common law of the country, viz., that rivers and natural streams as well as springs in unoccupied or Government land belong to Government(Dhamar Kumar, 1975, pp.230-231)[1]. "Whenever water is supplied or used for purpose of irrigation from any river, stream, channel, tank, or work belonging to or constructed by Government it shall be lawful for the Government to levy at pleasure on the land so irrigated a separate cess for the use of the water, which cess shall be additional to any land assessment that may be leviable on the said land as un-irrigated or Punjab" (Government of Madras, 1865, pp. 130-131). All lands permanently supplied with the means of irrigation for a single wet crop and which are cultivated as nunjah and have actually been irrigated for two or more seasons prior to the 18th July, 1863 were classed as irrigated and charged Rs. 3 per acre per annum for water, in addition to their fixed land assessment Whenever water was supplied for a second crop of any description of nunjah land, in addition a water rate of Rs.3 per acre was charged for the same.

Except in the Godavari and Krishna deltas and on the Kurnool-Cuddapah canal, the assessment on irrigated land was consolidated, and the shares due respectively to land and water could be only approximately determined. In the Godavari and Krishna deltas and on the Kurnool-Cuddapah canal, the assessment on irrigated lands was not consolidated, but a separate water rate was levied on the area irrigated. For the determination of the share due to irrigation resulting from the disintegration of consolidated assessments, elaborate rules were framed (Government of Madras, 1879, P.38). Where assessments had been revised by the Settlement Department, the consolidated assessments were resolved into land and irrigation revenue respectively, by assigning to land the amount proper to dry lands of the same class and sort in each village and the remainder to water

(Government of Madras, 1879, P.39). Where settlements had not been revised the average dry rate of the village, or where that was not available of the talooks, or where that could not be determined of the district, the rate was applied to the total area irrigated. The product was then assigned to land and the remainder to water. With regard to double crop lands, the charge for the two crops was consolidated-the charge for the second crop being essentially in the nature of a water-rate.

TABLE- 5.1: WATER RATES IN THE GODAVARI AND KRISHNA DELTAS AND ON THE KURNOOL-CUDDAPAH CANAL - 1869 (IN RUPEES PER ACRE)

Nature of Crop	Godavari and Krishna Deltas	Karnool-Cuddapah canal
Single wet crop, per acre	4	4
Second wet crop, per acre	4	3
If compounded for both crops for not less than five years	6.5	6
Single dry crop Second dry crop on irrigated lands if not compounded	2 2	1 1
Garden crop	8	6
Garden crop if compounded for not less than five years	6.5	-
Crops requiring frequent floodings	-	3

Source: Based on CD.Maclean, 1987, P.411

The rates were fixed according to the Revenue settlements, and the difference in the water-rate both in Godavari, Krishna and the Kurnool-Cuddapah deltas were due to the variations in duration and supply of water to the tracts, where both wet and dry crops were sown(see Table 5.1). In tracts like the Krishna and Godavari deltas, the assessments of irrigated lands were made up of the assessment of me lands considered as dry with the addition of a separate water rate. In all districts of the Madras Presidency that had been re-settled by the Settlement Department, the assessments of the same class and sort of dry lands were determined accordingly. In other cases, they were approximated based chiefly on the application of average dry rates to wet areas, the product representing the land assessment proper and the balance of the wet assessment was assigned to irrigation. The incidence of irrigation revenue per acre for each class of works, was deduced from the same accounts on the works of Classes I and II (see Table 5.2).

Table 5.2: INCIDENTS OF IRRIGATION REVENUE UNDER EACH CLASS OF WORK **1869**

CLASS OF WORK	AVERAGE IRRIGATION REVENUE PER ACRE (RS.)
Works which capital and Revenue Accounts arc kept	
I Productive public works	3.27
II Public works not classed as productive Works for which neither capital nor revenue accounts are kept:	3.28
III Works for which in a continuous records of expenditure is maintained individually	4.93

Source: Based on C.D.Maclean, 1987, P.419

The greater part of the amount of water-tax was levied in the delta talooks irrigated from the Godavari and Krishna anicuts, where all lands were assessed at the dry rates, water tax being separately imposed on the customary nunjah lands, which elsewhere paid a consolidated assessment. This was the practice till 1869, and the Board of Revenue then condemned the system on the grounds that, the ryot was in the hands of the karanam who was powerful, frauds were perpetrated on Government, and the cultivator never knew exactly what was really due by him. The rates themselves were numerous and unfair (Government of Madras, 1869, Para-7). This led to the introduction in 1874 of a system of fixed water-rates Rs.4 per acre being charged for a wet crop grown on dry land and Rs.2 for dry crop. A distinction between occasional and systematic irrigation was drawn in 1890 and crops systematically irrigated became chargeable as wet (Government of Madras, No. 272, 1890). Prior to 1890, the charge for water was regulated by the class of crop raised, but not by the number of waterings it received. In that year, a charge was made by the term dry crops was hardly appropriate to crops which were regularly irrigated and it was therefore directed that when crops, which might be grown as dry crops, were systematically irrigated, they should be charged as wet. Six years later, it was pointed out by Nicholson, Collector of Anantapur mat the systematically irrigated crops were not wet in the same sense as paddy. Thereupon, the Board of Revenue of Madras recommended a rate intermediate between the wet and dry rates which was imposed on dry crops systematically irrigated and charged on crops grown in beds and irrigated at regular intervals (Government of Madras, No.3038, 1896). The Board in reporting on the effects of tins scale in 1903, said that the intermediate scale was complex and uncertain in its application, that the distinction between systematic and occasional irrigation was impossible to maintain with fairness and that it gave great scope for fraud and black mail (Government of Madras, 1903, pp. 271-281). The Government men proposed to abolish the intermediate systematic-irrigation rate and to base all water-rates on a definite classification of crops as dry or wet in each district.

The Board in reply condemned the fixed water-rate system. Its objections to this system were that it made a distinction between systematic and occasional irrigation, that it assumed only two classes of irrigation sources where as in most districts mere were four or five or six classes, that it involved a classification of crops, a procedure inconsistent with the principles underlying the ryotwari settlement, and mat it penalized the bad lands and let off the good lands too lightly(Government of Madras, 1923,pp.34-35). The Board recommended in its place the differential system, which stated that, when a dry land was irrigated, the appropriate water rate was the difference between the wet assessment and the corresponding dry assessment for the same class and sort of land It imposed the same charge for raising a wet crop like paddy on dry land as for raising there on an irrigated dry crop of poor quality like ragi. On the other hand, it had the advantage of being more equitable man the existing arrangement, in as much as under it the poorer soils should pay less man the richer and the charge for water should be proportionate to the known fertility of the soil

Another advantage incidental to the application of differential water-rates was that as irrigation sources are divided into four or five classes for purposes of fixing the wet assessment against only two for water-rate, the scheme would make greater allowances for differences in the capacity of the irrigation sources than was possible under a uniform water-rate (Government of Madras, 1923, pp.34-35). The Government agreed for the adoption of a graduated scale of water-rates based on the settlement classification of the soils and on a simple division of crops into two main groups wet and dry. The Government accordingly drew up a scheme in 1906 for water-rates in varying terms of the difference between the wet and dry assessments. The scheme was introduced first in Kurnool district.

Again in 1913, the Board condemned the differential system on the grounds that it was inefficient and pointed out that the fixed rate system caused no serious injustice though open to the objection that it did not take sufficient account of the adequacy of supply. If the relative productivity of soils be taken into consideration in determining water-rate, the best method would be to group the dry lands of each district into two or more classes with reference to their supposed value under irrigation assigning a fixed rate to each class. It was really unnecessary to attempt to discriminate relative productivity, but it was desirable that the quantity of water available should not be ignored in fixing the charge for water, and that such quantity could be allowed for by attaching a separate fixed rate to each group of sources in a district (Government of Madras, 1923, P.35). On these grounds, the Board urged, the abolition of the differential system and the introduction of a system of fixed water-rates varying with the adequacy of supply of the irrigation source. The abolition of the distinction between systematic and occasional irrigation, and the grouping of irrigation sources for purposes of Water rate into two groups became effective. The Government decided to discontinue the differential system and propounded a scale in which irrigation sources and soils were each grouped into three classes. Again the Board recommended that the grouping of soils might be given up and that the rates should depend on a classification of source alone. Some revised rules for the levy of water-cess on dry lands irrigated from a Government source or work m lieu of the existing rules in relating to standard scale of water rates, the Godavari, Krishna and Guntur districts, the Kurnool-Cuddapah canal, Kurnool district etc. Irrigation sources were divided into three groups for purposes of charging water rate (Government of Madras, 1923, P.66). Irrigation sources which could ordinarily afford a supply of water for not less than eight months in the year were placed in the first group; irrigation sources which could afford a supply of water from five to eight months were placed in the second group. Other irrigation sources were in the third group (see Table - 5.3). Second and third wet crop would be half the rate charged for a angle wet crop with variation in the supply of water.

TABLE-5.3: WATER RATES OF DIFFERENT CROPS, 1923

Nature of Crop	Group-I (Rs.-Annas)	Group-Ii (Rs.-Annas)	Group-Iii (Rs.-Annas)
For a single wet crop per acre (Paddy)	6-4	4-3	3-2
For a single dry crop per acre	3-2	2-1	1-9
For a double crop per acre	0-6	6-4 !	4-11 !

Source : Government of Madras, Revenue, No. 1089, dt. 19.07.1923 (Ms), P.66.

From 1874 to 1906, the processes of development ranged from the simple to the complex. In selling a charge for water supplied for irrigation, the factors considered were the area of the land irrigated, the quantity of water supplied and the period during which it was supplied, the soil of the land irrigated and the effect on the productivity of the soil caused by bringing water to it. AD these factors and more were considered in the settlement of a consolidated wet assessment.

III

Systems of Water Rates

5.3.0 introduction:

There were several systems for levying separate water rates in the Madras Presidency. They are: wet assessment, differential water rate, volumetric rate, and fixed water rate along with a few specific rates.

5.3.1 Consolidated Wet Assessment:

Consolidated wet assessment was the system of levy of charges tor irrigation adopted in the erstwhile Madras Presidency, the princely states of Mysore, and Hyderabad and parts of the Bombay Presidency. The charge for water under dm system was merged in land revenue proper and fixed on settlement principles, with due regard to soil characteristics and the productive capacity of lands. Madras was the only state in India which had adopted net produce as the basis of land revenue assessment (Government of Madras, 1878, P. 1143). During the settlement, net produce was derived by deducting the cultivation expenses from the gross value of produce. The Indian Irrigation Commission

1901-03 was of the opinion that consolidated wet assessment system was evidently the most simple and the area irrigated was subject only to slight changes as in the rice fields of the deltas in Southern India (Government of India; 1903, pp. 69-98). One of the essential preliminaries under this system was an accurate survey and soil classification of each individual holding.

The estimates of net produce in this system, were the result of conjecture as of investigations tempered by informed judgment, since the estimates in regard to commutation rates and cultivation expenses had a definite bias towards under estimation of the value of net produce, the final rates adopted were in actual practice less man the theoretical standard of 50% of the net produce (Government of Andhra Pradesh, 1959, pp. 498-500). Under the Telangana system, the role of scientific soil rating in the fixation of land revenue rates was considerably minimised due to the high degree of description enjoyed by the settlement officers. While in the Andhra area, the unit of settlement was a tract comprising one or more talooks, the unit for the settlement in Telangana was a group denoted by a maximum rate of assessment which comprised various groups villages in various talooks (Government of Andhra Pradesh, 1959: pp.498-500). The advantage of the ryotwari settlement principle was that an attempt was made to relate the land revenue to the productivity of the soil as it was the productive capacity of the soil which determined the output which enabled the ryot to pay a portion of this output *as* land revenue. The original settlement was based on a soil classification done in detail and with great care. The relative values of the lands were reflected in the soil classes they carried and the relative rates of dry land revenue or wet assessment was dependent on this soil rating. Consolidated wet assessment method of levy of charges for the use of water, when they stated that it avoided multiplicity of tax and reduced, to some extent, the cost of assessment. The system also provided for compulsory payment of the water charges which ensured a minimum return on the project The rate of tax was dependent on me value of water to the cultivator which was influenced by the nature of the sod of the land under irrigation. The Maharashtra Irrigation Commission was of the view that this system was well suited when a single category of crop alone (Government of

Maharashtra, 1962,pp.67-75)). And was grown as it used to be during the days of settlement in the Madras Presidency, as the several irrigators got the same average benefit from an acre from year to year due to uniform cropping pattern.

5.3.2 Some Defects:

During the settlement, calculations in the Andhra Area were the ascertainment of the standard staple grain. For irrigated land the standard grain adopted was uniformly paddy to the exclusion of other irrigated crops presumably due to the non-existence of the practice of irrigating dry crops. This practice had led to the inequality of burden of tax between the lands cultivated with commercial crops and food crops. The determination of the standard grain which in all cases of wet cultivation had been paddy, the next defect in the settlement process was the ascertainment of the outturn of such crop on lands of different soils. In the early stages of settlement work, this was done after numerous crop cutting experiments on different classes of soils. But after 1882 the actual crop cutting experiments were dispensed with in general and the average of the out turns of the adjoining districts was adopted. Actual experiments of out-turns were conducted only in special cases (Government of Andhra Pradesh, 1959, pp.498-500). The results of these experiments could not be considered as the correct standards for the reason that they were likely to have been affected by the seasonal conditions of the years in which the experiments were conducted. The grain out-turns required to be commuted into money value since the assessment was payable in cash. There was no uniform method adopted for computing the commutation rate in the settlements conducted in the earlier years. But after 1885, the prices of 20 non-famine years in the preceding year of settlement were taken into account in working out the commutation rates.

In the Telangana area, water class value was also taken into account besides soil value while fixing water rates depending on the character and the value of the means of irrigation assigned to each unit of land. For the purpose of pani classification or water classification, a distinction was made between sources having an ayacut of 30 acres and above and those having an ayacut below 30 acres (Government of Andhra Pradesh; 1973, pp. 193-220). In the Telangana system, there had never been any attempt to fix the average cost of cultivation even on a rough way as was done in the Madras system or to find out the net produce and then to fix the assessment equal to the money value of a certain percentage of the net produce calculated with fair commutation prices (Government of Andhra Pradesh, 1973: pp. 193-220). The empirical method excluded, by definition in precise concept as to the tax base and the share of the state eliminated by implication, any systematic and scientific procedure in fixing the rates. The consolidated wet assessment method of levy of water charge, related to the productivity of the soil, could be said to have existed then when settlement was done but could not be considered to be reflective of the present productivity. On the other hand, the pattern of agricultural production vastly changed in recent years efficient functioning of irrigation works and the improvement in prices and yields of different crops.

5.3.3 Replacement of Consolidated Wet Assessment:

Owing to some defects of the wet assessment, the Government considered the system as inefficient and recommended abolition of consolidated wet assessment Then all registered wet lands would have to be hereafter treated as dry, liable to pay land revenue like any other dry land. These lands would be charged, in addition, an appropriate water rate for the supply of water. The process of abolition was as in 1868. The Secretary of State laid down as the policy that, in order to justify the expenditure of borrowed money on the construction of irrigation works, the increased returns from the works should yield an income at least equal to the interest on tile outlay on the works, that a clear account of the returns directly due to the irrigation should be maintained.

The controversy regarding the differential and fixed water rates began in 1878 in various regions of Madras Presidency. Mr. Wilson, the Special Officer for the compilation of Revenue Receipts, pointed out that in the case of districts to winch the separation of the settlement department have been extended, the resolution was easy; the class of sort of the wet land were known, but in the non-settled districts the facilities for thus determining at once the revenue due to irrigation were thus wanting. An approximation to its value might be obtained by a comparison of the average wet and dry rates of the occupied lands in the village (Government of Madras, 1878; P. 1445). But the Board of Revenue did not agree. According to them, it was necessary either to assume a fixed water rate, or to take as water rate the difference between the dry and wet assessment of every field As regards the first alternative, the Board held mat it was impossible to assume a fixed water rate as the charge for water always varied with the soil and position of the land, while in regard to the second, it pointed out that although it was not unreasonable to assume the difference between the wet and dry rates as the charge for water, me field by field separation of the irrigation revenue in settled tracts would be entire burdensome work.

The Board accordingly issued the additional rules for general adoption in this Presidency. On the lands in the Krishna and Godavari anicute where the land tax and water rale were distinct, the amount credited to irrigation works was to be the total demand for water rate minus the actual remissions of land tax and water rate granted on account of excess or deficiency of irrigation. In the case of consolidated quit rents on usual wet inams, one-third of such quit rents was to be taken to represent the land tax and two-thirds were to be taken as the irrigation credit. No part of the peshkush on zamindari lands irrigated from Government works would be included in the irrigation credit On all lands except those above provided for where the land tax and water rates were consolidated the average dry crop rate of the village if this could be conveniently ascertained or of the district in other cases is to be applied to the irrigated area. The product of the dry rate multiplied into the irrigated area would men be deducted from the total wet revenue collections. The following water rates are to be included in irrigation credits: the whole charge for second crop, the water rate levied on dry lands converted into wet the water rate on dry crops watered and the water rate on zamindari dry lands inams other than usual wet inams paying consolidated rents.

The Board proposed in 1917 to adopt a fixed percentage of total assessment under each source as the share due to water. The percentage was fixed in 1917 on the actual assessment of the previous ten years. A further revision was made regarding percentage in 1930 subsequent to resettlement

The observations of the Ragavendra Rao, Subrahmanian Committee and S.R. Kaiwar Committee regarding this issue, indicate very dearly me undeairability of splitting up of consolidated wet assessment and treating the portion attributable to water in consolidated wet assessment as the water rate to be charged on these lands. Ragavendra Rao pointed out that the fixed rates to be decided in replacement would be arbitrary and that if they were fixed so low as to be even lower man the standard rates, they would press lightly on good soils and if they were fixed high, they would effect poorer soils adversely (Government of Andhra Pradesh, 1973; pp. 200-20). Now the fixed water rate in force in the Krishna-Godavari deltas, the standard scales of water-cess and the uniform water rates now enforce were liable to this charge. But, the fixed water rale ignored the relative fertility of the soil (Government of Andhra Pradesh; 1973, pp. 200-20). Another objection was that abolition of consolidated wet assessment will be a difficult, laborious and cumbersome process and that it would necessitate extensive azmaish of all wet lands (Government of Madras; 1951, pp. 62-67). Mr. Kaiwar objected in regard to the levy of fixed assessment and raised that soil, rain-fall and drainage facilities being different from district to district one uniform set of rates could not be fixed tor an districts alike (Government of Andhra Pradesh, 1973, pp. 200-20). However, in parts of Andhra Pradesh the consolidated wet assessment system existed due to unrelated **soil** fertility. Governments like Orissa and Mysore abolished the consolidated wet assessment and replaced it by appropriate dry rates and water rates.

5.3.4 Differential Water Rates:

The differential water rate proceeds on the principle that, when dry land is irrigated, the appropriate water rale is the difference between the wet assessment and the corresponding dry assessment for the same class and sort of land (Government of Madras, 1931, P. 1-37). The system was in force in the districts of Srikakulam, Kuroool, Cuddapah, Anantapur, Chittoor and Nellore, except in the tracts covered by the standard scales of water cess or projects for which special rates have been specified. The rates of water cess chargeable under the differential water rate system in terms of dry and wet assessment (see Statement 5.1).

Statement 5.1: Differential Water Rates

NATURE OF CROP	RATES
For a single wet crop	The difference between wet and the dry rates at which fee land is assessed.
For a second or third wet crop	One-half of the charge shown against item 1 plus half of the dry assessment
For a first, second or third dry crop	One third of the charge shown against item 1
For Sugarcane	betel plantation and other wet crops which ordinarily remain on the ground
for more than six months	The sum of the charge specified against item 1 and 2
For dry crops which ordinarily remain on the ground for more than six months	One and a half times the charge shown against item 3

Source: Government, of Madras, Standing orders of the Board of Revenue (Land Revenue Settlement area Miscellaneous) 1931.

This system was a corollary of the consolidated wet assessment system. In Telangana area, whenever dry land was irrigated, the corresponding wet assessment was charged in lieu of the dry assessment In other words, a system of differential water rate was in force in the Telangana area also.

In the then Madras Province, the suitability of the differential water rate system vis-a-vis the fixed wet rate system was the subject of a long controversy between the years 1905 and 1923. The Government of Madras, accepted in 1918, the view that Ac most satisfactory system of levy of water cess was the one in which sources were grouped according to the quality and quantity of supply afforded by them, and the crops were classified in a reasonable manner. The Government decided mat the system of fixed water rates was the suitable for the Madras state. The relative merits of the fixed and differential water systems were examined very thoroughly, when the Board considered clause-8 of the Land Revenue Assessment Bill men under consideration (Government of Madra, 1939,pp. 169-175). The majority of members in the Board of Revenue opposed the proposal to adopt differential water system as normal system in the province through this clause. Clause 8 of the Land Revenue Bill, sought to make the deferential water cess system the normal system in the then Madras Province in preference to the fixed water cess which was to be the exception.

The Board was of the view mat the differential water rate system has a misleading appearance of scientific accuracy, but it was not realty even theoretically sound. All the officers who had experience of the differential water rate system, condemned it and the theoretical perfection claimed for it was disproved. The fixed water rate system extending to the sought to avoid on unnecessarily large number of rates and such limitations of the number of rates was obviously desirable from an administrative point of view. Under the differential water rate system this consideration was ignored and the number of rates depended upon the number of dry tarams and corresponding wet tarams of the irrigated land which were liable to pay water cess. Dry assessment had been fixed with reference to me productivity of the land in terms of purely rainfed dry crops of the varieties common in the tract They argued that "dry tarams do not therefore give any correct indication of the relative values of the lands under those tarams if they are irrigated". A soil which was good for dry crops might not be equally good for wet crops and in so far as the differential water rate formula assumed a close correspondence between the gradations of wet and dry, it rested on an unsound basis (Government of Madras, 1939, pp. 169-175). In the Cuddapah and Kumool Districts, an attempt was made to get over this difficulty by assigning a double classification to each irrigable dry land.

In the case of large irrigation systems, the question of a "fit return" was an important consideration and the differential water rate system was unsuitable. In the case of tanks and other upland sources which were not connected with anicut system, the amount of water available over and above the requirements of the registered wet ayacut would be limited (Government of Madras, 1939, pp. 169-175). It was not therefore unreasonable that the ryot growing a wet crop on dry land should be asked to pay more than on wet and dry. The registered holder of wet land had to pay the wet assessment whether he took the water or not, while the owner of a dry land had normally the option to take water or not as he liked and he had to pay water cess only if he took water and on the area which was actually irrigated

The arguments in favour of the differential water rate system was that it was elastic, while a system of fixed water rates would press heavily on the poorer lands and lands in the tail-end of irrigation sources in the deltas. In the Krishna and Godavari deltas two groups were considered sufficient Irrigation sources in the uplands in the Godavari and Krishna had been grouped in three groups for purposes of water cess. The advantage claimed for mis system was that it enabled the charge of a water-fate on a land which would be commensurate which the yielding capacity of the land and was thus free from the objection usually levelled against a fixed water rate, namely that the same flat rate was charged both for a poor land and a ferule land. It is a well-known fact that soils of different classes did not react to irrigation in the same proportion. Clay soils which were the best suited for dry crops were not so good as loam for wet crops. The best dry land of regar clay under irrigation could not be compared with the best wet land. "It was for these reasons that the Indian Taxation Enquiry Committee (1924-25) pronounced this system as unsound in theory and exceedingly clumsy in practice" (Government of Madras, 1926, pp. 110-120). The Land Revenue Reforms Committee of Madras under the chairmanship of M.V. Subrahmanian had examined "the relative merits of fixed water rate system and differential water rate system and recommended that the system of fixed water rate is preferable to the differential water rate system, and that it should be introduced in the districts where the differential water-rate system is now in force". The committee highlights the Raghavendra Rao recommendations that "the advantage from differential water-rate system is only of a limited character, as the corresponding wet rate adopted need not necessarily be in the appropriate wet rate for the land in question (Government of Madras; 1951, P. 62-67). So the Subrahmanian Committee further recommended for the levy of water cess me adoption of the fixed water-rate system in preference to the differential water-rate system and the correlation of the standard scale of water-cess to the current level of prices, and the project scale of water-cess to the standard assessment

The foregoing considerations reveal that the differential water rate systems had nothing to commend. The differential water-rate system being a corollary of the consolidated wet assessment method could not continue once consolidated wet assessment was abolished. The reason was that the differential water rate system did not have a set of standard rates and hence it was discontinued.

5.3.5 Volumetric System:

Fixed water-rate could be a unit rate, or crop rate, seasonal rate or project rate. When a rate is prescribed for a unit of water, it is called volumetric rate. A volumetric supply system could be conceived of in two ways: supply of water measured with the help of a meter and charging water rate on the basis of the acreage irrigated irrespective of water consumed, and measuring the water supplied for irrigation, with the help of a meter and charging water rate on the quantum of water consumed for irrigation. This second method involved the ryots observed economy in the use of water and thus avoiding wastage of water.

It was an attractive idea to many irrigation officers that the true method was to sell the water by measure at the bank of the distributary channel on the assumption that under mis system the self interest of the cultivator would induce hire to make every effort in economising water. The Indian Irrigation Commission 1901-03 had examined (Government of India, 1903, pp. 90-98). The question of volumetric charging in great detail and the major hindrances noted by the commission towards adoption of the system, were in the initial stages, the cultivator would be diffident to adopt the system, as they would not know in advance the likely charges to be paid, the cost of measuring water for individual fields would be prohibitive, cost of irrigation will vary with the distance from out let to field on account of transmission losses, irrigation requirements would be highly varied and a year of good rainfall would demand less water and thus leaser return where as in a dry year the charges would be more when the cultivator might be getting only very low return from the land, payment would become obligation once water was let out through canal system, and difficulty was anticipated in fixing suitable rates. Consequently, the Commission did not favour the idea of volumetric charging.

The Taxation Enquiry Commission, 1953-54 agreed with the Indian Irrigation Commission's (1901-03) recommendation that "the emphasis should be on a system of distribution by volume rather than on assessment as the mechanical aspect of measurement of water present very great difficulty and as the practice is liable to serious abuse on the part of petty officials" (Government of India 1953-54, pp. 155-203). Another study also came to the conclusion that the system of charging for water according to volume supplied, though, theoretically, more scientific than any other, was not recommended as it would involve a large initial investment for meters and supervisory staff (N.C.A.E.R; 1959, pp.68-74). After considering the advantage of volumetric charging as Nasim Ansari recommended, "the right thing clearly would be to fix rates for different crops in proportion to the quantities of water used by them, and the most precise method of doing this would be volumetric charging" (Ansari, 1968; pp. 71-73). The difficulty involved in its introduction was the high cost of installation of meters etc. The proper maintenance of administrative machinery regarding this system was not advisable in the present circumstances.

5.3.6 Fixed Water-Rate System:

Fixed water-rate system is one in which the charge for use of water for irrigation is levied at a fixed rate related to the nature of the crop or the season of cultivation on the basis of the extent irrigated or the quantum of water supplied without reference to the fertility of the soil (Government of Andhra Pradesh. 1973; pp. 100-114). Fixed water-rates in force in the state could be grouped into three categories viz., the standard scale of water cess, the special project water rates, and the new project rates.

5.3.7 Standard Scale of Water Cess:

This rate was in force in parts of Andhra other than the areas in which the differential water rate was applicable in the case of sources for which no special project rates had been fixed.

TABLE-5.4: STANDARD SCALE OF WATER CESS ON DRY LANDS IN THE MADRAS PRESIDENCY: 1931 TO 1956 (IN RUPEES)

Description of crop		Charge per-acre					
First crop	Second crop	First Class Source			Second class source		
		First Crop	Second Crop	Total	First Crop	Second Crop	Total
Wet	Wet	8.00	4.00	12.00	6.00	3.00	9.00
Wet dry	Systematically irrigated	8.00	3.00	11.00	6.00	2.25	; 8.25
Wet dry	Occasionally Irrigated	8.00	2.00	10.00	6.00	1.50	7.50
Dry, system irrigated	Wet	6.00	5.00	11.00	4.50	3.75	8.25
-DO-	Dry, systematically irrigated	6.00	4.00	10.00	4.50	3.00	7.50
-DO-	Dry, Occasionally irrigated	6.00	3.00	9.00	4.50	2.25	6.75
Dry Occasic irrigated	Wet	4.00	6.00	10.00	3.00	4.50	7.50
-DO-	Dry, systematically irrigated	4.00	500	900	300	3.75	6.75
-DO-	Dry, occasionally irrigated	4.00	4.00	8.00	3.00	3.00	6.00
Sugarcane			12.00			9.00	
Any other crop (requires water for more than six months)			12.00			9.00	
Third crop if Wet			4.00			3.00	
Dry			2.00			1.50	

Source-Government of Madras, Appendix I of Standing order No.4, Paragraph, 2, P.164-165, B.S.O.I.1931.

Irrigation sources were divided into two classes for purposes of charging fixed rate of water cess (see Table - 5.4). Irrigation sources placed in the first or second group by Settlement Department should be treated as the first class, and those placed by the settlement Department in group lower than the second should be treated as second class. In the district of Anantapur, however, irrigation sources classed in the third group by the settlement department should also be treated as first class. It must be mentioned here that the standard scale was originally fixed *as* far back as 1873 and remained unchanged till the year 1956.

5.3.8 Special Project Water-Rates:

Finding the standard scales in force to be too low as compared to the quantum of investment, special rates came to be fixed for irrigation under different projects at different times as and such irrigation projects were completed taking into consideration the quantum of investment on the project, the assuredness of supply from the source and the ability of the ryots to pay a certain fee. Whereas the standard scales and the differential water rales were applicable to areas, the special project rales were applicable to particular projects the rate varying with the project (see Table - 5.5). Such special project rates were the scale of water in the Krishna and Godavari delta systems.

TABLE-5.5: SPECIAL PROJECT WATER RATES IN KRISHNA, AND GODAVARI DELTA SYSTEMS : 1931 TO 1956

DESCRIPTION OF CROP	RATE PER ACRE I CLASS IRRIGATION Rs.-PS.	CLASS IRRIGATION RS.- PS.
First crop, if Wet	12.50	10.00
First crop, if Dry	6.25	5.00
Second Crop, if Wet and following a first Wet crop	6.25	5.00
Second crop, if Wet and following a first Dry crop	12.50	10.00
Second crop, if Dry	6.25	5.00
Third crop, if Wet	5.00	4.00
Third crop, if dry	2.50	2.00

Source: :Govemment of Madras, Standing Order No.4,Para.2, PP. 164-65 of B.S.O.L1931.

6.3.9 UNIFORM RATES :

New project rales or uniform rales could not be classified as a separate category. These rates were also applicable to particular works or projects (see Table 5.6). These rates happened to be the highest of all the project rates.

TABLE-5.6. UNIFORM RATES OF WATER CESS : 1931 TO 1956

DESCRIPTION OF CROP	RATES PER ACRE (RS.- PS.)
For the first irrigated Wet crop	15.00
For the first irrigated Dry crop	10.00
For a dufasal crop	22.30
For the second or third irrigated crop	7.50

Source: Government of Madras, Standing Order No.4, Paragraph 2, PP. 164-165, B.S.O.L 1931.

Thus, in the British administration there were several systems of charging irrigation water in different parts of the country. Hence, the British Government invented a separate and uniform system of charging the irrigation water to suit the newly emerging irrigation environment. The uniform and fixed system prevailed in the initial stage of the British rule. Later the differential water rate system was introduced in 1909 and experimentation was carried out for some years. Since it proved to be very complicated in practice, again the fixed and uniform water rate system, with some modifications, was re-introduced 1931.

IV

Water-Rates in Independent India

5.4.1 Introduction:

Water rates in India vary not only among states but also among canals of the same state. These variations and inconsistencies in water rates in India were attributable to the peculiarities of the particular historical forces which went into their formulation of water rates, which, in most cases were the inheritance from either the colonial past or from the erstwhile princely administration. They emerged as ad hoc arrangements to be substituted by consistent policies later on. Rut thin substitution was never made and as such, water rates in India have never been fixed on a scientific basis.

There existed a wide variety of systems for the calculation of water rates. There was multiplicity both in principle and in the rates for assessment in India (Central Water Commission, 1992, p. 2). Sometimes, the value of the crop at maturity served as a rough guide in fixing irrigation charges. At other times, the cost of providing water has been the overriding consideration for the rate fixing authority while calculating water rates. The productivity criteria for canals as evolved by me Government from time to time seems to reflect this.

This issue of the economics of irrigation pricing was received the widest attention in the 20th century especially after Independence. The first deviation from me traditional past was made by Gadgil. He referred to a number of economic benefits from an irrigation to the society as a whole and made a strong plea for a change in the productivity criterion to lest the economic viability of an irrigation project. A distinction was brought out between the motives behind the private and the state investment It was mentioned mat "the investment policy of the state could be determined from a point of view broader man that of the direct net return on investment" (Gadgil, D.R. 1948, p. 173). Accordingly, for the state investment in irrigation projects both the direct and the indirect benefits should be taken into account Hence, he recommended that the measurement of economic benefits in case of all irrigation projects be made to include both the direct and the indirect benefits that accrue to the community and not merely the direct net return as advocated earlier.

The situation changed, during the period of the Five Year Plans. Though, productivity criterion is not given up fully, it has not been adhered to strictly in practice. It has been realised mat on the basis of existing rates of irrigation charges hardly any major work could be expected to be remunerative (GOI, 1952, pp.354-356). Large investments have been provided for improving the irrigation facilities throughout the country. Investments in irrigation have risen both in monetary and real terms as a result of works of construction for the irrigation projects.

With regard to the water rates, whether water rate is a service charge or includes an element of tax. The Taxation Enquiry Commission (1953-54) had this to say : the scale of water rates being largely dependent upon economic and other circumstances of the area commanded by the works it takes the character of a service charge in some areas and of a tax in other areas (GOI, 1953-54, pp.252-55). According to this Commission, "broadly, the assessment of water rates may be regulated according to three different principles, viz.. no loss and no profit, no profit and some loss and some profit and no loss. No single principle can, however, be recommended for universal application. Generally, water rates must cover the maintenance charges, i.e.. the policy must be no profit but also no loss. But to this there would be several exceptions. A policy of no profit and some loss would be justified in the case of an irrigation work for a dry land area which is being economically developed. On the other hand, a policy of some profit and no loss would be justified where an irrigation project has been provided for a fairly well-off area or where an old work existed from which benefit had already been derived and continues to be derived by cultivators in a particular region.

In determining the water rate that is payable by those who take water, the principle would be. as indicated earlier, that the realisations from such a rate should at least cover the debt charges and over-head expenses on the project. Besides this principle, several other considerations are taken into account in fixing water rales. The more important of these are ; quantity of water supplied, value of crop grown, extent of benefit realised by the cultivator, and ability of the cultivator to pay.

Recently, the attention has shifted from the question of investment decision to that of recovery of cost. Thus there has been two contradictory rules (GOI, 1957, P 43) I he Planning Commission and the irrigation administrators have been emphasising the need for augmenting resources from irrigation. lt is in this context that they have invariably recommended the upward revision of water rates in the different Five Year Plans. Government in the states are also directed for imposition of betterment levies, compulsory annual cess on all lands in command areas, agricultural income tax etc. The

Plan documents have noted the extreme inadequacy of measures taken so far by the State Governments to augment irrigation revenues. This has been yet another view point advocating the case of keeping the level of irrigation charges lower. This argument has been based mainly on the under utilisation of irrigation potential created under the plan period. Thus, the Foodgrains Enquiry Committee (1957) recommended that concessional rate be charged for irrigation in regions where there was under-utilisation of potential (GOI, 1957, P.43). The Committee held that most important fact determining the use of irrigation water was the level of charges made for irrigation.

As irrigation confers benefits on the region served as a whole and as a part of its benefits flow back to the state through direct and indirect receipts on the account of increase land revenue, stamp duties, railway earnings, excise earnings, income tax etc,. It also considered exclusive reliance on recovery of cost of project through water charges as unreasonable. Another view is that what is relevant for fixation of water rates is not cost but benefits (National Council for Applied Economic Research, 1959, pp.68-74). The only sound and justifiable basis for the irrigation rate should be the additional net benefit available to the cultivators for the use of water supplied. Since the demand for water depends on the willingness of the cultivators to make use of it, the amount of profits of the actual net farm product available to cultivators can only be charged in the form of water rates. This amount of net profits to cultivators will vary from time to time, upon changes in land assessments, the prices of agricultural products, the excise duty imposed upon farm products, etc., This is the maximum which the cultivators can be charged.

Water rates should be conducive to the most efficient utilization of water. The rates should offer sufficient inducement to the cultivator for the use of water. The rates should be such as to encourage the implementation of the national objectives or the state policy at the particular time in as much as the frame work for considering criteria for water rate is largely set by state policy. No single percentage of net benefit can be prescribed as water rate which can be fixed only on the basis of specific studies. In view of the need to allow the cultivator a share of the portion of the benefit the actual rates should in no cases exceed 50% of the additional net benefit to the cultivator(NCAER,1959,pp.68-74). The actual charge could vary between 20% to 50% depended on nature of crop and supply of water. The minimum water rate is that which ensures the full use of the water rate. Till such time fanning becomes commercial and farmers are able to grow the most valuable crop suited to the soil of his plot with requisite finance and facilities he should be charged on what he grows rather than on what best can be grown on his farm. As water rate has to be charged uniformly on all cultivators without regard to the abilities of the individual cultivators, soil conditions and other factors the rate has to be so fixed as to enable even the lowest group of fanners to pay the charges without difficulty. The system of charging water according to volume supplied is not recommended as it involves a large initial investment for meters and supervisory staff. The principle of fixing water rates on the value of crop is not justifiable. Within the limit of the net additional benefit available to the cultivators and having considered the economic conditions of the majority of the cultivators, the rates should be fixed at a level mat win bring in maximum revenues to the state. To attain the three fold objectives of furtherance of the social and economic policy of the state, maximization of not profits on the newly added farm products and realization of reasonable revenues for the state the actual application of the benefit criterion, should take into consideration.

On the basis of additional net benefits arising from region to region and from canal to canal, the canal systems could be divided into three zones, viz., high, middle and low benefit zones and the percentage chargeable for each zone can be fixed variously within the zone by taking into consideration the following factors, the nature of the soil the Type of crop and the season in which the cultivation takes place, and the volume of water required for each crop.

The basis of the crop rate system was the belief, right or wrong, that the level of individual rates according to the class of crops on which they were levied was enough to obtain a broad equality in the distribution of the burden of the tariff. The

Maharashtra Irrigation Commission 1962, suggested that irrigation facility is a service and that it is reasonable that it should be paid for by the persons who take advantage of it and recommended that irrigation works as a whole should give an annual income which is equivalent to the annual cost there of and mat the burden of providing irrigation should not fall, even in part on the general tax payer (Government of Maharashtra , 1962; PP.67-75). The Commission considered the objectives of a satisfactory structure of water rates to be the total recoveries on account of water rates should not be less than the annual cost incurred by the state for providing the services. The water rate for a crop should be equitable in the sense that it should be related to the ability of the crop to bear it Water rates should be so pitched as not to lay any irrigation potential unutilized on account of either the system of charging rates or the level of particular rates.

Further, the Commission indicated the following as the facts to be taken into consideration in formulating water rates for individual crops : The cost of irrigation water required by the crop, the level of average gross income obtained from the crop under the usual conditions of fertility, supply of manure, supply of water, level of efficiency of cultivation, and prices.

Prompted by the desire to improve the financial returns from the projects the Government of India appointed a committee to suggest ways and means of improving financial returns from irrigation projects under the chairmanship of Nijalingappa (GOI, 1964; pp. 1-31). The Committee considered, among other things, the criteria for fixing of water rates. In addition to this, they reviewed the studies made till then m this regard with specific reference to the study of the N.C.A.E.R, and the findings of the Maharashtra Irrigation Commission. Consequently, the Committee felt that the best way of fixing water rates is to base it on the additional net benefit derived due to irrigation by the cultivators

This was to be measured, according to the Nijalingappa Committee by the extent of net benefit after irrigation over the net benefit before irrigation. The Nijalingappa

Committee recommended water rates equal to 25% to 40% of the additional net benefit derived per acre production of crops produced before and after irrigation, and those regarding per acre cost of production before and after irrigation. It is obvious mat this committee tried to compromise the recommendations of the N.C.A.E.R and the Maharastra Commission as the former has recommended water rate varying between 25% to 40% of the net benefit and the latter between 6% to 12% of the gross produce.

There were studies also available from demand side suggesting that, in order to wipe out the resulting deficit between the construction cost of the modem irrigation project and the net return, a considerable rise in rates become necessary (Ansari, N, 1968, P. Vi). The demand side also studied that there was considerable scope for raising of rates on the basis of existing productivity. This study also showed a nominal relationship between the pitch of the water charges and the level of utilization as the latter depended more on a number of other technical and economic factors.

The problem of the relationship between the growth of irrigation facilities and cost recoupment principle was also studied by the Second Irrigation Commission (GO1; 1972, P. 406). This study held that the benefit of irrigation is the benefit for the former. From the irrigation point of view, the water rate should be related to the benefit which irrigation confers rather than to the cost of an irrigation project, and felt that all factors from demand side need to be considered as criteria for fixation of water rates. These factors are: full utilization of available supplies, gross income of the cultivators and the fanner's capacity to pay for irrigation. The only factor that has been maintained from the supply side is the precaution against incurring losses. This study disfavored the idea of incurring losses in irrigation project.

A water rate structure which had for its baas the irrigation of only a angle crop, namely, rice, is therefore no longer valid. In recent years great progress has been made in the development of agricultural technology. This has a bearing on irrigation practices (GOI, 1972; P. 407 - 10). The value of irrigation is what it gives to the fanner in the form of an additional profit. The irrigation is primarily interested in the net gain from irrigation and to him the cost incurred in making water available is of little consequence. Ms willingness to pay for water varies in proportion to the gain that he expects from its use. From an irrigation point of view, therefore, water rates should be related to the benefit which irrigation confers rather than to the cost of irrigation projects (GOI 1972; pp.407-10). The irrigation requirements of various crops are governed by a number of factors such as climate, contribution from effective rainfall, if any, the level of the ground water table and the duration of the crop in the field Because, the requirement varies not only from crop to crop but from the same crop grown in different seasons, such as the first, second or third crop of rice. Therefore, the quantity of water supplied is also relevant.

Irrigation projects differ widely in their capacity to meet the irrigation requirement of crops, on projects with storage reservoirs it is possible, ordinarily to meet the full requirement of kharif crops although there may be some difficulties in the pre-monsoon period. For rabi. the supplies vary from year to year. On projects with uncertain and fluctuating supplies, irrigation is less satisfactory and the irrigators have often to do with fewer or shallower waverings. Thus, there are areas which depend on tanks which fail in bad years. In such areas, proper crop planning and a resort to improved agricultural practices becomes difficult and in consequence yields are low. Adequacy and dependability of supply thus become important considerations in fixing irrigation rates. Where irrigation rates are kept unduly low, irrigators are, apt to use water carelessly and wastefully. On the other hand, a high rate may be burdensome to the cultivator and may discourage him from using available facilities. Such under-utilization results in less revenue to the Government and lower production for the farmer. Therefore, on canals which are under-utilized, a development rebate, which should be progressively reduced, would help to ensure fuller utilization. Needless to say, there will always be some lag in the utilization of water during the initial years after the completion of a project Water rates can, to some extent, influence the cropping pattern in a project area. It is possible to discourage the growing of a particular crop in an area by fixing a high water rate for it. Effective regulation of cropping patterns through water rates, however, is not feasible. But even in fixing water rates for the different crops, the state policy in respect of cropping needs to be kept in mind because some crops consumes more water than others. The crops which consume more water, are charged higher water rates than those that consume less water.

While fixing me appropriate rate, viz., the nature of the source, the duration of supply, the nature of the crop and the quantum of water required by crops, should be kept in mind (Government of Andhra Pradesh, 1973; P. 313). The committee recommended, a reduction in the real burden of water from as much as 25% of gross produce or half of the net produce to about 2.5% of the gross produce due to increase in prices, increased profitability of irrigated crops and improving productivity, increasing cost of construction, repair and maintenance of projects.

The system of irrigation water rates in various States of the country is as diverse as the culture and the people. Rates have been fixed considering a number of factors. Some times without any rational and objective considerations, they arc seldom revised. Major factors leading to variation of water rates are: geographical unit, system of irrigation and crop and season, in states like Uttar Pradesh, Punjab, Haryana, Rajasthan, Bihar, Gujarat and Tamil Nadu water rates are charged for actual areas irrigated under different crops, the rates varying with crops, regions and projects. In Orissa, there is a flat water rate per acre of land within the cultivable command area of an irrigation work payable to the state Government for supply of water whether used or not from an irrigation work (Central Water Commission, 1992, P.20). In Andhra Pradesh and other southern states, consolidated wet assessment is levied on lands registered as wet. Water rates are not being realized in Assam and Himachal Pradesh. In Nagaland and Meghalaya, there are no irrigation rates at present. In Sikkim, irrigation rates have not yet been finalized. There is thus, no uniform basis for irrigation charges in the country.

Rates for storage schemes are higher than those for flow or diversion scheme. Rates for lift irrigation from canals are generally higher man flow rates if arrangement for lifting is made by the government, but if the cultivators themselves make the arrangements for lifting water, the rates are lower than the flow rate. This is practised in Haryana, Madhya Pradesh, Maharashtra, Punjab and Uttar Pradesh.

In general, crop and season are two important factors in deciding the water rate structure. Water requirements of the crop and variation in seasonal availability of water are then the guiding principles. However, there is considerable diversity among states with regard to the weight given to them. Rates vary according to crop in almost all states. Water rates are generally higher for long-duration perennial crops such as sugar cane, as compared to short-duration crops. Sometimes the variation extends to the season also, as in Gujarat, Haryana, Maharashtra and Punjab, where different rales are charged for the same crop in different seasons. In Bihar and West Bengal rates are uniform for all crops in a given season, except for jute in hot weather in Bihar. In the Southern state as e.g Tamil Nadu, the charge is levied according to the crop and season particularly for older irrigation systems. There arc per-crop rates also for new irrigation projects.

Some times rates are kept low in order to induce farmers to use irrigation. This is prevalent in Gujarat, Madhya Pradesh, Orissa etc. Tower rates are charged in the initial years of commissioning of projects in some states. Similarly, location of the project is a factor in fixing a lower water rate if it happens to be in a drought-prone or backward area.

5.4.2 Assessment and Collection of Water Charges

Mechanisms for assessment and collection of revenue are diverse. Assessment is generally based on area irrigated, except for Bihar, Orissa, and older systems of irrigation in Andhra Pradesh. Karnataka and Tamil Nadu, where the water rale is a pan of land revenue. In Bihar and also in some parts of West Bengal Orissa and Madhya

Pradesh, agreement rates are prevalent. In Orissa a compulsory basic rale is charged for rice in Kharif season from every cultivator whose land is served by the irrigation projects. For other crops of Rabi season, per crop rates are collected.

Reasonability for assessment and collection of revenue is shared by irrigation and revenue departments in the states, but there is no uniformity in this regard amongst the states.

Table- 5.7: STATE-WISE ACCUMULATED ASSESSMENT INCLUDING ARREARS AND COLLECTION OF REVENUE (RS. 10 MILLION)

State	Period	Assessment	Accumulated Assessment	Collection Including Arrears
Bihar	1984-85 to 1991-92	102.5	321.2	57.7
Gujarat	1980-81 to 1989-90	90.8	301.4	73.0
Haryana	1982-83 to 1991-92	105.2	192.7	98.9
Madhya Pradesh	1983-84 to 1991-92	195.3	722.0	137.3
Rajasthan	1982-83 to 1991-92	68.5	113.3	636
Uttar Pradesh	1980-81 to 1990-91	514.6	821.8	454.4
West Beneal	1980-81 to 1990-91	30.2	173.3	88

Source. Central Water Commission, 1992, P.21.

The accumulated assessments, including arrears and collections, for the states of Bihar, Gujarat, Haryana, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal are given (see Table 5.7). They show that substantial amounts remain unrealized as arrears, and that collection falls short of even current assessment in all the states.

5.4.3 Water Rates for Principle Crops:

The wide variety of systems and norms followed at present in fixing water charges lead to sharp variations in the levy from canal to canal in the same state apart from lack of uniformity among states.

Given the heterogeneity of the system of water rates prevailing in different states, it is extremely difficult to make a meaningful comparison of the levels of rates prevailing in those states. Strictly speaking, crop-wise rates cannot be compared in view of the fact that there is additional differentiation on the basis of the source of irrigation. While some states have adopted a simple system of charging water rates, others have adopted complicated ones which depend upon the source of irrigation, the nature of crops grown and the season of water supply (see Appendix V). There is a wide disparity in water rates for principal crops under flow irrigation in various states. In Gujarat, water rate ranges from Rs.234.16 to Rs.332.00 per acre of sugarcane crop. The rate in Maharashtra is as high (Rs.100 to Rs.700) as against this. The prevailing water rate in all other states is less than Rs. 100.00 per acre except, Madhya Pradesh, Karnataka and West Bengal. In the case of paddy, Madhya Pradesh, Maharashtra, West Bengal and Gujarat are charging the highest water rates, (ie., Rs.79.00 to 197.67; Rs.26 to 300; Rs.50 to 96 and Rs.44 to 100 per acre of water rates respectively), whereas it is around Rs.95 to 75 in the majority of the states including Andhra Pradesh. Orissa is has the lowest rate of Rs.15.6 to3.95 per acre of paddy crop. Maharashtra has a charging rate of Rs. 72 to 120 per acre of cotton which is the highest in India. Madhya Pradesh, Gujarat and Uttar Pradesh are charging the highest rates of Rs.98.84; Rs.44.00; and between 57.32 per acre of wheat respectively.

The water rate in Andhra Pradesh is fixed for wet and irrigated dry crop, irrespective of crop-wise fixation of water rates. For a single wet crop in Andhra Pradesh the rate per acre is between Rs.60 - 40, whereas for 2nd and 3rd wet crop the rate per acre is the same as in 1st wet crop. For the irrigated single dry crop, the rate per acre is between Rs.40 - 20, whereas for the 2nd and 3rd irrigation dry crops, the rate per acre is the same as in single dry crop. For dufasal crop for 12 months period (i.e, Fasli Year) the rate per acre is between Rs.120 - 80.

The prcvafling water rates in respect of Paddy in Andhra Pradesh are lower when compared to those in Maharashtra, Madhya Pradesh, West Bengal and Gujarat but higher than those in Punjab and Haryana (see Appendix-V). However, it is important to note that the existing water rate for paddy is higher in Andhra Pradesh than in Southern States of Tamil Nadu, Karnataka and Kerala. In the case of sugarcane, Andhra Pradesh is charging higher rates than Tamil Nadu,

It is also important to note mat except Punjab, Kerala and Haryana all the states have revised the water rates in the mid eighties. Many of the states are not willing to revise the water rates mainly owing to political reasons.

V
Water Rates in Andhra Pradesh

5.5.1 Water Rates in Andhra Area:

All cultivable lands in the Andhra area, are classified and registered in the land revenue accounts under three heads, viz., wet, dry and manavari lands. Classification of lands was originally made during the Revenue settlement operations on the basis of conditions on ground at the time of settlement and were liable to change during re-settlement operations. The rate of assessment was payable by the different categories of wet lands for different crops in the different crop seasons (Government of Andhra Pradesh, 1973, P. 159). There are two categories of registered wet lands, viz., single crop wet lands, and double crop wet lands. Wet lands which in all ordinary season have an unfailing supply of water for one wet crop from a Government source of irrigation are registered as single crop wet lands. The rate of assessment varies with the taram of the wet land, and the settlement tract in which the land is situated and the classification of the source.

Wet lands, which in all ordinary seasons have an unfailing supply of water for two wet crops, are registered as doule crop wet lands and are normally charged 11/2 times the single crop wet assessment are to be found only under class I source.

Irrigation cess or water rate is levied on dry lands for use of water for irrigation from *a* Government source and for irrigation of a crop other man the first crop on registered single crop wet lands. In Revenue Parlance, water rates are levied on registered dry lands are called Thiruva Jasthi' and the irrigation cess payable for irrigation of second crop in a single crop wet land is known as Fasli Jasthi (Government of Andhra Pradesh; 1973, P. 171). A second wet crop raised on such lands is liable to an extra charge which is ordinarily half the wet assessment But when under any particular source of irrigation or in any particular locality a definite rate of charge has been prescribed for such crops. Extra charge will be levied at that rate and not half the single crop assessment Thiruva Jasthi, in addition to land assessment on lands classed as dry when irrigated from a Government source would be imposed. Broadly speaking, the two systems for levying separate water rate in the Andhra area are : The differential water rate system and the fixed water rate system which were mentioned in previously.

5.5.2 Water Rates in Telengana Area :

In (he Telangana area, all cultivable lands arc classified and registered in the land revenue accounts under three heads, viz., dry, wet and garden. Wet assessment is levied on registered wet lands. The rates are fixed as maximum wet rates for a group of villages having identical conditions for the first crop. Wet lands arc classified as single first crop wet (Ekfasala Abi), single second crop wet (Ekfasala Tabi), and double crop wet (Dufasala-ae). Wet cultivation is compulsory in all lands under flow irrigation sources. Flow irrigation wet lands are classified by settlement variously as single crop abi single crop tabi or double crop ae (Government of Andhra Pradesh; 1973, P. 167). Abi crop ts deemed to be the first crop and the tabi crop as the second crop. If flow irrigation water is taken for double crop wet cultivation in a single crop wet land throughout the year full double crop wet assessment is levied. In case of lands classified as double crop wet lands, full single crop wet assessment is levied for abi and half the abi assessment for the tabi crop. A differential water rate system more or less same as in the Andhra Area is in force in Telangana area also while charging a dry land for use of water from a source.

5.5.3 Water Rates in Andhra Pradesh Since 1956 :

Resettlements were abandoned in Andhra in the year 1939 and in Telangana in the year 1953 as a matter of state policy. Instead of revision of assessment on wet and dry lands periodically through resettlements, thereafter, the rates of assessment came to be revised from time to time.

At the time of formation of the State of Andhra Pradesh, the settlement or resettlement rates, as the case may be. existing as standardized by the Act of 1952 where the rates of assessment applicable in Telangana area were in force till the Government of Andhra Pradesh enacted the Andhra Pradesh Land Revenue Additional Assessment (Government of Andhra Pradesh, No.l68, dt31.01.1963). In so far as, the Andhra area of the Andhra Pradesh was concerned, the assessments levied under resettlements continued in force till 1956. Land assessment of different settlement tracts, and districts having been settled at different times the rates of assessment obtaining in different parts of Andhra area where not uniform in its incidence in as much as the continuous rise in prices during the period of resettlement had resulted in higher commutation rates being adopted in the case of the districts resettled at a latter date than in the case of those settled earlier. The result was that the pitch of assessment varied widely from district to district

Thus, in Andhra Pradesh, prior to 1986 land revenue was being levied on both dry and wet lands at specific rates and the charge for use of water from a Government source of irrigation was levied in the form of consolidated wet assessment, in respect of lands registered as wet in revenue records. As this rate was said to notionally comprise an element of land revenue and a charge for water, no separate charge was required for single crop wet land for raising first wet crop. For raising second or third wet crop on registered single crop wet land and for irrigating a dry land, water cess was leviable, to respect of unirrigated dry land, only basic land revenue was levied besides land and local cesses.

The water sources were divided into the following five classes : perennial rivers, tanks giving water for not less than 8 months, minor river channels and rainfed tanks giving water for 5 months and more, spring head and other channels giving water for 3 months and more and all irrigation under jungle streams with a precarious water supply as well as rainfed tanks giving water for less than 3 months.

The rates which were standardized in 1956 were enhanced in 1967 with effect from 1st July 1962, in 1975 with effect from 1st July 1974 and in 1986 with effect from 1st July 1986.

Substantial modifications for the basis, rates and collection of water tax have been made with effect from 1st Jury 1986 through the Andhra Pradesh Water Tax Act, 1988. All lands, were regarded as dry and separate land revenue was abolished.

The Act also contemplated recovery of water tax in respect of lands irrigated by category I and category II sources only. For this purpose, all major and medium irrigation projects are to be regarded as category I while other government sources which supply water for not less than 5 months in a year belong to category II. Further, water tax is chargeable with reference to the nature of wet crop, irrigated dry and dufasal crop. The rates of water tax ranged from Rs.40 to Rs.120 in respect of lands irrigated by category 1 sources and Rs. 20 to Rs.80 in respect of category II sourccs 54.16 lakhs of acres of land is irrigated by category 1 sources and 14.41 lakhs acres of land is irrigated by category Ii sources, while 15.85 lakhs acres are irrigated by sources supplying water for less than 5 months.

The procedure of assessment of water tax is analogous to that of land revenue in vogue earlier. The basic record for computation is village account containing details regarding survey number, extent of land, pattadar, nature of crop, source of irrigation etc. The demand which is initially worked out annually by the Village Administrative Officer is finally approved by the Jamabandi Officer. The tax is collected in two instalments by the Village Administrative Officer and remitted into the treasury. These remittances are reconciled by the Mandal Revenue Officer with the treasury figures.

Table - 5.8: REASONS FOR VARIATION OF WATER TAX AND RECEIPTS AS ON 1994-95 (IN RS. LAKHS)

REASON	LOSS
1 . Adoption of incorrect wet assessment rate	28.21
2. Short levy of water tax due to incorrect categorization	16.07
3. Short assessment of water tax due to adoption of incorrect pre revised rate	5503
4. Incorrect implementation of the provisions of the Andhra Pradesh Water Tax Act, 1988	8.97
5. Incorrect grant of remission	88.20
6. Water tax in terms of court's order was not correctly interpreted	9.61
7. Non-determination of water charges may result in non-recovery of royally in respect of water supplied for non- irrigational use	109.50

Source: Government of Andhra Pradesh, 1996, No.2, P.81.

The reasons for large variation between budget estimates and actual receipts were attributed by the department to re-introduction of Village Administration (see Table 5.8). Nonetheless, the receipts recovered under Water Tax are very less when compared to operation and maintenance costs.

VI
Conclusion

The irrigation policy of the British rulers was marked by an apparent change in the methods of fixing of water rates. The British government had evolved a separate and uniform system of charging the irrigation water to suit the newly emerging irrigation environment. The uniform and fixed system prevailed in the initial stages of the British rule. Later, the differential water rate systems were introduced in 1909 and experimentation was carried out for some years. Since it proved to be very complicated in practice, again the fixed and uniform water rate system, with some modifications was re-introduced in 1931.

The approaches mentioned here involve radical changes in the way the irrigation systems are organised and managed even as it requires users to pay substantially higher prices for the water they use. Judging by the reported trend in revenues the impact of these revisions on users of public irrigation systems has not been significant nor have they led to any improvement in the financial performance of these systems. These changes are essential and important constituents of any effort to improve public finances generally and that of the State Government in particular.

There were several systems of charging irrigation water in different parts of the country during the British administration While the British tried to rationalise the high water rates by searching for principles of fair returns to investment by both the government and farmers, the present Independent India does not seem to have any rational economic principles on which to determine low rales.

APPENDIX-V-i

COMPARATIVE WATER RATES FOR PRINCIPAL CROPS UNDER FLOW IRRIGATION IN DIFFERENT STATES (RS. PER ACRE)

State	Date of Endorsement	Rice	Cotton	Wheat	Sugarcane
Andhra Pradesh	1st July 1986 Wet crop 1st crop	60 to 40	60 to 40	60 to 40	60 to 40
	2nd or 3rd Irrigated dry 1st Crop	-do- 40 to 20	-do- 40 to 20	-do- 40 to 20	-do- 40 to 20
	2nd or 3rd	-do-	-do-	-do-	-do-
	Dufasal crop in fasli year	120 to 80	120 to80	120 to 80	120 to SO
Assam		—	—	—	—
Bihar	-			-	-
Gujarat	15.06.1981 Kharif (reclaimed Kharif)	44 to 50	40.00	44.00	332.00
	Rabt	10 to 16	80.00		-
	Hot weather crops	100.00	-	-	
Haryana	Kharif 1975 (different canals)	29.60 to l9.77	-	11 86 to 3 6	39.54
	Other than Kharif (different canals)		24.71 to ll.86	24.7l to 17.89	33.6 to 19.98
Himachal Pradesh	—				
Karnataka	01.07.1985 within 12 months	34.60 to 39.54	21 74	39.54	148.27
	up to 18 months				222.40
Kerala	01.07.1974 1st to 3rd crop	14.8 to 39.6			14 8 to 39 6
Madhya Pradesh	1.10.1992 Kharif	79.00	69.19	9884	296.53
	rabi	197.69	197 69 (for H.Y V)		
Manipur and Meghalaya					
Maharashtra	1.7.1990 Kharif (on agreement)	26 to 36	72 to l08	40 to "0	400 to 700
	On demand	48 to 80			
	Rabi	72 to 120	72 to l20		
	Second Crop	228 to 300			
	Hot weather 1st March	192 to 320			
	1st April	160 to 240			
Nagaland					

Orissa	24.09.1981 (for different classes of irrigation works)	15.6 to 3.95	22.24	12.85	40.03
Punjab	Kharif(1974) (for different canals) other than Kharif	19.28 to 19.52	15.97 to 13.00	5.44 to 5.97	26.69 to 27.13
Rajasthan Sikkim and Tripura	01 .04. 1982 (for perennial channels in pre and post 1952 canals	9.88 to 3934	17.79 to 35.58	12.8 to 29.67	20.73 to 57.33
Tamil Nadu	Varied from district to district	14.82 to 24.71	19.77 to 24.7 1	24.71	4.8 to 29.65
Uttar Pradesh	01.07.1983 Class I	57.32	| 22.76	i 57.32	90 S9
	Class II	34.59	11.86	i 34.59	90 89
	Class III	25.70	1 7.91	25.70	47.20
	Class IV	7.91	7.72	7.91	19.77
West Bengal	| 19.05.1984	50 to 60	| 47.44	| 24.00	-

Source: Government of India, 1992, Appendixes.

NOTES

1. Under the raiyatwari system, all landholdings are registered for revenue purposes. Every plot of land on which land revenue is payable is registered in the name of an individual who is responsible for the payment of the land revenue he is issued with a document, a patta, describing the lands registered in his name. The man who pays the revenue on the land in effect is its owner:

> Under the raiyatwari system every registered holder of land is recognised as its proprietor and pays directly to Government. He is at liberty to sub-let his property, or to transfer it by gift, sale or mortgage. He cannot be ejected by Government so long as he pays the fixed assessment. The ryot, under this system, is virtually a proprietor on a simple and perfect title, and has all the benefits of a perpetual lease without its responsibilities, in as much as he can, at any time, throw up his lands, but can not be ejected so long as he pays his dues: he receives assistance in difficult seasons, and is not responsible for the payment of his neighbours.

> If the pattadar defaulted on his land revenue, the Government sold as much of his land as was enough to recover the dues. The pattadar was allowed to relinquish part or all of his land so that he would not be liable to pay the land revenue due on it, provided, first, that he applied for permission to do so early in the season so that the land was available to others. Anyone could apply to take up unoccupied lands, though mirasdars and residents of the village were given first refusal (Dharma Kumar. 1975, pp.230-231).

CHAPTER-VI

PRODUCTIVITY, PRICES AND WATER RATES IN ANDHRA PRADESH

I

Introduction

The supply of water to the farms is the chief service rendered by the government when it constructs an irrigation project It might, therefore, be expected that the benefits of this operation would be measured by me prices which the farmers would be willing to pay for the supply of the water. To the extent that conditions are favourable for a good crop with irrigation, it is likely mat a surplus of resources will be generated which benefit the farmers, managers, the government, and the consuming public. Incomes are increased, increased resources are available, increased taxes can be generated, and increased food grains are available at reasonable prices. Where irrigated agriculture is profitable for water users, they have high stakes in the related activities and they would be willing to co-operate in the improvement of their management practices. Also, managers can make credible claim on government resources for systems operation and maintenance budgets, and regimes would be readily willing to invest in their operation and maintenance (Uphoff. N, et al., 1991, p. 90). The profitability of irrigation encourages the farmers and government to invest in its expansion and improvement. But there arc strong reasons which preclude so simple a measure. If the farmers had to pay as much for it as it was worth in terms of additional output, there would be no incentive for them to engage in the long and back-breaking task of bringing the irrigable acreage into intensive cultivation. Thus, a direct measure of the economic worth of the water supply could not be predicated on the actual revenues, but rather on a hypothetical computation of the maximum amounts which the farmers would be willing to pay if they were perfectly rational entrepreneurs (Eckstein, Otto, 1958; P.197). There are two categories of direct farm benefits. Firstly, increased family incomes including the home-grown products consumed by the family and the high level of other prerequisites such as the farm dwellings. And secondly, the increased cash allowances for the family in the form of living expenditures, the increased cash income after deduction of all the production expenses. Thus the direct economic returns to irrigation in India can be indexed by analysing the trends in the crop productivity, their prices and their water rates. Therefore, the need for estimating the share of water rates in the gross value of output generated by investment in irrigation in a secular period is worth studying.

Because of lack of comparable data relating to the cost of cultivation of all crops and other details for the past years, it is felt mat it would be convenient to compare the gross value of the yields of rice per-acre measured by the annual average wholesale prices prevailing at the chief market centres. There are some limitations of such estimates. Firstly, the method of estimation implies shifting land out of rain-fed cultivation into irrigated cultivation. Secondly, the aggregate data for the irrigated area used in this study had covered wide range of gross irrigated area. These estimates indicate only the direct production effects evaluated at domestic prices, and do not attempt to include additional benefits from employment and stimulation of other economic activities or other indirect benefits. The productivity differential reflects the combined effects of irrigation, and complementary inputs, such as technology, and farm labour on output per-acre. Thirdly, rice is the most important crop raised in the state accounting for more than 50% of the total cropped area and for more than 70% of the total irrigated area in 1989-90 (sec Table 6.1) Thus, irrigated farming in the State is represented almost by a single crop, viz., rice And finally, the four delta districts of East Godavari, West Godavari, Krishna and Guntur in Coastal Andhra, Kurnool in Rayalaseema and Nizamabad in Telangana region have the largest proportion of their irrigated area under the canals. Therefore, these six districts have been chosen for a study of the productivity, prices, and value of output of rice per acre in relation to the incidence of water cess.

Table 6.1:- District-wise total cropped Area, total Area irrigated and area irrigated under rice-1998-99

Sl. No.	Districts	Total Cropped Area	Total Irrigated Area (Gross)	Total Area under canals	Total Area under Non-canal sources	Total Area irrigated under Rice	Total Area Irrigated under non-rice crops	% of (3)
1	2	3	4	5	6	7	8	[illegible]
1.	Srikakulum	425142	194579	91165	103414	167360	27219	2[illegible]
2.	Vizianagaram	458250	169832	39560	130272	123185	46647	8[illegible]
3.	Visakhapatnam	449828	165403	55268	110135	92186	73217	1[illegible]
4.	East Godavari	781927	472797	335080	137717	393809	78988	[illegible]
5.	West Godavari	688073	598838	360448	238390	452063	146775	5[illegible]
6.	Krishna	739088	482345	369786	112559	414500	67845	[illegible]
7.	Guntur	870789	400607	33294	68313	325466	75141	3[illegible]
8.	Prakasam	595081	206605	78406	128259	144715	61950	1[illegible]
9.	Nellore	360731	306477	91594	214883	226092	80385	2[illegible]
10.	Chittor	540509	240584	2276	238308	100992	139592	[illegible]
11.	Cuddapah	457402	194250	22583	171667	76073	118177	[illegible]
12.	Anantapur	1065187	185088	36772	148316	64754	120334	[illegible]
13.	Kurnool	1018552	228257	91404	136853	92140	136117	[illegible]
14.	Mahbubnagar	864497	226366	17356	209010	143023	83343	[illegible]
15.	Ranga Reddy	342801	100317	3136	97181	58123	42194	[illegible]
16.	Hyderabad	282	281	--	281	118	163	
17.	Medak	543428	195845	2961	192884	120314	75531	[illegible]
18.	Nizamabad	387895	275276	40181	235095	156066	119210	1[illegible]
19.	Adilabad	578228	96045	23762	72283	60280	35765	
20	Karimnagar	579867	401171	89713	311458	256246	144925	1[illegible]
21	Warangal	648804	365954	2150	363804	199787	100167	
22	Khammam	503095	223255	77024	146231	155617	67638	[illegible]
23.	Nalgonda	724285	361842	123460	238382	318042	43800	[illegible]
		13624681	6092074	2286379	3805695	4140951	1951123	

Source: Based on Season and Crop Report 1998-99. DES, Hyderabad.

Table 6.1:- District-wise total cropped Area, total Area irrigated and area irrigated under rice-1998-99

Sl. No.	Districts	Total Cropped Area	Total Irrigated Area (Gross)	Total Area under canals	Total Area under Non-canal sources	Total Area irrigated under Rice	Total Area Irrigated under non-rice crops	% of (5) in (3)
1	2	3	4	5	6	7	8	9
1.	Srikakulum	425142	194579	91165	103414	167360	27219	21.4
2.	Vizianagaram	458250	169832	39560	130272	123185	46647	8.6
3.	Visakhapatnam	449828	165403	55268	110135	92186	73217	12.3
4.	East Godavari	781927	472797	335080	137717	393809	78988	42.8
5.	West Godavari	688073	598838	360448	238390	452063	146775	52.4
6.	Krishna	739088	482345	369786	112559	414500	67845	50
7.	Guntur	870789	400607	33294	68313	325466	75141	38.2
8.	Prakasam	595081	206605	78406	128259	144715	61950	13.2
9.	Nellore	360731	306477	91594	214883	226092	80385	25.4
10.	Chittor	540509	240584	2276	238308	100992	139592	0.4
11.	Cuddapah	457402	194250	22583	171667	76073	118177	4.9
12.	Anantapur	1065187	185088	36772	148316	64754	120334	3.5
13.	Kurnool	1018552	228257	91404	136853	92140	136117	9.0
14.	Mahbubnagar	864497	226366	17356	209010	143023	83343	2.0
15.	Ranga Reddy	342801	100317	3136	97181	58123	42194	0.9
16.	Hyderabad	282	281	--	281	118	163	0
17.	Medak	543428	195845	2961	192884	120314	75531	0.5
18.	Nizamabad	387895	275276	40181	235095	156066	119210	10.4
19.	Adilabad	578228	96045	23762	72283	60280	35765	4.1
20.	Karimnagar	579867	401171	89713	311458	256246	144925	15.5
21.	Warangal	648804	365954	2150	363804	199787	166167	0.3
22.	Khammam	503995	223255	77024	146231	155617	67638	15.3
23.	Nalgonda	724285	361842	123460	238382	318042	43800	17.1
		13624681	6092074	2286379	3805695	4140951	1951123	16.8

Source: Based on Season and Crop Report, 1998-99, DES, Hyderabad.

II

Trends in Productivity

The benefits of irrigation are well recognised, particularly by the farmers concerned. Reliable and timely water supplies enable fanners to get increased yields from the existing crops. The yields per-acre of rice generally showed an upward trend over time in the sampled rice-producing districts. There were some differences in the yield estimates of the ryots and those that were estimated from government experiments. For example, in Tinnevelly, in 1869, the yield estimates of ryots was 52 Madras measures, on the best black loam grade of land whereas the yield estimates of government experiments was 50 Madras measures. And the best red-sand soils according ryots estimates yielded 37 Madras measures, whereas the yields estimates of government experiments was 40 Madras measures(Government of Madras, dt.22.5.1869) (see Appendix VI - 1). To ascertain the grain out-turn of the irrigated lands, paddy were taken as standard. The yield estimates might also have differed on account of extraordinary vicissitudes of season and barren patches. Not only the yields but also the costs were some times over estimated. For example, the average produce of paddy per-acre was estimated in Krishna in 1869 at 2421 Ibs, (or 1099 kgs.) valued at Rs.44 and 2574 Ibs, (or 1169 kgs.) of straw valued at Rs. 12 and the total of Rs.56. Of this one-fourth was supposed to represent cost of cultivation and after deducting land revenue and water charges of Rs.9, the fanner was left with a clear profit of Rs.33.

The method of fixing the assessment and water rates may appear to be close to reality. But much depends on the reliability of the experiments. For example, in Tinnevelly district, in 1869, the land assessment was carried out on the basis of detailed classification of soils and their respective yields. Land was classified into 25 classes of wet as well as dry lands which were further grouped into 8 classes. The best black loan soil was ranked at the top and the worst red- sand at the bottom (see Appendix VI - 1). In order to estimate the yield of irrigated lands, 256 experiments were undertaken (Government of Madras, dt. 22.5.1869). The standard assessment was arrived at by raking half of the net produce as government share after deducting 10% for unprofitable areas. Same kind of the assessment was followed for other districts also. The average assessment was Rs.8.14 for the first wet crop, Rs. 5.06 for the second wet crop and Rs.1.06 for dry crops. The water rates were Rs.3.53 for the first wet crop, Rs.2.64 for the second wet crop of class I works (see Appendixes - VI- 2 & 3). Therefore, the total land assessment for irrigated lands was around 25% of the gross produce a high % when compared to the corresponding rates after Independence.

Table-6.2 : Productivity of paddy per-acre of some irrigated districts in the Madras Presidency -1860-1909(in quintals)

Year	Districts				
	East Godavari	West Godavari	Krishna	Gnntur	Kurnool
Original Settlements	2.00	2.00	1.00	4.00	3.50
Re-settlements	4.60	4.60	4.60	4.70	4.40

Source: Government of Andhra Pradesh, 1959, pp.85-309

Table - 6.3: Productivity of paddy per acre of some irrigated districts in the Madras Presidency-1918-1954(in quintals)

YEAR	DISTRICTS				
	EAST GODAVARI	WEST GODAVARI	KRISHNA	GUNTUR	KURNOOL
1918-19	9.1	8.6	8.2	7.3	N
1927-28	9.1	91	82	82	7.3
1939-40	8.0	7.4	6.6	82	7.1
1940-41	84	8.1	80	80	7.9
1942-43	8 1	86	7.4	7.0	5.8
1943-44	8.2	8.4	7.8	7.4	6.5
1945-46	7.7	6.8	7.4	7.8	6 1
1946-47	87	78	76	7.0	6.3
1947-48	8.6	8.4	7.4	7.4	6.7
1950-51	7.5	8.1	7.4	1	5.2
1953-54	91	9.1	8.2	8.2	6.5

Source: Government of Madras, Season and Crop Reports, Office of the Economic Advisor to Government of Madras, for different years

Note One Ib- 0.454 g., lkg - 2.20 Ib, 1 quintal - 220 Ibs, Collins. Gem English Dictionary (p.612), 1990.

The productivity of rice per-acre (in quintals) in some selected districts of the Madras Presidency increased between the year's 1860-1909(see Table 6.2). But later years (1918-19 to 1946-47) it was slightly decreased(see Table 6.3). However, the general productivity except in the Kurnool district did not decrease by 1953-54. There was a decline in rice yield in Nizamabad District i.e., from 1,110 Ibs or 5.0 quintals per-acre during 1925-30 to 792 Ibs or 3.6 quintals per-acre in 1930-35. The yield per-acre of rice increased steadily from quinquennium to quinquennium. Before the construction of the Nizamsagar Project there was no assured water supply and the yield of rice fluctuated year to year. After the Nizamsagar Canals came into operation the yield of rice increased constantly. It increased to 822 Ibs or (3.7 quintals per-acre) during 1935-36 to 1939-40. further to 952 Ibs or (4.3 quintals per-acre) during 1940-41 to 1944-45 while it was only 792 Ibs during 1930-31 to 1934-35 (see Table 6.4). Yields of almost all crops in Nizamabad district increased and got stabilised after Nizamsagar came into operation. Thus, the impact of irrigation on yields per-acre particularly in case of rice was relevant.

Table 6.4 : Yield per-acre of rice in Nizamabad District during the period 1925-26 to 1944-45

Years	Yield in Quintals
1925-26 to 1929-30	50
1930-31 to 1934-35	36
1935-36 to 1939-40	3.7
1940-41 to 1944-45	43

Source: Agricultural Statistics, Estimates and Yield of Principal Crops 1925-26 to 1944-45 (3 issues), H.E.H., the Nizam's Dominions, Hyderabad.
Note: Figures calculated for five years average.

Even though the productivity of rice declined between 1925 and 1945 in Nizamabad, it increased by a large extent during the period 1955-56 to 1996-97 in the delta areas of East Godavari, West Godavari, Guntur and Krishna districts. The yield of rice per-acre increased by 55%, 50%, 60% and 50% respectively in the above districts, while in Kurnool it was 54%. In Nizamabad it increased only 37% (see Table 6.5). (For details see Appendix-VI-4). This trend was mostly influenced by irrigation facilities.

Table 6.5 : Productivity of rice per-acre in quintals in some irrigated districts of Andhra Pradesh - 1955-56 and 1996-97

Year	EastGodavari	WestGodavari	Krishna	Guntur	Kurnool	Nizamabad
1955-56	6.6	6.0	6.7	6.0	5.6	4.5
1975-76	7.3	8.3	6.0	6.2	6.3	7.7
1996-97	11.9	12.0	11.2	12.0	10.3	12.1

Source: Based on data given in the Season and Crop Reports of Andhra State and Andhra Pradesh and Statistical Abstracts of Hyderabad State, for different years-D.E.S, Hyderabad.
Note: This data are derived from three yearly moving averages taking 1954-55 as base year, One lb= 454 g., lk.g = 2.20 Ib, 1 quintal = 220 Ibs. (Collins Gem English Dictionary (p.612)).

There have been significant variations in the productivity of rice over the past two to three decades, except in the case of Nizamabad district Consequently, the gross value of output of rice per acre rose enormously, under the impact of rising prices.

There arc some limitations in the data on yields including me non-availability of separate figures of yield for delta and upland areas. Only the average district yields arc available. Thus the decrease in some years in the average yields of some of the delta districts might have occurred in the upland areas, while that of the delta area might have remained relatively constant

There had been also an enormous increase in the general price level in Andhra Pradesh as well as in the country as a whole. Prices of commodities appear to have varied greatly during the 19th century in different parts of the country owing to the difficulty of communication and general insecurity.

The old prices are, strictly speaking, not comparable with recent prices on account of the variety of the measures in terms of which the prices were quoted in the old days and the uncertanity as to their contents, but they nevertheless give a fairly correct general idea of the direction of changes that occurred.

Representing the average prices of the rice in the five years beginning with 1853 by 100, the average prices of paddy at the quinquennial periods had increased during the period of 1861-1865 by 264 points and it decreased by 216 points by 1870-1874 period, (see Table 6.6). Prices rose rapidly after 1853 till they reached their culmination in the five years ending 1865, when they were two-and-a-half times what they were prior to 1853 and twice as high as in the early years of the Century (Raghavaiyangar, S. 1893. pp. 58-59). The causes of this sudden rise have been the gold discoveries of America and Australia in 1848 led to a large influx of gold into Europe, raising prices and creating a demand for Indian productions.

Table 6.6 : Average price at the quinquennial periods -1853 to 1888 in Madras Presidency

Grain	Average for Five-years ending			
Paddy	1853	1865	1874	1888
	100	264	216	234

The Indian Mutiny necessitated large remittances in silver for expenditure in India, and the construction of public works especially railways had the same effect. After 1870, prices fell by about 20% from what they had been in 1865, but were nevertheless nearly twice as high as in 1853 and 50% higher man in the earlier years of the Century.

There had been considerable fluctuations in the prices of agricultural commodities. Its price system had the direct impact of the two Great wars and the depression, Durmg the four year period before the commencement of the first world war in 1914, the retail prices of rice were on the rise. It was a clear indication that crop conditions had heavy bearing on prices of agricultural commodities. The starting of war in the following year had its repercussion on the price situation. It had its adverse effect on the balance of trade of the State, huge quantities of agricultural (export) products remained unsold. In 1914-17 prices, declined compared to those of 1913, though crop conditions were good. War time conditions thus in no way provide a boom to the cultivators nor to the State.

In spite of this general fan in prices during the twenties, it would be interesting to notice from the retail prices of rice, that compared to the pre-war level, the prices during 1921-28 were still much higher. This had mainly been due to the effects of the Post-War inflation.

The onset of the Great Depression in 1929 and its continuation for a six year period ending in 1934 wrought unprecedented havoc in the economic fortunes of the cultivating masses in particular and others in general. The prices of agricultural products went crashing down from year to year throughout the period. The declining ranged from 50% in respect of rice.

Post-depression boom in productivity outstripping the demanding, and differential effects of crop conditions were important factors that contributed for these price variations.

The outbreak of the Second World War started the period of rising prices in 1939. Excepting slight fall in 1941 and rather heavy in 1944-45, the rest of the period, both during and after the war, was marked by a scene of ever-rising prices.

The price of Paddy in some irrigated districts of the Madras Presidency during the period of 1918-1919 to 1946-47 had increased by 78% (see Table 6.7). For details see Appendix VI-5, (1874-75 onwards). During the period of 1947-48 to 1969-70, it had increased by 16%. During the period of 1970-71 to 1979-80 it was increased by 53% and in the period 1980-81 to 1996-97 it increased by 46%

Table 6.7 : Farm harvest prices of Paddy in some irrigated districts of Andhra Pradesh, 1914-15 to 1953-54 and average wholesale prices of Rice in some irrigated districts of Andhra Pradesh, 1954-55 to 1996-97.

(Rs. per quintal)

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1914-15	4.17	_	4.54	4.53	6.05	
1920-21	7.52	_	7.73	7.94	8.48	
1931-32	3.63	3.59	3.84	3.71	4.32	6.70
1944-45	8.74	8.48	8.59	9.20	9.78	4.25
1969-70	72.00	76.90	68.08	74.52	61.00	59.08
1979-80	190.23	185.50	184.6	186.80	190.60	190.30
1996-97	461.80	466.60	410.00	552.80	520.10	472.50

Source: Based on Statistical Adas of the Andhra State. Season and Crop Reports. D.E.S.. Hyderabad.

Thus, the prices and the yield per unit of irrigated area have increased substantially because of the technological improvements in agriculture, and especially in the case of paddy grown under assured irrigation conditions. Since assured irrigation is the basis for the increased output there is justification for rising the water rates. Simultaneously, the impact of rising commodity prices led to rising costs of production with rising prices of other inputs like manures, seeds and labour.

III

Trends in Water Rates

The settlement department in me Madras Presidency was organised in 1856. The initial settlement of the land revenue assessment was completed during the last quarter of the 19th century. The old assessments had been excessive. A large extent of land often of superior quality, had fallen out of cultivation in consequence of the unequal pressure of assessments on the different classes of soil (Raghavaiyangar, S, 1893, p. 186). It was to put an end to this state of things that the government undertook the survey and re-assessment of the cultivable lands throughout the Presidency. The object in view was two-fold, viz., first to reduce heavy assessments and to fix a moderate tax on lands; secondly, to remove the anomalies and inequalities in the assessments and to adjust to some extent, the tax levied on lands of different qualities with reference to their relative productive powers (Raghavaiyangar, S, 1893, p. 187). There was no minimum size for fields in Madras Presidency but inconveniently small holdings of the same kind under certain conditions were clubbed together (Baiden-Powell, B.H. 1892. 1990, p.56). A share of the net produce was to be considered as the maximum state charge eventually fixed at one-half. Grain assessment should be commuted in the money-value with reference to the average prices at which grain had been showed by the ryots in view to taking account of the fluctuations in prices.

The first step was to divide the soil into certain main classes according to the mechanical composition and chemical properties of the lands dealt with, mere are 14 such classes recognised by the settlement department. Each class of soil was then sub divided into some 3 to 5 "sorts" with reference to their degrees of fertility as ascertained by an examination of the constituents of the surface soil and sub-soil the total varieties of soils dealt with being 66. (Raghavaiyangar, S.S., 1893, pp. 187-189). This was based on the carefully formulated survey records.

The second step was to ascertain the grain out-turn of the lands irrigated and un-irrigated. For this purpose, certain prevailing dry crops in the case of dry lands and paddy in the case of irrigated lands were taken as standards, and the average out-turn, in terms of these crops, of every variety of soil was ascertain by actual harvest experiments conducted for a series of years. From the average out-turn then ascertained a deducting from it 15% to 25 % was made on account of extraordinary vicissitudes of season and barren patches. (Raghavaiyangar, S.S., 1893, p. 190). This measure seems to have been associated with some arbitrariness.

The third step was to find out the money value of the grain out-turn. For this purpose, the average of the market prices of standard crops in the months in which the ryots sold their produce for a number of years, generally *20,* was ascertained and deducted from it 8% To 20% for cortege and merchants profits. The remainder was taken to represent the ryots prices and the grain out-turn was converted into money at fins rate. (Raghavaiyangar, S.S., 1893, p. 188). This too sometimes led to over-estimated.

The fourth process was to ascertain by actual enquiries the expenses of cultivation for each kind of soil. The difference between the money value of the grain and the cultivation expenses was taken as the net value of each kind of soil of which represented the land tax and a table of rates was accordingly framed.

Thus, fair land in a good situation immediately adjoining the inhabited portion of the village would be classed in the first sort 'good', while good land at a great distance would be classed as 'moderate'. In case of irrigated lands their classification into 'sorts' also was adjusted with reference to their facilities fur irrigation owing to their proximity or otherwise to the irrigation source.

In theory, it was sought to be appropriated by way of wet assessment nearly 50% of the net value of agricultural produce. But then, the elaborate procedures followed and the liberal concessions allowed in the process of valuation of the produce reduced the effective incidence of the land revenue including assessment to less than l/4th to l/6th of the gross produce. For instance, the average price prevailing in 20 non-famine years preceding the settlement was generally adopted as the basis for calculation. Since the prices adopted were wholesale prices prevailing in market centres, a deduction of about 15% was allowed from the wholesale prices towards profits of merchants, and another deduction of 10% to 25% was allowed towards vicissitudes of the season. The revenue both land amassment and water charges under different classes of irrigation works for the year 1886 were analysed, for class I and II works, project-wise whereas for class III and IV data were given district-wise (Proceedings of Board of Revenue, dt.7.6 1886) (see Appendix VI-3). The water charges were ranging from Rs.3.18 per acre in case of Godavari anicut to Rs. 6.57 in case of Srivaikuntam *anicut*, in Class I works. The variations were not much in the second crop water rates and also in dry land assessment Similar trends are observed in case of other classes of works. It can be noted that the average land assessment, and rates higher for class I works were higher than that of class II works. These high rates along with higher proportion of area covered under class I works might be the reason for the higher proportion of surplus revenues in class I works. As far as class III works were concerned the rates were the highest of all the classes of works and the area of coverage was also higher than that of class II works. The Imperial works dominate the class IV works both in terms of assessment and water rates.

It might be interesting to raise the question as to what was happening to these rates over a period of time. The data available for the limited period of 1890-91 for all the works except class III (for which the data refer to the period 1861-62 to 1884-85) show that were not many changes in water rates over the years in all the classes of works. From (his one can infer that the 25 percent of the gross revenue as wetland assessment remained the same. This is apparent because in the context of constant technology one can be certain that the changes in the average gross output would be marginal. On the other hand, one can expect even a hike in the proportion of wet assessment to gross value of output because the area under irrigation fell.

Water rate for Godavari delta was fixed at Rs. 3 an acre in 1861. It was raised to Rs. 4 in 1865 in G.O. No. 1006 dt. 12.5.1865. This was again rained to Rs. 5 per-acre in G.O. No. 562, Revenue, dt. 2.8.1894. Since 1931, with the resettlement the rate has been increased to Rs. 6.25 per acre. Subsequently, there was no revision in the water rates till 1956-57. Since then the project rate or water-rate was increased in stages by 25% in 1956-57 (Government of Andhra Pradesh, No.982, dt27.05.1957), another by 25% in 1957-58 and another 50% in 1962-63 (G.O.No.168, dt.31.01.1963) Further, it was enhanced to Rs. 30 in 1975-76 (Government of Andhra Pradesh, No.412, dt22 03.1975), and in 1986-87 (Government of Andhra Pradesh, Act-11 of 1988, dt. 24.08.1989) a uniform water rate was fixed which was enhanced to Rs. 60(see Table-6.8) Major and medium irrigation works were divided into category I and II. Any source of irrigation coming under Major and Medium irrigation projects come under category-l Sources other than the major and medium irrigation sources come under categoty-II. The Government of Andhra Pradesh had further enhanced the water rate through ordinance to Rs. 200 in 1st Jury 1996 (Government Ordinance, dt01.07.1996)(see Tabk 6.8).

TABLE - 6.8: Water Rates per-acre in the Delta Areas 1931-32 to 1996-97 (Category -1)

YEAR	Rs.-PS.
Till 1931-32	5.00
1931-32	6.25
1956-57	7.50
1957-58	9.40
1962-63	12,50
1965-66	1500
1975-76	30.00
1986-87	60.00
1996-97	20000

Source: 1. Based on data in the Government Orders, Revenue Department, Government of Andhra Pradesh in different years.
2. Andhra Pradesh Irrigation Commission Report, 1973.

Note: Old denomination of prices- 192 pies = Rs.l, New denomination of prices- 12 paise = 1 anna, 16 annas = Rs.l, 100 paise = Rs.l

Almost a similar trend is evident in the case of Kurnool district also, in the case of which, average consolidated wet assessment has been taken for analysis. There was no enhancement of the rates of wet assessment at the time resettlement and the average rate per-acre for wet lands in Kurnool district was Rs.6.88 till 1955-56, when it was increased by 1/2 anna in a Rupee. The variations in water rates when compared to other delta and Nizamabad districts, there was differential water rate system operated in Kurnool district The rate was enhanced by 18 3/4% in 1956-57 and again by 18 3/4% (G O No 982, 8dt.27.05.1957), in 1957-58 and by 1962-63, the rate was doubted to Rs 14-20. which is also me current average wet rate of assessment (G O No.168. dt.31 01 1963) (see Table 6.9). Further, it was enhanced to 10% (i.e.; Rs.15), in the year 1965-66 and it was Rs.30 in 1975-76, (G.O.No.412, dt.22.03.1975). During the year, 1986-87, a uniform water rate was fixed throughout the state (G.O.Act-11 of 1989, dt24.08 1989). Wet assessment was abolished and water rate was Rs. 60. It was further enhanced to Rs. 200 (per acre) in 1996-97 (Government Ordinance 01.07.1996) (per single wet crop under category-I)

This enhancement was taken place owing to the mounting cost of capital for development irrigation, which mentioned in the G.Os.

TABLE - 6.9: Average Rate of Assessment/Water cess for wet lands in Kurnool District (Rs. Per Acre) 1955-56 to 1996-97

YEAR	RS -PS
Till 1955-56	6 88
1955-56	7.90
1956-57	8 41
1957-58	10.00
1962-63	14.20
1965-66	15.00
1975-76	30.00
1986-87	60.00
1996-97	20000

Source: 1. Based on data in the "Government Order's Revenue Department. Government of Andhra Pradesh.
2. Andhra Pradesh Irrigation Commission Report, 1973.

Note: Old denomination of prices - 192 pies = Rs.l, New denomination of prices- 12 paise = 1 anna, 16 annas = Rs.l, 100 paise = Rs.l.

For Nizamabad District also average consolidated rates, have been considered. At the time of the formation of Andhra Pradesh the rates of land revenue were already considerably higher in the Telangana districts as compared to the remaining districts of the state and therefore, as part of the programme of rationalisation of land revenue assessment in the state, only a small enhancement of about 30% was effected in Nizamabad and other Telangana districts as against 100% in wet assessment in the Andhra region (Government of Madras, 1931; P.277). The average wet rale of assessment in Nizamabad district was Rs.10.60 till 1952-53 when it was enhanced by one anna in a rupee, to Rs. 11. There after the average rate was again enhanced to Rs. 14-24 in 1962-63 (sec Table 6 10) During the year 1966-67, average rate was enhanced by 5% (i.e., Rs 15; and m the year 1975-76, it was Rs. 30 enhancement (G.O.No.412, dt.22.03.1975). Further in the year 1986-87 (G.O.Act 11 of 1988, dt.24.08.1989) a uniform rate was fixed instead of consolidated assessment and it was enhanced to Rs.60. Further it was enhanced to Rs.200 - per acre

Table - 6.10: Average Wet Rate levied on the lands in Nizamabad District (Per Acre) 1952-53 to 1996-97

YEAR	RS-PS.
Till 1952-53	1040
1952-53	11.00
1962-63	14.30
1966-67	15.00
1975-76	30.00
1986-87	60.00
1996-97	200.00

Source: 1. Based on data in the "Government Order's **Revenue Department** Government of Andhra Pradesh, Hyderabad, Andhra Pradesh.
2. Andhra Pradesh Irrigation Commission Report, 1973.

Note: Old denomination of prices- 192 pies = Rs.l, New denomination of prices- 12 paise = 1 anna, 16 annas = Rs. 1, 100 paise = Rs. 1.

These differences were taking place (periodical enhancement) because the government claims that the water rate is chargeable only in respect of lands covered by the projects coming under the per view of the Andhra Pradesh (Andhra area) Irrigation Cess Act, 1865 and Andhra Pradesh (Telangana area) Irrigation Cess Act, 1357 Fash. The input costs cannot remain constant. Besides, the prices of agricultural produce also increased considerably. The relevant reason of enhancement of water rates existing on the consideration that the maintenance costs of sources have gone up considerably The existing rates those were fixed a decade ago.

Thus, there was a variation in water rates from protect to protect in different districts. In delta districts consolidated wet assessment was implemented. In Kurnool district, differential water rate system was implemented. Nizamabad. was under the domain of Nizam's till 1948. It was during the period 1986-87. onwards uniform rate implemented throughout the state of Andhra Pradesh.

IV

Share of Water Rates in the Gross Value of Output

The proportion of Government assessment to the gross produce was estimated by the settlement calculations at 6.3%, taking the value of the gross outturn at 50 crores of rupees, and land revenue at 3.16 crores in Madias Presidency. They have excluded from land revenue 1.37 (2.9%) crores as water charge and not forming part of land tax proper. Including this the proportion was 9.2% (Raghavaiyangar, 1893, pp.112-113). In these calculations, however, the outturn of favourably assessed inam lands and of **zamindari** lands, which paid to government a smaller revenue man ryotwari lands, has been included

Taking the ryotwari lands alone, the average rate of assessment for wet lands was Rs.5/- per acre and for dry lands Rs.l/- per acre and these rates are between one-fourth and one-fifth and one-fourth and one-sixth respectively of the gross outturn according to settlement calculations after deducting from the average outturn 16.66% in the case of wet and 25% in the case of dry lands as allowance for vicissitudes of season.

Table- 6.11: Statement showing the average yield, the cultivation expenses and the rent per-acre in the Madras Presidency-1861 to 1880

ITEM	DRY		WET	
	RS.	Ps	Rs.	Ps
Value of produce	8	11	25	43
Cultivation expenses	3	28	*0*	57
Water rate	1	20 !	5	15
Former's profit	3	65	10	79 '
Ratio of water rate to the produce	1487%		20 08%	

Source: Based on S.S. Raghavaiyangar's Memorandum on the Progress of the Madras Presidency: During the last fifty years. 1893, Appendixes - Table -3, P.cxlvii.

Note: Old denomination of prices- 192 pies = Rs.l, New denomination of prices- 12 paise = 1 anna, 16 annas = Rs.l, 100 paisc = Rs.1.

The share of water rate to the grow value of output was around one-sixth in dry areas, while in wet areas it was one-fifth. The ratio of water rate to the produce was 20.08% (see Table 6.11). In the irrigated dry the ratio of water rate to the produce was 14.87%.

Table-6.12: Gross value of rice per acre (in Rs.) in some irrigated districts of Madras Presidency -1918 to 1954.

YEAR	DISTRICT				
	EASTGODAVARI	WESTGODAVARI	KRISHNA	GUNTUR	KURNOOL
1918-19	53.33	–	46.25	47.30	N
1927-28	62.15	–	52.56	56.74	53.73
1939-40	28.72	28.86	26.42	33.78	33.30
1940-41	48.81	37.58	37.84	43.86	43.77
1942-43	44.23	61.92	54.39	66.92	46.98
1943-44	60.52	70.90	65.52	70.52	63.64
1945-46	66.61	58.14	61.20	73.63	62.40
1946-47	77.43	68.41	68.40	68.74	66.65
1947-48	90.98	90.10	77.92	90.80	102.71
1950-51	103.72	112.91	107.60	102.67	96.10
1953-54	168.35	160.43	142.11	123.00	82.88

Source: Derived from Tables 6.3 and 6.7 and Appendixes - VI - 4 and 5

The gross value of output during the period 1918-19 to 1953-54 in the districts East Godavari West Godavari, Krishna, Guntur and Kurnool by 31.7%, 25.6%, 43% 38.5% and 64.8% respectively (see Table 6.12). In Nizamabad district, during the period. 1925-26 to 1944-45, it was decreased by 1% due to severely effected successive famines (see Table 6.14).

Table-6.13: Share of water rates (%) to Gross value of output of rice per-acre in some irrigated districts of Madras Presidency 1918 to 1954.

YEAR	DISTRICT				
	EAST GODAVARI	WEST GODAVARI	KRISHNA	GUNTUR	KURNOOL
1918-19	9.4	--	10.8	10.6	N
1927-28	8.1	--	9.5	8.8	12.8
1939-40	21.8	21.7	23.67	18.5	20.7
1940-41	12.8	16.6	16.5	14.2	15.7
1942-43	14.1	10.1	11.5	9.3	14.6
1943-44	10.3	8.8	9.5	8.7	10.8
1945-46	9.4	10.7	10.2	8.5	11.0
1946-47	8.1	9.1	9.2	9.1	10.3
1947-48	6.7	6.9	8.0	6.9	6.7
1950-51	6.0	5.5	5.8	6.1	7.2
1953-54	3.7	3.9	4.4	5.1	8.1

Source: Derived from Tables 6.8, 6.9, 6.10, and Appendix - VI - 6.

The Project water rate increased by 150% since 1900 as against a rise of 750% to 1000% in the gross value of output per acre. As a result, the incidence of the project water rate fell to less than even l/4th of its former level in the delta districts. The average wet assessment of Kurnool district formed about 21% of me gross value of rice per acre around the year 1900 (Government of Andhra Pradesh, 1973, pp. 275-278). It is generally assumed that on an average, water charge constitute about 2/3rds of the consolidated wet assessment Thus, the comparative incidence of average wet assessment in delta districts of that time would have been of the order of 15% to 16%. The relatively lower incidence, despite higher rates of assessment, is attributable to higher yields in the delta region (see Tables 6.12 and 6.13). By 1953-54, tile average water rate to gross value per acre in Kurnool District declined to 8.3% and it further fell to 4.8% by 1968-69 (see Tables 6.16 and 6.17) (For details see Appendixes VI - 6 and 7). During the year 1978-79, the average water rate to gross value per acre of output of rice decreased to 2.8% and in the year 1989-90, it was 1.8% (see Table 6.17). Whenever enhancement of water rate was taken place, the share of water rate is fluctuating with gross value of output

The share of average wet rate in Nizamabad district was formed about 39.3% of the gross value per acre in 1925-26 but it ultimately declined to 4.8% by 1968-69, owing to increased output and prices. The considerable fall in the proportion of average land revenue or water rate between 1944-45 and 1968-69 in Nizamabad district was not only due to increase in the price levels and stagnation in the rates of assessment but also due to a significant increase in the productivity per acre following development of cultivation in the Nizamsagar area (see Tables 6.15, 6.16 and 6.17). The average rate in relation to grow value, further decreased 1985-86 by 1.3%. (see Table 6.17). This has increased by 35% of gross value due to output enhancement of water rate in 1996-97 (i.e., Rs. 60 to Rs 200 per acre).

Table 6.14 : Value of Gross Output of Rice per acre in Nizamabad District 1925-26 to 1944-45

Years	Gross Value of Output (in Rs. per acre)
1925-26 to 1929-30	26.47
1930-31 to 1934-35	32.00
1935-36 to 1939-40	30.40
1940-41 to 1944-45	25.37

Source: Computed from Tables 6.4 also see Appendix - VI-5.

Table 6.15 : Water rates as percentage of the Gross Value of output per acre of Rice in Nizamabad District (1925-26 to 1944-45).

Years	Share of Water Rales in Gross Value of Output
1925-26 to 1929-30	39.3
1930-31 to 1934-35	32.5
1935-36 to 1939-40	34.2
1940-41 to 1944-45	41.0

Source : Computed from Tables 6.10 and 6.14.

Table 6.16 : Value of Gross Output of Rice per acre in some irrigated districts of Andhra Pradesh, 1955-56 to 1996-97.

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1955-56	123.75	105.78	99.23	11064	92.4	36 00 '
1965-66	288.00	313.00	268.00	277.00	331.00	331.00
1975-76	1329.3	1189.8	977.4	957.5	928.2	1213.10 !
1985-86	3154.2	3114.7	3381.2	3359.8	2412.9	2301.30
1996-97	5495.4	5599.2	4592.00	6633.60	5356.00	5717.30

Source: Computed from Tables Appendixes - 4 and 5.

Table 6.17: Water Rates as percentage of the Gross Value of output per acre of Rice (1955-56 to 1996-97).

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1955-56	5.0	5.9	6.3	5.6	8.5	30.6
1960-61	12.4	9.8	17.7	12.7	15.9	13.9
1970-71	3.3	2.2	2.2	2.2	2.8	2.2
1980-81	1.5	1.4	1.6	1.9	2.4	1.7
1985-86	1.0	1.0	1.0	1.0	1.2	1.3
1996-97	3.6	3.6	4.6	3.0	3.7	3.5

Source : Computed from Appendix - VI-6 and Tables 6.8. 6.9 and 6.10.

In general, water cess formed about 11% to 9% of the gross value of nice per acre towards 1900, while it had come down to about 5% to 4% in delta areas, and 8% in Kurnool by 1953-54 (see Table 6.13). But, in Nizamabad District it had increased from 39.3% to 41% during the period 1925-26 to 1944-45 (see Table 6.15).

As a consequence in the value per acre as compared to the water rate levied, water rate further declined as a percentage of gross value to about 2% in almost all the districts by 1971-72. Further, 1% level in 1985-86 and 3.5% level in 1996-97 (see Table 6.17). (For details see Appendix VI-7). Gross Value of output per acre of rice increased through out the period (1955-56 to 1996-97) by Rs. 100 to Rs. 5,400, whereas water rates increased only Rs. 5 to Rs. 200 during period 1955-56 to 1996-97. Thus, the low water rates in relation to gross value of output show the decreasing trend of water rates

Share of Water Rates in the Cost of Production

The cost of cultivation of the crops varied from district to district depending upon local conditions prevailing and availability of irrigation facilities. In early times the cost of cultivation consist of cost of initial preparatory for cultivation, manures, seeds and sowing, costs of after cultivation, irrigation and harvesting expenses (Government of Andhra Pradesh, 1959, pp. 130-155). During the settlement scheme reports of original and resettlements i.e.. 1860 and 1931. the cost of paddy per acre in East Godavri and

West Godavari was Rs. 3.50 and Rs. 14. In Krishna District during original and resettlement reports, it was Rs. 6.50 and Rs. 20. In Guntur it was Rs.5.00 and Rs. 14.00. In Kurnool District, the cost of Paddy per acre was Rs. 3.60 and Rs. 12.25; while in Nizamabad district it was Rs. 14.60(see Table 6.18).

The cost of Paddy per acre in the year 1958, had increased tremendously in East Godavari, West Godavari, Krishna, Guntur, Kurnool and Nizamabad by Rs. 175, Rs. 151. Rs. 120, Rs. 150, Rs. 260, and Rs. 210 respectively(see Table 6.18). From 1970-71 onwards, the data on cost of cultivation has been collecting agricultural departments systematically dividing the Andhra Pradesh into six zones. Here, the data was shown the average of six zones, Andhra Pradesh as a whole.

Table- 6.18 Cost of Cultivation of Paddy (per-acre) in some irrigated districts of Andhra Pradesh(in Rs.)

Year	Districts					
	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
Original Settlements	3.50	3.50	650	500	360	
Resettlements	14	14	20	14	12.25	1460
1958(DES)	175	151	120	150	260	210

Source: l.Raghavaingar,S S, 1893, Appendixes, Table-3
2. Government of Andhra Pradesh,1959, pp 130-55
3. Government of Andhra Pradesh. 1958. Statistical Atlas D. E. S. Hyderabad.

A number of cost concepts such as cost A1, cost A2, cost B and cost C have been following in the analysis. The concept of total cost is used as synonymous with cost C and this includes the expenditure incurred on human labour (owned, exchanged and levied), bullock labour (owned, exchanged and levied), seed (owned, exchanged and purchased,) organic manure (owned and purchased), fertilizers, pesticides, land revenue, cesses and taxes, irrigation charges, depreciation, interest on working capital interest on fixed capital rent paid for leased-in land, imputed rental value of owned land, imputed value of family labour and others miscellaneous expenditure. The costs of cultivation of paddy in one acre has gone up by six times between 1971-72 and 1989-90. The rising levels of yields have slowed the rise in costs per quintal of paddy rose less than twice while that per acre rose by nearly three times. Increases in yields and gross value of output have occurred in the case of irrigated crops. Costs of cultivation in the State have been higher than in other states. Irrespective of paddy it is higher than in Punjab and Uttar Pradesh.

<u>Table 6.19:</u> Water Rates as % of Cost of Cultivation of Rice in Andhra Pradesh.

YEAR	TOTAL COST OFPRODUCTION (IN RS.PER ACRE)	WATER RATES (Rs.)	WATER RATE AS % OF COST OF PRODUCTION
1971-72	597.70	15.00	2.5
1972-73	547.21	15.00	2.7
1973-74	695.87	15.00	2.2
1974-75	909.49	30.00	1.7
1975-76	808.05	30.00	3.7
1976-77	1011.65	30.00	3.0
1977-78	1096.96	30.00	2.7
1978-79	1248.06	30.00	2.4
1979-80	1273.44	30.00	2.4
1980-81	1576.74	30.00	2.0
1981-82	1556.64	30.00	2.0
1982-83	1790.00	30.00	1.8
1983-84	2142.19	30.00	1.4
1984-85	2332.19	30.00	1.3
1985-86	2466.03	30.00	1.2
1986-87	2591.13	60.00	2.3
1987-88	2894.87	60.00	2.1
1988-89	3233.89	60.00	1.9
1989-90	3210.89	60.00	1.9

<u>Source:</u> From 1971-72 to 1983-84 data given in Cost of Cultivation in Principal Crops - 1990 *D.E.S.,* New Delhi & from 1984-85 to 1989-90 data given in cost of cultivation Cell, A.P.A.U., Rajendranagar, Hyderabad

The per acre total cost of production of rice during the year 1971-72 was Rs.597.70, while the water rate was Rs.15 per acre in the same year, which was 2,5% of total cost of production (see Table 6.17). From the period 1971-72 to 1976-77. the cost of production and water rates per acre were increasing tremendously. During the period 1971-72 to 1976-77 the cost of production, and water rates per-acre increased by 41% and 17% respectively. But during the period 1977-78 to 1989-90 the total cost of production of Rice per-acre was increased to 66% while water rate decreased to 30%. It is clear from the table 6.17 that the cost of production increased by 5 times during the period 1970-71 to 1989-90. whereas the water rate share in the cost of production has been decreased to 25%.

When compared to value of gross output and cost of cultivation for wet crop, the average value of produce per-acre of rice during the period 1861 to 1880 in Madras Presidency was Rs. 25.43, while cultivation expenses was Rs. 9.57 (see Table 6.10) Water rate was Rs. 5.15. From this farmer's profit went to Rs. 10.79. Finally, the ratio of water rate to the produce was 20.1%. In the year 1970-71, the average value of gross output per-acre of rice was Rs, 619, and cultivation expenses was Rs. 598, m this the charge of water rate included. The farmer gained marginally. The share of water rate had come drastically. In the year 1989-90, the average value of grow output per-acre of rice was Rs. 3,905, and cost of cultivation was Rs. 3,211. In this water rate was Rs 60 only. Thus, the charge of water rate has been came down drastically, and the subsidy element has gone up.

VI
Conclusion

The benefits from irrigation are significant though the economic rates of return from irrigation are low. The productivity and prices of rice had increased to a large extent in the selected districts of East Godavari, West Godavari, Krishna, Guntur, Kurnool and Nizamabad. Over time, the ratio of water rate to gross value of output was 20,08% during the period 1861-1880. It has been decreasing continuously; i.e. in 1918-19 it was around 10%, and in 1953-54 around 4%, it was 2.6% in 1970-71, and in 1995-96 it was near to

The gross value of output per-acre of rice increased throughout the period by Rs. 100 to Rs. 5.400 (1955-56 to 1996-97). whereas water rates increased by only Rs. 5 to Rs. 200 (1955-56 to 1996-97). Thus, the low water rates in relation to gross value of output may be from the low assessment of water rates, while benefits are well recognised owing to the irrigation development.

Gross Production and Productivity increased, water rates too increased but their proportion in the gross output had declined over the time period of 1854 to 1999. The cost of cultivation had increased as a percentage of the gross output leaving the farmer with a declining margin of profits. However, the cost of irrigation did not increase as fast as the costs of the other inputs. This implies that the subsidy clement in irrigation supply had been increasing as though the Government wanted to compensate the farmer for the increasing costs of other inputs or probably his inefficiency leading to the increased demand for irrigation water under all the major and minor projects.

NOTES:

1. The Irrigation Commission (1992) had suggested that water rates should be fixed at around 5% of gross income for food crops and 12% for cash crops. At present, the actual gross receipts per acre of area irrigated by major and medium projects is barely 2% of the estimated gross output per acre of irrigated area, and less than 4% of the difference between output per acre of irrigated and unirrigated areas. Since the gross receipts include several items other than water charges and cesses levied on irrigated land-accounting for about *27%* of the total receipts during the early 1980's. In Andhra Pradesh, during the year 1992-93, the items other than water charges and cesses levied on irrigated land account for about 0.55% i.e., below 1% (Land Revenue Drainage cess, other receipts from major and medium, minor were Rs.7628 lakhs, while total gross value of agricultural production was in Rs. 13,77,172 lakhs). When considering items other than water charges and cesses levied on irrigation land, the incidence of irrigation charges per se must be considerably low (Government of India, 1992, pp.30-71).

APPENDIX VI -1

GRADES OF LAND AND WATER RATES FOR PADDY (Per Acre) IN TINNEVELLY DISTRICT: 1869

Grades of Land	Yields (Madras measures) Farmers	Govt Experi-Mental formal	Value (Rs.)	Expenditure (Rs)	Assessment (Rs.)	Water Rate (Rs)	% of Value
Best Black Loam	52	50	34-6	14	20-6	9-0	26
Good Black Loam	0	45	30-15	13	17-15	8-0	26
Ordinary Black Loam	38	40	27-8	12	15-8	7-0	25
Worst Black Loam	28	30	20-10	10	10-10	5-0	24
Inferior Black Loam	0	35	24-1	11	13-1	6-0	25
Best Black Clay	38	40	27-8	12	15-8	7-0	25
Good Black Clay	0	35	24-1	11	13-1	6-0	25
Ordinary Black Clay	31	30	20-10	10	10-10	5-0	24
Inferior Back Clay	0	25	17-3	8	9-3	4-0	23
Worst Black Clay	19	20	13-12	6	7-12	3-8	25
Best Black Sand	38	40	27-8	12	15-8	7-0	25
Good Black Sand	' 0	35	24-1	11	13-1	6-0	25
Ordinary Black Sand	27	30	20-10	10	10-10	5-0	24
Inferior Black Sand	0	25	17-3	8	9-3	4-0	23
Worst Black Sand	18	20	13-12	6	7-12	6-8	25
Best Red Loam	0	45	30-15	13	17-15	8-0	26
Good Red Loam	38	40	27-8	12	15-8	7-0	25
Ordinary Red Loam	34	35	24-1	11	13-1	6-0	25
Inferior Red Loam	0	30	20-10	10	10-10	5-0	24
Worst Red Loam	25	25	17-3	8	9-3	4-0	23
Best Red Sand	37	40	27-8	12	15-8	7-0	25
Good Red Sand	0	35	24-1	11	13-1	6-0	25
Ordinary Red Sand	27	30	20-10	10	10-10	5-0	24
Inferior Red Sand	0	25	17-3	8	9-3	4-0	23
Worst Red Sand	17	20	13-12	6	7-12	3-8	25
Average	31	33	22-11	-	-	-	-

Source: PBR, 22 May 1869.

Note: One Ib=0.454 Kg., 1M.M (Madras Measures)=2.53 Ibs., i.e., 1 M.M.=1.15 Kgs.

APPENDIX IV-2

RATES OF ASSESSMENT OF LAND AND WATER: 1868-69

District	Dry Rate Rs.-Ps.	Wet Rate Rs.- Ps.	Water Charge Rs.-Ps.
Ganjam	1.54	3.65	2.11
Vizagapatnam	1.17	5.31	4.14
Godavari	2.28	7.51	5.23
Krishna	2.04	6.79	4.75
Nellore	1.57	5.00	3.37
Cuddappah	1.37	7.82	6.39
Bellary	1.23	4.83	3.60 i
Kurnool	1.85	7.77	6.84
Madras	1.06	4.S7	2.75
North Arcot	1.80	6.71	4.85
South Arcot	2.44	5.73	4.21
Tanjore	1.52	5.13	4.47
Trichinopally	1.86	4.83	3.89
Madurai	1.61	4.51	3.82
Tinnevelly	1.61	10.76	10.01
Coimbatore	1.81	8.59	7.70
Neilgherries	1.09	2.48	2.25
Salem	1.55	6.53	5.84
Malbar	2.04	3.08	1.96
Average	1.20	5.32	4.12

Source: PBR, 22 May 1869.

Note: Old denomination of prices - 192 pies = Re. 1., New denomination of prices - 12 paisa = 1 anna, 16 annas = Re.l.

APPENDIX VI-3

CLASSES OF WORKS, LAND ASSESSMENT AND WATER CHARGES - 1886

Classes of Works	Land assessment (per acre) Rs.-Ps.	Water Charges Crop I Rs.-Ps.	Crop II Rs.-Ps.
CLASS I WORKS			
Godavari Anicut	1.14	3.18	3.06
Krishna Anicut	0.00	3.36	2.58
Cauvery Anicut	1.32	3.74	2.38
Pennar Anicut	0.99	3.76	2.91
Sangam Anicut	1.15	4.07	2.49
Srivaikuntam Anicut	0.76	6.57	3.42
Average	1.16	3.53	2.64
CLASS II WORKS			
Polar Anicut	1.05	2.74	2.19
Chembakam Tank	1.00	3.14	2.59
Pelandorai Anicut	1.05	3.20	2.89
Madras Supply Irrigation Extension	0.77	2.80	1.65
Average	1.01	2.82	2.22
CLASS III WORKS			
Vizagapatnam	0.83	2.38	0.96
Kurnool	1.15	4.43	3.88
Chengulput	1.19	1.82	1.90
North Arcot	1.03	3.53	2.54
South Arcot	2.09	3.88	2.80
Tanjore	1.31	2.94	1.92
Tinnevelly	1.42	7.09	4.53
Coimbatore	1.15	5.56	2.21
Chelam	0.91	2.15	1.53
AVERAGE	1.55	4.45	3.44
CLASS IV WORKS			
Ganjam	1.44	1.92	2.20
Vizagapatnam	0.76	1.89	0.61
Godavari	1.00	1.95	3.30
Krishna	0.72	2.98	-
Nellore	0.88	3.62	2.22
Cuddappah	0.90	3.83	2.38
Anantapur	0.49	4.67	2.16
Bellary	0.61	5.62	2.64
Kurnool	0.95	3.31	248
Chengulput	0.99	2.31	2.02
North Arcot	1.29	3.21	1.96
South Arcot	1.61	3.66	3.42
Tanjore	0.85	2.13	200
Tirchinoply	1.21	2.83	1.79
Madurai	1.03	2.76	1.71
Tinnevelly	0.98	4.67	2.15
Coimbatore	1.36	3.94	2.27
Salem	1.78	3.56	1.48
AVERAGE	1.09	3.15	205

CLASS IV (MINOR)			
Ganjam	1.14	1.32	1.11
Vizagapatnam	0.62	3.04	1.65
Godavari	0.65	1.65	2.58
Krishna	1.19	4.26	3.17
Nellor	0.98	3.27	2.00
Cuddappah	0.70	3.08	1.77
Anantapur	0.37	3.86	2.04
Bellary	0.56	3.18	1.32
Kurnool	0.82	3.24	2.50
Chengulput	0.95	2.08	1.88
North Arcot	1.23	3.10	1.89
South Arcot	0.96	3.36	2.70
Tanjore	1.04	1.70	1.90
Tirchinoply	0.88	2.08	1.78
Madurai	1.13	2.23	1.42
Tinnevelly	0.81	4.24	2.04
Coimbatore	0.87	3.39	1.97
Salem	1.29	2.80	1.01
AVERAGE	1.01	2.76	1.68

Source: PBR, 7th June 1886.

APPENDIX -VI - 4

Productivity of Rice in some Irrigated Districts of Andhra Pradesh, 1955-56 to 1996-97

(In quintals)

YEAR	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1955-56	6.6	6.0	6.7	6.0	5.6	4.5
1936-37	7.4	5.6	6.4	5.4	5.1	4.5
1957-38	6.2	6.4	6.8	5.5	4.4	4.3
1958-59	6.1	6.2	7.6	6.4	3.9	7.7
1939-60	6.3	6.6	7.4	6.3	4.2	6.5
1960-61	6.4	7.8	4.6	6.4	4.9	6.3
1961-62	7.4	6.8	7.2	7.0	6.3	6.5
1962-63	6.7	6.1	6.2	5.6	.1.7	4.4
1963-64	67	7.0	6.1	5.9	5.2	5.4
1964-65	7.3	7.2	7.4	6.8	6.4	6.7
1965-66	7.2	7.3	! 6.7	6.8	6.2	8.2
1966-67	7.0	7.3	6.5	5.7	4.8	9.5
1967-68	6.2	7.1	6.3	6.5	5.6	8.1
1968-69	6.1	7.5	5.2	4.8	5.5	6.5
1969-70	4.7	6.1	5.2	4.5	4.6	7.2
1970-71	4.8	6.9	6.5	6.2	5.3	7.1
1971-72	6.4	7.7	6.6	6.9	6.2	5.8
1972-73	6.4	7.9	7.1	6.3	6.3	5.7
1973-74	7.1	8.1	6.8	6.4	5.8	5.9
1974-75	7.6	8.7	7.2	6.9	5.9	6.0
1975-76	7.3	8.3	6.0	6.2	6.3	7.7
1976-77	5.9	6.4	5.8	6.1	6.1	7.1
1977-78	8.3	8.9	4.3	5.3	4.2	7.6
1978-79	9.3	9.4	7.8	7.9	6.4	8.2
1979-80	8.7	10.0	7.2	7.5	7.0	7.5
1980-81	9.8	10.3	9.4	7.9	5.7	8.4
1981-82	9.9	10.7	9.3	8.1	6.4	9.5
1982-83	10.3	11.8	9.7	8.9	8.0	8.8
1983-84	10.1	11.6	8.8	9.2	8.3	8.0
1984-85	10.1	11.2	8.7	9.1 !	8.0	7.8
1985-86	10.1	10.8	11.4	10.7	7.0	7.6
1986-87	9.0	7.0	114	9.2	8.2	6.1
1987-88	9.7	10.9	10.1	9.1	8.6	83
1988-89	10.1	9.3	10.4	9.9	8.6	9.1
1989-90	10.2	9.0	12.2	10.3	8.3	9.7
1990-91	8.2	9 5	10.9	13.0	9.7	9.8
1991-92	9.4	10.5	9.9	11.6	10.8	10.2
1992-93	10.7	12.0	11.4	12.2	9.8	8.1
1993-94	12.8	13.3	13.5	12.2	10.7	8.2
1994-95	10.5	12.9	11.7	10.8	8.8	9.3
1995-96	11.4	11.1	11.1	12.4	10.5	10.2
1996-97	11.9	12.0	11.2	12.0	10.3	12.1

Source: Based on data given in the **Season and Crop Reports** of Andhra State and Andhra Pradesh and **Statistical Abstracts** of Hyderabad State, for different years-D.E.S, Hyderabad.

Note: One lb= 0.454 g.. Ik.g = 2.20 Ib, 1 quintal = 220 Ibs (Collins Gem English Dictionary (p.612)).

APPENDIX - VI - 5

Farm harvest prices of Paddy in some irrigated districts of Andhra Pradesh, 1874-75 to 1953-54 and Average wholesale prices of Rice in some irrigated districts of Andhra Pradesh, 1955-56 to 1996-97 (in Rs. per-quintal)

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1874-75	2.01	--	2.23	--	2.65	--
1875-76	1.87	--	2.04	--	2.61	--
1876-77	3.23	--	3.67	--	5.21	--
1877-78	4.83	--	5.30	--	5.72	--
1878-79	4.17	--	4.50	--	4.20	--
1879-80	2.53	--	2.67	--	3.07	--
1880-81	2.20	--	2.37	--	3.06	--
1881-82	2.17	--	2.58	--	3.14	--
1882-83	2.30	--	2.86	--	3.12	--
1883-84	2.54	--	2.82	--	3.00	--
1884-85	2.48	--	2.88	--	3.16	--
1885-86	2.79	--	2.65	--	3.11	--
1886-87	2.65	--	2.43	--	2.99	--
1887-88	2.52	--	2.70	--	2.73	--
1888-89	2.64	--	2.84	--	3.15	--
1889-90	2.61	--	2.85	--	3.31	--
1890-91	2.69	--	3.57	--	3.29	--
1891-92	3.52	--	3.38	--	4.15	--
1892-93	3.24	--	3.17	--	3.64	--
1893-94	3.08	--	3.10	--	3.16	--
1894-95	2.82	--	2.81	--	3.11	--
1895-96	2.75	--	2.84	--	3.11	--
1896-97	3.84	--	3.64	--	4.10	--
1897-98	4.27	--	4.31	--	4.59	--
1898-99	3.09	--	4.13	--	3.36	--
1899-00	3.49	--	3.53	--	4.09	--
1900-01	4.00	--	4.19	--	4.35	--
1901-02	3.38	--	3.50	3.34	3.91	--
1902-03	3.01	--	3.23	3.07	3.46	--
1903-04	2.83	-	3.09	2.91	3.06	--
1904-05	3.18	--	3.24	3.19	3.45	--
1905-06	3.90	--	3.82	3.83	3.87	--
1906-07	4.46	--	4.32	4.29	4.10	--
1907-08	4.82	--	4.67	4.68	4.84	--
1908-09	5.31	--	5.26	5.02	5.15	--
1909-10	4.20	--	4.23	4.31	4.66	--
1910-11	3.99	--	4.03	4.03	4.40	6.50
1911-12	4.85	--	4.68	4.81	5.01	7.50
1912-13	5.25	--	5.28	5.32	5.69	6.50
1913-14	4.67	--	4.95	4.86	5.52	5.50
1914-15	4.17	--	4.54	4.53	5.05	6.50
1915-16	4.47	--	4.75	4.73	4.73	8.50
1916-17	4.41	--	4.88	4.95	4.98	8.50

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1917-18	4.56	--	4.93	5.07	5.44	7.50
1918-19	5.86	--	5.64	6.48	7.82	6.00
1919-20	7.13	--	6.72	8.15	9.56	3.50
1920-21	7.52	--	7.73	7.94	8.48	3.50
1921-22	6.64	--	6.89	7.35	7.75	3.80
1922-23	5.68	--	6.25	6.66	7.15	4.13
1923-24	6.19	--	6.34	6.87	7.34	4.60
1924-25	6.56	--	6.17	7.24	7.64	3.15
1925-26	6.83	--	6.34	6.85	7.39	4.50
1926-27	7.07	--	6.82	7.05	7.43	5.15
1927-28	6.83	--	6.41	6.92	7.36	5.10
1928-29	6.05	--	5.80	6.33	6.77	5.50
1929-30	5.84	--	5.72	5.97	6.56	5.70
1930-31	4.39	--	4.43	4.61	5.25	5.13
1931-32	3.63	3.59	3.84	3.71	4.32	6.70
1932-33	3.37	3.15	3.43	3.55	4.11	8.50
1933-34	2.72	2.62	2.71	2.81	3.54	9.40
1934-35	3.26	3.41	3.48	3.61	4.06	10.00
1935-36	3.52	3.48	3.53	3.80	4.19	8.60
1936-37	3.53	3.36	3.51	3.72	4.08	8.10
1937-38	3.59	3.58	3.70	3.82	4.27	7.12
1938-39	3.58	3.51	3.63	3.76	4.17	7.13
1939-40	3.59	3.90	4.02	4.12	4.69	7.13
1940-41	4.04	4.64	4.73	5.08	5.54	6.90
1941-42	5.19	5.04	5.37	5.55	6.19	6.10
1942-43	5.46	7.19	7.35	9.56	8.10	6.86
1943-44	7.38	8.44	9.09	9.53	9.79	5.50
1944-45	8.74	8.48	8.59	9.20	9.78	4.25
1945-46	8.65	8.55	8.27	9.44	10.23	3.50
1946-47	8.90	8.77	9.01	9.82	10.58	3.25
1947-48	10.58	10.72	10.53	12.27	15.53	3.50
1948-49	13.45	12.99	13.27	14.66	24.22	3.50
1949-50	13.61	13.13	14.17	14.11	15.52	4.30
1950-51	13.83	13.94	14.54	14.46	18.48	4.30
1951-52	13.01	14.27	13.96	15.00	17.52	7.60
1952-53	15.76	15.18	13.66	14.81	14.50	7.60
1953-54	18.50	17.63	17.33	15.00	12.75	5.76
1954-55	18.01	16.96	14.70	16.01	13.99	4.30
1955-56	18.75	17.63	14.81	18.44	16.50	8.06
1956-57	17.50	16.08	16.80	20.36	16.50	10.52
1957-58	11.08	11.32	11.18	10.50	14.40	10.59
1958-59	12.10	13.06	10.96	11.51	13.51	12.42
1959-60	12.00	11.95	12.11	11.51	13.36	13.39
1960-61	11.84	12.30	11.56	11.59	12.75	12.08
1961-62	32.59	36.31	33.06	33.18	33.37	34.22
1962-63	31.22	33.74	37.89	31.93	36.71	28.53
1963-64	33.41	33.95	34.19	34.57	37.41	33.43
1964-65	42.02	39.26	39.23	41.08	49.17	35.12
1965-66	40.05	42.83	40.00	42.08	53.44	40.33

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1966-67	45.51	46.94	43.18	50.09	46.31	42.87
1967-68	55.77	53.32	54.94	62.15	52.83	47.95
1968-69	61.12	63.16	59.17	69.21	54.00	47.95
1969-70	72.00	76.90	68.08	74.52	61.00	59.08
1970-71	93.71	97.86	103.79	110.35	101.25	98.15
1971-72	130.91	122.06	111.53	132.06	118.96	120.25
1972-73	140.58	128.25	126.35	149.27	143.50	152.68
1973-74	182.91	153.76	163.00	155.81	168.78	147.62
1974-75	206.99	184.69	200.96	176.56	213.22	185.25
1975-76	182.03	143.35	162.90	154.43	147.34	151.55
1976-77	200.73	165.28	186.35	192.21	174.96	160.88
1977-78	196.71	154.67	164.74	172.87	168.76	162.60
1978-79	146.71	149.10	154.32	161.80	164.70	147.03
1979-80	190.23	185.50	184.60	186.80	190.60	190.30
1980-81	202.20	210.1	205.0	203.2	218.6	209.3
1981-82	230.3	240.5	201.8	211.5	222.2	221.9
1982-83	269.4	267.9	252.8	254.7	261.5	260.9
1983-84	254.1	260.2	249.8	251.8	279.1	244.3
1984-85	269.0	264.0	266.5	268.0	282.5	255.0
1985-86	312.3	288.4	296.6	314.1	344.7	302.8
1986-87	299.7	292.9	301.1	312.9	331.6	298.2
1987-88	191.2	192.4	189.3	195.8	200.2	177.9
1988-89	356.3	311.7	354.2	301.7	380.2	376.7
1989-90	430.5	363.5	373.5	369.0	409.0	413.5
1990-91	409.7	374.4	302.1	324.3	401.0	409.0
1991-92	367.3	355.5	311.1	370.0	385.5	397.1
1992-93	335.9	327.4	324.1	361.0	433.1	380.2
1993-94	377.1	371.3	373.9	384.3	378.9	385.8
1994-95	447.3	423.9	439.0	447.5	433.8	452.3
1995-96	487.1	439.2	426.5	496.7	429.0	461.1
1996-97	461.8	466.6	410.0	552.8	520.1	472.5

Source: 1) Based on data given in the Statistical Atlas of the Andhra State from 1874-75 to 1950-51 1360 Fasli (1950-51), Bureau of Economics and Statistics, Government of Andhra Pradesh, Hyderbad.

2) For Nizamabad, data given in the Season and Crop Reports, 1943 (1352 Fasti), Office of the Directorate of Statistics, The Nizam's Dominions, Hyderabad (Trices of grains in Seers per C.S. Rupee).

3) From 1951-52 to 1996-97, Data given in the Season and Crop Reports of different years of Andhra State, and Andhra Pradesh and Statistical Abstracts of Hyderabad State, D.E.S., Hyderabad.

Note: One Ib=0.454 gms., 1 Kg.=2.20 Ib., 1 quintal=220 to.

APPENDIX-VI-6

Value of Gross Output of Rice per-acre in some Irrigated Districts of Andhra Pradesh, 1955-56 to 1996-97

(in Rs. per-acre)

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1955-56	123.75	105.78	99.23	110.64	92.4	36.0
1956-57	129.50	90.16	107.52	109.94	84.15	47.34
1957-58	68.82	72.45	76.1	57.75	63.36	45.54
1958-59	73.81	81.22	83.3	73.7	52.7	95.63
1959-60	75.6	79.2	89.61	72.5	56.11	87.1
1960-61	75.8	95.94	53.18	74.18	62.48	78.65
1961-62	241.17	246.91	237.6	232.3	210.23	222.43
1962-63	209.17	205.81	234.8	178.81	209.25	125.53
1963-64	223.85	237.65	208.6	203.96	194.53	180.52
1964-65	306.6	282.67	290.30	279.48	314.69	235.30
1965-66	288	313	268	277	331	331
1966-67	318.5	343	281	285.6	222	407.3
1967-68	345.8	378.6	346	404	296	388.4
1968-69	372.8	473.7	307.7	332.2	297	311.7
1969-70	338.4	469.1	354	335	280.6	425.5
1970-71	449.8	675.2	674.6	684.2	535.3	696.9
1971-72	838.2	939.4	736.1	911.5	737.6	697.5
1972-73	899.7	1013.2	897.1	940.4	904.1	870.3
1973-74	1298.7	1245.5	1108.4	997.2	978.9	870.9
1974-75	1573.1	1606.8	1446.9	1218.3	1257.9	1111.5
1975-76	1329.3	1189.8	977.4	957.5	928.2	1213.1
1976-77	1184.3	1057.8	1080.8	1172.5	1067.3	1142.3
1977-78	1632.7	1376.6	708.4	916.2	708.8	1235.8
1978-79	1364.3	1401.5	1203.7	1278.2	1054.1	1205.4
1979-80	1655.0	1855	1329.1	1401	1334.2	1427.3
1980-81	1981.6	2164	1927	1605.3	1246	1758.3
1981-82	2280.9	2573.4	1876.7	1713.2	1422.1	2108.1
1982-83	2774.8	3161.2	2452.2	2266.8	2092	2295.9
1983-84	2565.4	3018.3	2198.2	2316.6	2316.5	1954.4
1984-85	2716.9	2956.8	2318.6	2438.8	2260	1989
1985-86	3154.2	3114.7	3381.2	3359.8	2412.9	2301.3
1986-87	2697.3	2050.3	3432.5	2878.7	2719.1	1819.1
1987-88	1854.6	2097.2	1912	1781.8	1721.7	1476.6
1988-89	3598.6	2898.8	3683.7	2986.8	3269.7	3428.1
1989-90	4391.1	3271.5	4556.7	3800.7	3394.7	4011.1
1990-91	3359.5	3556.8	3292.9	4215.9	3889.7	4008.2
1991-92	3451.7	3732.8	3079.9	4292	4163.4	4050.4
1992-93	3594.1	3928.8	3694.7	4404.2	4244.4	3079.6
1993-94	4826.9	4935.6	5047.7	4688.5	4054.2	3163.6
1994-95	4696.7	5468.3	5136.3	4833	3817.4	4206.4
1995-96	5553	4875.1	4734.2	6159.1	4504.5	4703.2
1996-97	5495.4	5599.2	4592	6633.6	5356	5717.3

Sourcer: Computed from Appendixes VT-4&5

APPENDIX - VI-7

Water Rates as percentage of the Gross Value of output per-acre of Rice, 1955-56 to 1996-97

Year	East Godavari	West Godavari	Krishna	Guntur	Kurnool	Nizamabad
1955-56	5.0	5.9	6.3	5.6	8.5	30.6
1956-57	5.8	8.3	6.9	6.8	9.9	23.2
1957-58	13.6	12.9	12.4	16.2	15.8	23.9
1958-59	12.7	11.6	11.3	12.7	18.9	11.5
1959-60	12.4	11.9	10.4	12.9	17.8	12.6
1960-61	12.4	9.8	17.7	12.7	15.9	13.9
1961-62	3.9	3.8	3.9	4.0	4.8	4.9
1962-63	5.9	6.1	5.3	6.9	6.9	11.3
1963-64	5.6	5.3	5.9	6.1	7.3	7.9
1964-65	4.1	4.4	4.3	4.5	4.5	6.1
1965-66	5.2	4.8	5.6	5.4	4.5	4.3
1966-67	4.7	4.4	5.3	5.2	6.8	3.7
1967-68	4.3	4.0	4.3	3.7	5.1	3.9
1968-69	4.0	3.2	4.9	4.5	5.1	4.8
1969-70	4.4	3.2	4.2	4.5	5.3	3.5
1970-71	3.3	2.2	2.2	2.2	2.8	2.2
1971-72	1.8	1.6	2.0	1.6	2.0	2.2
1972-73	1.7	1.5	1.7	1.6	1.7	1.7
1973-74	1.2	1.2	1.4	1.5	1.5	1.7
1974-75	1.0	1.0	1.0	1.2	1.2	1.3
1975-76	2.3	2.5	3.1	3.1	3.2	2.5
1976-77	2.5	2.8	2.8	2.6	2.8	2.6
1977-78	1.8	2.2	4.2	3.3	4.2	2.4
1978-79	2.2	2.1	2.5	2.3	2.8	2.5
1979-80	1.8	1.6	2.3	2.1	2.2	2.1
1980-81	1.5	1.4	1.6	1.9	2.4	1.7
1981-82	1.3	1.2	1.6	1.8	2.1	1.4
1982-83	1.0	1.0	1.2	1.3	1.4	1.3
1983-84	1.2	1.0	1.4	1.3	1.3	1.5
1984-85	1.1	1.0	1.3	1.2	1.3	1.5
1985-86	1.0	1.0	1.0	1.0	1.2	1.3
1986-87	2.2	2.9	1.7	2.1	2.2	3.3
1987-88	3.2	2.9	3.1	3.4	3.5	4.1
1988-89	1.7	2.1	1.6	2.0	1.8	1.8
1989-90	1.4	1.8	1.3	1.6	1.8	1.5
1990-91	1.8	1.7	1.8	1.4	1.5	1.5
1991-92	1.7	1.6	1.9	1.4	1.4	1.5
1992-93	1.7	1.5	1.6	1.4	1.4	1.5
1993-94	1.2	1.2	1.2	1.3	1.5	1.9
1994-95	1.3	1.1	1.2	1.2	1.6	1.4
1995-96	1.1	1.2	1.3	1.0	1.3	1.3
1996-97	3.6	3.6	4.4	3.0	3.7	3.5

Source: Computed from Tables 6.8,6.9.6.10 and Appendix VI-6

CHAPTER - VII

SUBSIDIES IN IRRIGATION

Introduction

7.1.0 Some Concepts:

Subsidy is a payment made by the government or a private agency forming a wedge between the price paid by consumers and the costs incurred by the producers such that the price is less than the marginal cost. Government subsidies alter the distribution of income in favour of a particular class of income recipients. Although subsidies are often received by and paid by business, they ultimately affect the distribution of income among individuals. Subsidies are typically rationalised as a means of achieving objectives other than or in addition to the redistribution of income that is realised by other means. For example, subsidies to domestic producers are rationalised as a means of promoting domestic employment. Another example is that government may subsidise wage rates by paying a fraction of the cost of living of particular classes of labour. The wage rate paid by the employer does not increase with a wage subsidy as it does under a minimum wage law. Instead, it may fall, as the firms arc likely to increase rather than reduce unemployment (Thomas F.Pogue and L.G.Sgoutz, 1978, p.73). Subsidies arc some Limes negative excise or sales taxes. The net effects would be the substitution effects of the subsidies when an increase in expenditure is contemplated. For instance, the effect would be to cheapen goods relatively to leisure, and therefore, encourage more work in the subsidy case than in the transfer payment case, assuming substitutability between goods and leisure (Prest Nabarr, 1985, pp.78-79). Generally, if the revenue is raised in a given form-say a proportional income tax, for simplicity-the combined effects of revenue raising and disbursement on work incentives will depend on the constituents of government expenditure. As a first approximation, income effects win cancel out and so the net effect will depend on the extent of substitution. When the expenditure side substitution effects are important (e.g. if the revenue is used to subsidise wage goods as to increase the attractiveness of work at the margin) the disincentive effect will be less than where they are not (e.g., transfer payments which are made irrespective of work effect). Exact picture depends upon the nature and extent of the subsidies.

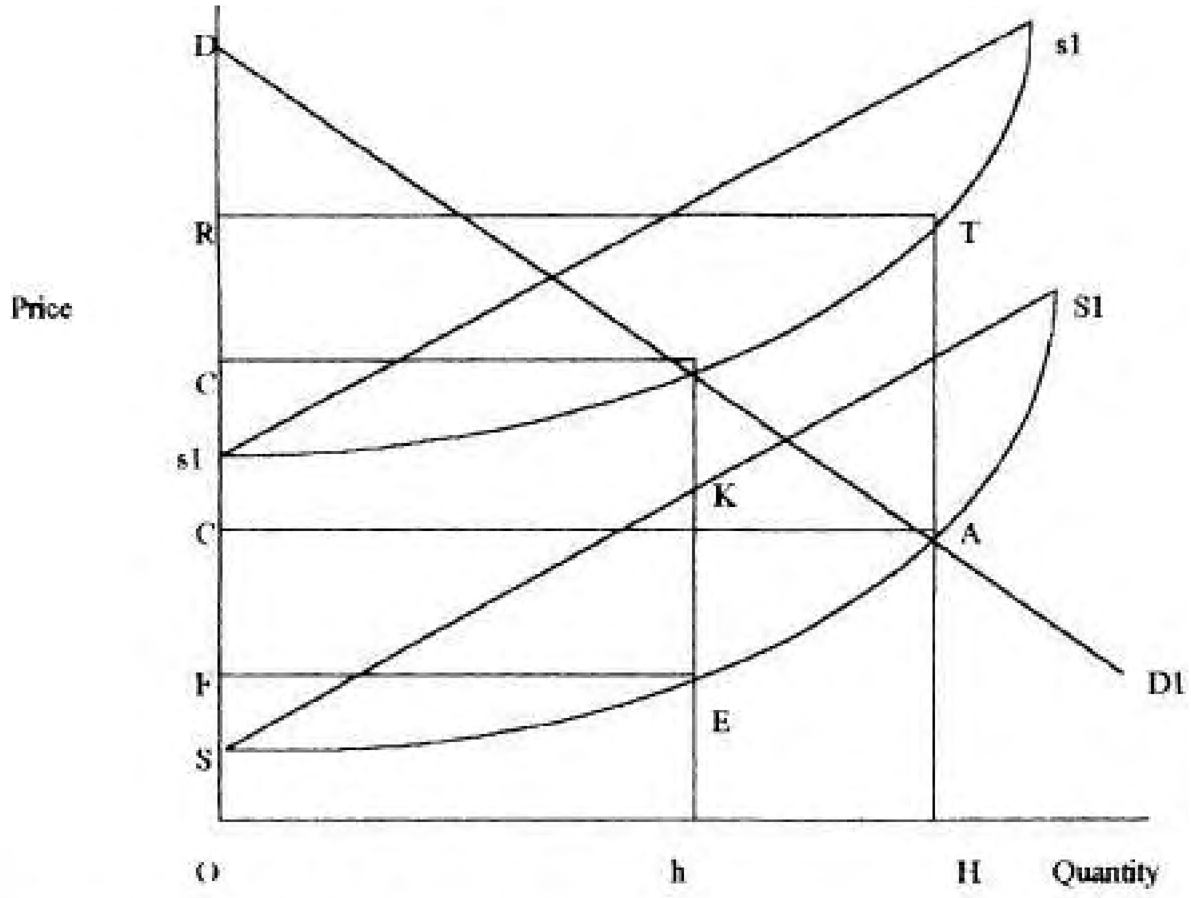
The 'new welfare economies' assumed that mere is an accepted value judgement that everybody is better off in one social slate than another according to his tastes. Then the first social state is preferred to the second. An universally accepted ordering of different possible welfare distributions in any given situations is difficult. The value judgement usually takes an egalitarian form. Rased on these value judgements, the subsidy concept was underlined as to prevent the inequitable shift in real income to a class, say, to farmers. It was proposed that there should be imposed an excise tax on food, accompanied by a per capita subsidy to consumers in the U.S.A (Arrow, K.J, (ed.,), 1972, p.166). Under the assumption that the supply of agricultural products is completely inelastic, the tax would be absorbed by the farmers while the subsidy would have no substitution effects at the margin, so the marginal rate of substitution for any pair of commodities would be the same for all consumers and hence the first value judgement would be fulfilled. The taxes and subsidies perform a purely distributive function and can be so arranged as to restore the status quo ante as near as possible, though the payment of a per capita subsidy implies a certain equalising effect. Subsidies and taxes are in conflict with the established norm of covering total costs (Little, IM.D, 1957, p.208). Therefore, subsidies and taxes payment are subject to wide public discussion. Any payments for the purpose of approximating to the optimum conditions, may often be a better guide man pure welfare theory in deciding whether a change would satisfy our criterion of desirability.

In order to promote maximum social satisfaction, Marshall coupled marginal-utility and demand curve with the theories of long-run supply to determine whether the government could subsidise industries to improve welfare. Marshall considered the welfare effects of subsidies on industries characterised by decreasing, increasing and constant long-run supply functions (Marshall, A., 1920, pp.450-490). Marshall considered the effects of subsidising on increasing-cost industry in graphical terms (see Figure 7.1). Marshall concluded that subsidisation of an increasing cost industry would cause a reduction in welfare.

Assuming that SS1 is the original supply curve and that price and quantity are originally OC and Oh, respectively. Should government subsidise the industry in the amount TA (or aE) per unit, the supply function would shift rightward toward SSI, increasing equilibrium output and price to OH and OC. The total amount of the subsidy required will be the unit amount TA multiplied by the new equilibrium quantity produced OH (or CA). It is equivalent to the area CRTA Consumers surplus increases by Cc aA when output increases from Oh to OH The increase in consumers' surplus is clearly less than the total subsidy. Marshall thus demonstrated that - on utility grounds, at least - increasing cost industries should not be subsidised in order to increase welfare.

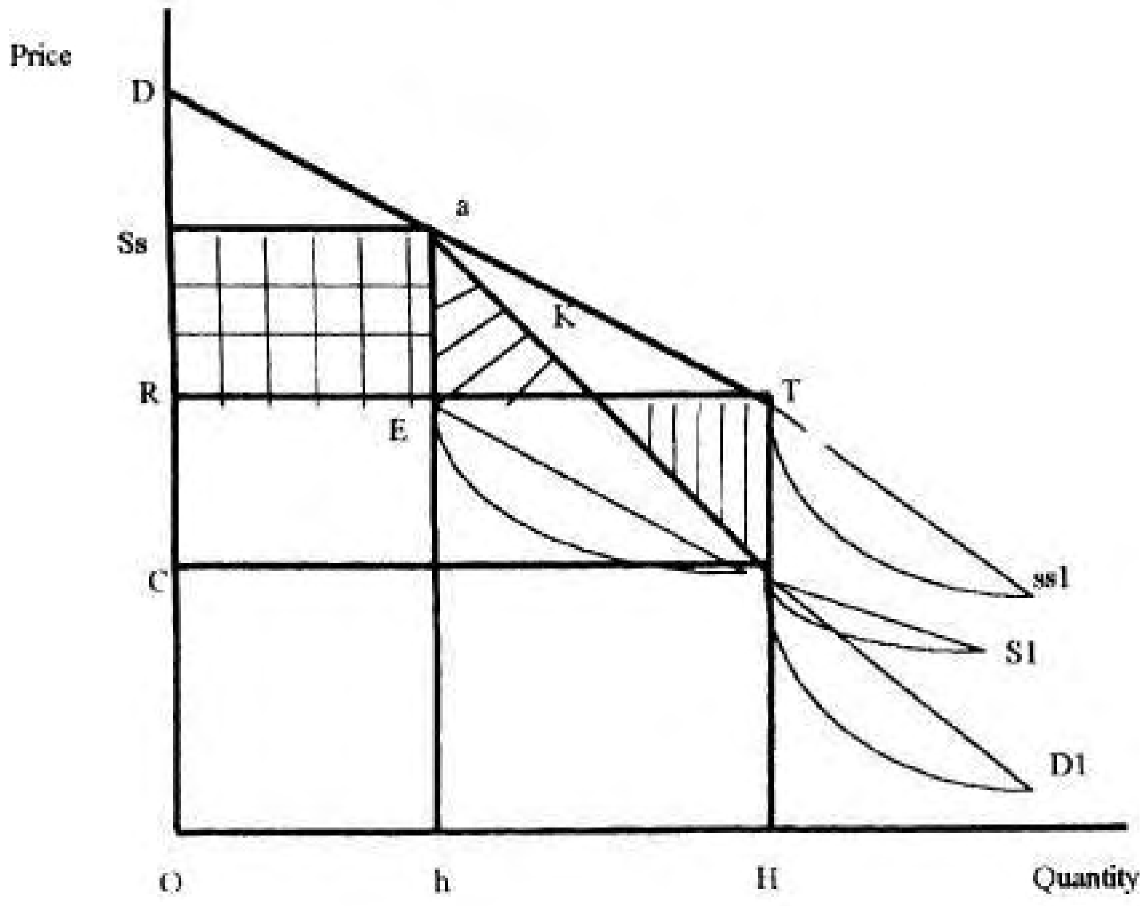
Marshall argued that on theoretical grounds decreasing cost industries should be subsidised in order to promote maximum wellbeing (see Fig. 7.2). Assume that the original industry supply and demand functions are DD1 and ssl, establishing price Oc and output oh. If the government decided to subsidise the industry in order to increase total output to OH, then the subsidy required for the effect would equal TA (or aE) per unit of output This supply curve will not, in effect shift downward to SSI and at the new equilibrium OH would be produced at price OC. Consumers' surplus increases from eDa (at output oh) to CDA (at output OH), an increase of CcaA. The total subsidy as in the increasing cost is equal to the per unit amount of TA multiplied by the number of units sold. OH (=CA), or a total subsidy equal to area CRTA, For the subsidy to create an increasing welfare, it is necessary that the increase in consumers' surplus CcaA be greater than the

FIGURE – 7.1



Source: Ekelund, Jr. R.B, and Hebert, R.F., 1988, p. 352.

FIGURE - 7.2



Source: Ekelund. Jr. R.B. and Hebert, R.F., 1988, p. 353.

government's subsidy CRTA. Marshall then demonstrated that welfare could be improved by subsidising decreasing cost industries.

Constant cost industries, of kind, were to be neither taxed nor subsidised. Given Marshall's assumptions, it is demonstrated that welfare would decline if either policy were enacted on industries of constant costs.

Later, Pigou expanded this idea and proposed a neo-classical Marshallian solution. In the context of possibility of market failure, the marginal social costs in the case of externalities exceed the marginal private costs to the externalalities involving firm (Pigou. A.C., 1962, pp. 575-700). Subsidy is method of addressing market failure. And it causes an expanded role for government, in the form of legislative or regulatory action.

7.1.1 Subsidy: Public Goods and Private Goods:

Government subsidies may be defined as the difference between the cost of delivering various publicly provided goods or services and the recoveries arising from such deliveries (Small and Carruthers 1991, pp. 143-44). However, a number of qualifications and adjustments must be introduced before this concept can be applied to measure subsidies.

The subsidy concept is necessary in order to frame the interface between the government budget and public enterprises. So the difference between financial assistance extended to such enterprises and the returns which government receives from them is included in the measurement of the volume of subsidies flowing through the government budget (Sudipto Mundle and Govinda Rao, 1991; P. 1157). The wide range of general social and the economic services offered by the government of India at the centre and in the states can, for analytical purposes, be classified into three broad groups, viz., are public goods, private goods and merit goods. Public goods and services are characterized by non-rivalry and non-exeludability. and no externality. A commodity or service which if supplied to one person can be made available to others at no extra cost A public good is thus said to exhibit non-rival consumption - one person's consumption of the good does not reduce its availability to any one else. Non-excludability, is that if the good is provided the producer is unable to prevent anyone from consuming it (Musgrave, 1959,pp.42-43). This characteristic prevents private markets from functioning since a seller would be unable to ensure that only those individuals who paid for the goods could obtain it Since the goods could be obtained without payments no one would be willing to pay for it Where consumption is non-rival, the charging of a price for the good or service is, in terms of the Pareto principle,[1] inefficient. This is so because adding an extra unit of consumption provides a benefit to the consumer without imposing any costs, while the charging of a price would prevent some consumption from taking place, thus causing a net loss of satisfaction or utility.

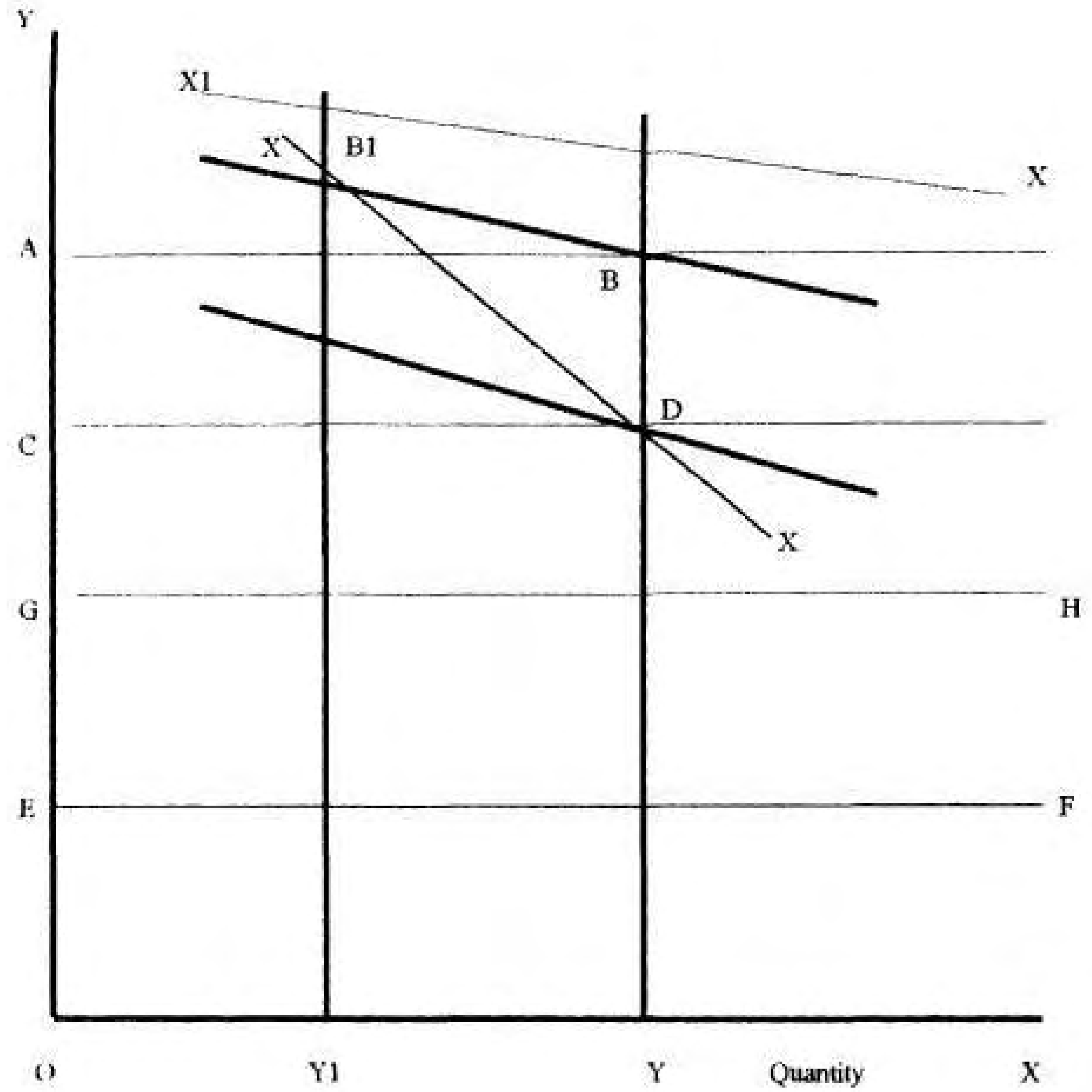
Private goods are characterised by rivalry, excludability and no externality. The first condition means that one person's consumption of the good reduces the quantity available to others. Excludability by the producer means that the producer can restrict use of the product to those consumers who are willing to pay for it(Musgrave,1959,pp.42-43). Exclusion by the consumer means that the consumer is not forced to consume the goods. Where goods display these characteristics, free exchange is possible and markets can operate.

Goods which are characterized by rivalry, excludability and varying degrees of externalities, are called merit goods. In the case of such goods, it is argued that consumer sovereignty does not hold and that if consumers are unwilling to purchase 'adequate' quantities of such goods, they should be compelled or encouraged to do so. Of these, the concept of subsidy is properly applicable only to the last two. In the case of pure public goods, from the theory of pubic expenditure, pricing rules can not in fact be applied because of the free rider problem. For this, an alternative method is that voting mechanism of near unanimity, choosing between alternative proposals along with associated tax prices, could lead to fairly efficient outcomes.

Public owned utilities have financial advantages which make it impossible to determine their relative economic merits by their rate structure with privately owned utilities. The lower financial burden allows public irrigation to provide at the same economic cost to sell for less than private irrigation. This publicly provided subsidy combines three different elements Producers, allocative and distributive subsidies (see Figure 7.3). OY be the quantity of some service which is publicly provided, YB the actual cost per unit, YD the efficient cost per unit and EF the curve of per unit recoveries. XX is the demand curve for the service. The rectangle ABHG measures the total volume of subsidy actually required in order to ensure that the market absorbs OY quantity of this publicly provided service if the market clearing quantity OY is considered socially inadequate. However, ABHG has two components, i.e., a necessary element CDHG which is a genuine allocative subsidy and an additional clement ABDC paid to supplies to cover their inefficiency. Finally, there is a subsidy element GHFE which need not have been paid to support consumption level OY given the state of demand, this is a pure distributive subsidy. Thus, a measure of subsidy which conceptually corresponds to the rectangle ABFE, combines a producer's subsidy, the allocative subsidy and a distributive subsidy.

Such payments have a number of possible objectives. The first objective is a transfer of income from tax payers to producers or consumers of a particular good, i.e., a payment made to an individual (usually by a government body) which does not form part of any exchange of goods or services. Such transfer payment is part of the process of redistribution of an economy's output; for example, raising farmers' incomes. The second objective is to influence the behaviour of producers or consumers via the mechanism of the elasticity of supply or demand, i.e., a measure of the percentage change in one variable in respect of a percentage change in another variable. The third objective is to keep the prices of certain goods tow and stable. This occurs if price controls are holding down prices when general inflationary tendencies are present in the economy. This is an anti-inflation policy (Pearce, W.David, 1986, P.406). Thus, while the subsidy can allow the government's total budget to be larger than the amount that it collected from the user fees, the amounts collected from the users must contribute, at the margin, to the size of the government's budget This point may be clarified by some examples. Fixed percentage of new investment costs and subsidized by the government, subsidies are based on a matching formula, and subsidies are designed to meet budget shortfalls. The purpose of deriving discount rates and conducting

FIGURE – 7.3



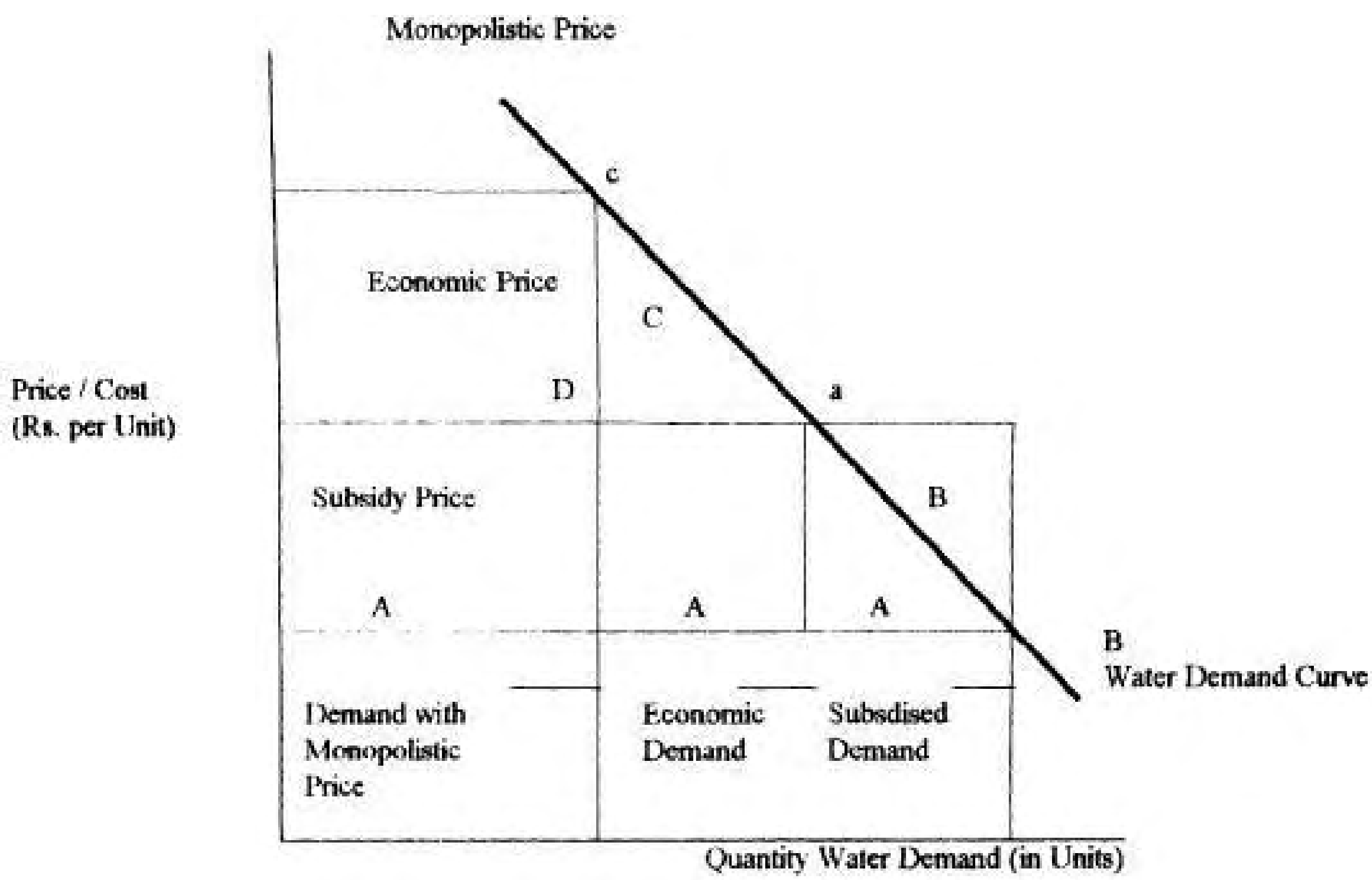
Source: Gulati and Sharma, 1995, pp. 93-95.

benefit-cost analysis is the efficient and socially desirable allocation of resources between private and government uses and within the government sector as well The same ends require that user charges be imposed to confront the beneficiaries with the cost of selected goods and services provided by the government This is desirable for three reasons: Firstly, it is equitable. Secondly, the demand response to such levies provides an indication of me optimum amounts of facilities or services. And finally, if the assessed costs of furnishing additional capacity or services are borne by those who demand it the charges act as a rationing device, limiting demand and encouraging use of the economically more efficient alternatives. In other words, when government is cast in the role of being a provider of private-type goods or services, its aim should be to duplicate a free-market mechanism, goods and services being produced only if consumers are willing to pay the full supply price. When this is not done, government programmes that support high-cost facilities tend to over expand, since there is no effective constraint on the demand for their services. This represents a misallocation of resources in that reallocation might yield a higher degree of social welfare (Gary Fromm and Paul Taubman, 1973, pp.46-47). Nonetheless, failing to adhere to a strict user benefit - charge relationship may be justifiable if by so doing greater over-all public satisfactions can be provided to exist and to be realisable. For instance, when users are unwilling or unable to pay the supply price of the goods or services and large external effects can be reaped, the government may find it desirable to provide a subsidy equal to the difference between the supply and demand prices if this is less than the value of the external effects.

As the difference between the project revenues and project cost must be recovered from other tax sources, low rates shift the financial burden from the irrigation user to the tax payer. This suggests a net income transfer from other regions to the one in which the project is undertaken (Krutilla and Eckstein, 1958, P. 263) (see in Figure 7.4). At a fair market price, water use will be at a point "a". If the subsidised public water lowers the price to point "b", area A represents the net income redistribution to consumers paid for any increased taxes. Area B also must be paid for by increased taxes and represents the cost of producing the additional water in excess of the value realised by the consumer. The low

FIGURE – 7.4

If subsidy reduces price from a to b, A area represent value of subsidy to consumer, B area represents social cost of misallocation.
If monopoloy increases price from a to c, C area represents social cost of monopolistic misallocation, D area represents monopolistic profit.



Source: James L. Douglas and Robert R. Lee, 1971, p. 349

public water rates thus cause a net reduction in national income amounting to area B. It state regulation of public utilities does not overcome monopolistic pricing the net loss in national income will be represented by area "c". Thus, public preference clauses discourage economic efficiency by establishing some criteria for sale other than the value of the water to the consumer.

Varieties of Subsidies

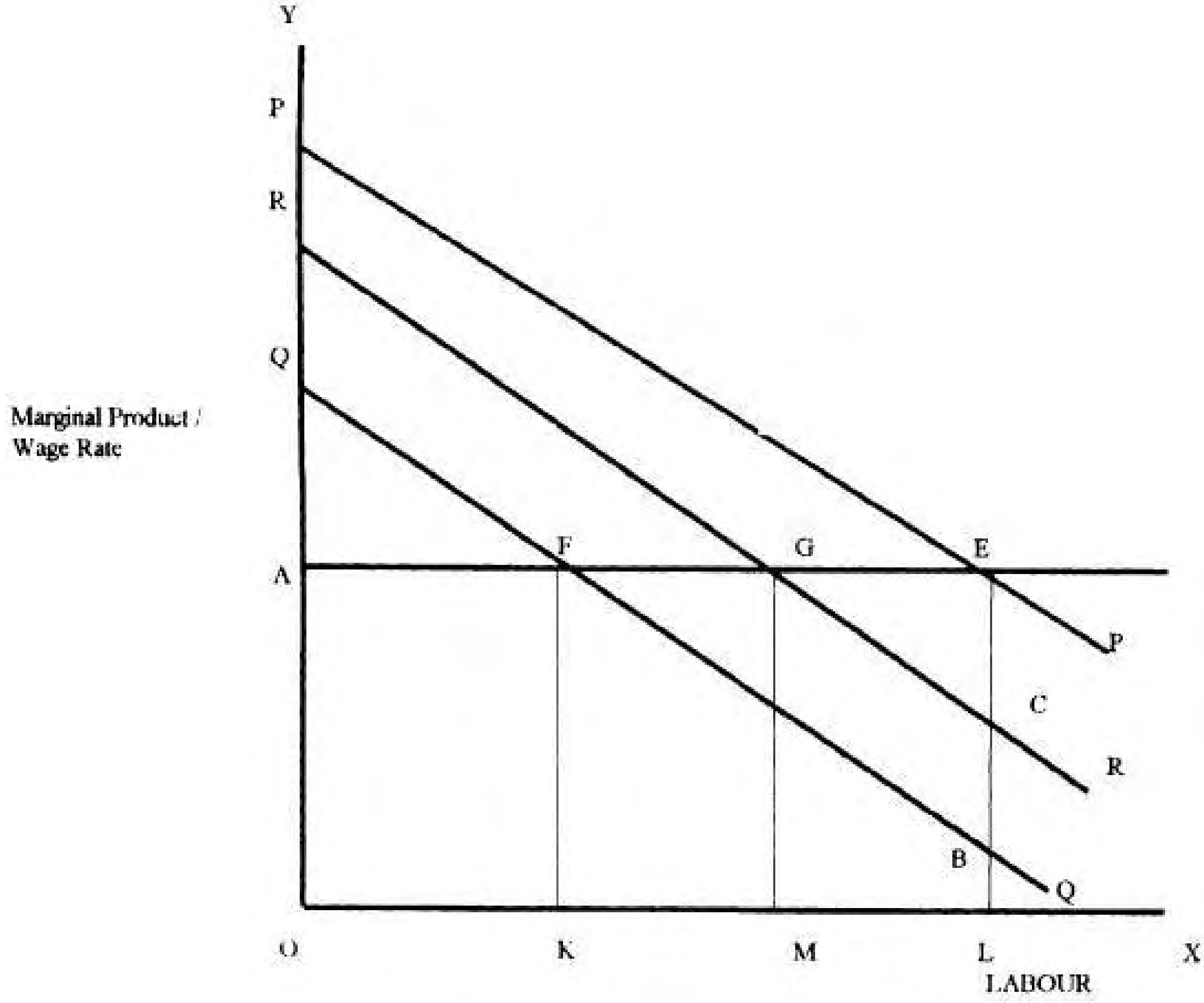
7.2.1 Wage Subsidies:

In a community in which wage rates are everywhere adjusted to the conditions of demand and supply, so that no wage-rates are un-economically high and there is no unemployment beyond what is necessary to allow adjustments to be made to industrial fluctuations, for the state to subsidise wages in particular industries must, in general, worsen the distribution of productive resources and damage the national dividend. A policy of wage subsidies applied to all industries would not necessarily damage the distribution of productive resources, but it could not improve this distribution. Though in some circumstances it might increase the dividend, it would probably only do so at the cost of causing too much work to be done, and therefore, in a manner it is injurious, and not beneficial, to economic welfare (Pigou, A.C, 1962; P.699). In the Pigouen sense, the concept is analysed, as there are two factors of production: capital and labour. Labour is available in plenty at the prevailing wage rate. The stock of capital is given as an initial condition. It is a market economy. The employment-oriented planning under these circumstances can do two things. One is to reduce the wage rate, or the other is to increase the stock of capital over time. A fall in wage rate would make the technique of production more labour intensive, and hence, a larger volume of labour would find job. On the other hand, an increase in the stock of capital goods would allow larger absorption of labour, even if the technical co-efficient is fixed. The goal of full employment remains elusive for two practical reasons. If the wage rate is already too low; it can not be depressed any further. Besides, the stock of capital goods can not be adequately augmented because of the scarcity of consumer goods with which the workers to be engaged in proposed capital projects are fed. Two escape routes have been suggested here. The rural economy, in general, it is argued, is not capitalist, but feudal in its mode of production, where wage paying employment is rare. Full employment can be attained in such a situation if a share-cropping type of arrangement in distribution of income is agreed upon (Georgescu Roegen. I960, pp. 1-40). According to the other study, the problem arising out of the scarcity of consumer goods for construction of capital goods can be circumvented if the relevant workers are persuaded to accept, in lieu of wage, a sort of deferred payment in the form of partial ownership of the assets to be created by the collective effort (Chakravarty. S. 1975, pp. 1-11). Of the two proposed solutions, the first one is a non-starter so long as the wage rate is already at the level of subsistence. As for the second one, it calls for a fundamental change in the concept and practice of ownership right to property which is not a simple economics.

Consider a simple situation (see Figure 7.5). In the figure the amount of cultivated land is given. It can be cropped twice. PP is the curve of marginal productivity of labour engaged during the first crop. The curve slopes down, for land is heterogeneous ; land is cultivated in a descending order of fertility. Labour co-efficient per unit of land is fixed. OL is the total supply of labour, which is homogeneous, available at wage rate OA. The initial equilibrium is at E where there is full employment of labour and land. In short, the agricultural sector has full employment during the season of the first crop. QQ is the marginal productivity of labour during the second crop. The wage rate being OA, the employment in this season is OK, and the corresponding cropping intensity is OK OL. Unemployment in this season is measured by KL, and the problem is essentially to get rid of it by increasing the intensity of cropping.

One straightforward way of doing so is to give wage subsidy to the farmers, to the tune of FEB, which is the deficit they would incur if they employ the additional volume of labour KL. The exact mechanism of administering the subsidy so as to ensure the corresponding employment is a separate matter.

FIGURE – 7.5



Source: Ranjit Sau, 1986, pp. 385-386.

Another way of resolving the unemployment problem could be as follows. It involves two steps. One step is to employ all or part of KL to construct some capital goods, irrigation channels, wells, organic fertilizers, etc. With those assets in hand, then, the marginal productivity curve QQ shifts up to RR. The other step is that, in a market economy, accordingly, employment during the second crop season would tend to be OM; but it can be stretched to OL if a wage subsidy by the amount of GEC is given to the farmers.

There are two alternative ways of having full employment in the agricultural sector. Under the first alternative the output was OQBL, as against ORCL in the other. One can choose that combination of subsidies and output which minimizes the average subsidy per unit of output, subject to full employment. It would involve a particular amount of subsidy to construct durable assets with rural labour, and a particular amount of subsidy to cultivate the land for raising a second crop. Any deviation from this mix would create an imbalance. But areas where the presence of excess capacity (such as irrigation) the amount of subsidy should be narrowed due to fiscal imbalances. Hence, subject to qualifications, in a community, in which apart from subsidies, rates of wages would be everywhere adjusted to the conditions of demand and supply. So the policy of subsidy is likely not justifiable. In publicly invested sectors like irrigation, subsidies are not as much healthier as possible. But in reality, due to market distortions, subsidies play a key role in the distribution of national dividend.

7.2.2 Subsidies and Irrigation Sector:

Subsidies play a crucial role in stimulating development of any country through increased agricultural production, employment and investment. They are advanced either to promote the use of new inputs or to transfer income in favour of farming community (Gulati and Sharma, 1995. P. A-94). Govemments may pay much higher prices for the agricultural products than what the farmers can obtain under free market environment Higher prices for farm products can be provided mainly by insulating the domestic markets from the world economy through a restrictive trade policy. On the other hand, vital inputs like fertilizers, irrigation water, credit and electricity used in the agricultural sector can be supplied to the fanners at prices below the open market prices.

The prices of these inputs, therefore, do not reflect their true value, i.e., the real cost of supplying these inputs. These are some reasons for which subsidies on inputs are normally preferred. Benefits of government expenditure can be derived by me fanners only in proportion to their use of inputs. Input subsidization also avoids rising food and raw material prices (Gulati and Sharma, 1995, P. A-94), thus avoiding tie plausible adverse effect on growing industrial sector, or on the large mass of poor Irving in the developing countries.

Costs of input subsidies have to be evaluated against the loss of potential benefit if the same amount was invested in creating productive potential of agriculture. It is argued that incentives like subsidies arc short-term measures and they are not meant to be substitutes for the long-term measures in social and physical infrastructures which alone can ensure the viability of the new technology. Even in the short-term, a sharp rise in subsidies may cut into the resources available for productive investments and this is what seems to have happened in the Indian context (Gulati and Sharma; 1995, P. 95). Input subsidies are cutting into the resources which could have been invested in generating new productive potentials. This is because in a country like India where resources are limited, the achievement of any particular objective usually comes at the expense of other competing objectives. A major chunk of the increase in resource flowing is being diverted to meet the expenditures originating from high input subsidies rather than making investment in agriculture. The recovery ratio is low when compared to expenditures incurred to a particular sector.

Subsidies on irrigation are generally viewed on the assumption that these are temporary measures and would be withdrawn once the objectives are achieved. But the past Indian experience clearly shows that it becomes increasingly difficult to reduce or abandon subsidies. In fact, there is nothing wrong with subsidies if they are well targeted and reach the intended beneficiaries and have a definite time-frame for their termination. But when the subsidies are appropriated by a few well developed regions and better off sections of the farming community it leads to distortions. And also these subsidies distort the choice of commodities and choice of techniques for each commodity leading to inefficient cropping pattern etc,.

Considering the fact that there are implicit and explicit input subsidies in Indian agriculture, this could be worked out from the farmer's point of view, from the view point of the input supplying agencies and from the societies point view (Gulati and Sharma, 1995, p. A-95). From the viewpoint of the fanner, who is a user of inputs, the subsidy could be defined as the difference between what he is willing to pay for it and what he is actually paying. In this case the maximum that a farmer would be willing to pay would be equal to the marginal value product of input use. From the viewpoint of input supplying agencies, the subsidy could be defined as the difference between the cost of supplying these inputs and revenue received from the farmers. And from the society viewpoint, subsidy could be defined as the difference between true resource cost of supplying inputs measured at shadow prices and what the farmers actually pay for it (Chakravarty, 1987, P.77). Here, subsidy may be defined as the difference between the cost of supplying a particular input and the recoveries from supplies. While the agricultural sector has prospered in many states and has created a large class of prosperous farmers, there is hardly any attempt at raising resources through direct taxation, but receive significant subsidies.

Ill

Subsidies: A Cross Country View

The subsidy issue in the world has risen especially under the Uruguay Round of GATT negotiations. Mostly, the distortions in world trade of agricultural commodities had arisen because of direct and indirect subsidies provided by several governments. The distortions are reflected in the 'unreal' level and behaviour of world prices of agricultural commodities. These are often transmitted to production baskets of different countries, as they produce commodities against the logic of comparative advantage. It leads to huge efficiency losses. All major country groups were responsible for the subsidies/distortions present in the world today.

There arc different ways of subsidizing cultivators through government intervention. The common way of subsidies is through a set of domestic and external policies that allow domestic cultivators to receive much higher prices for their outputs than would have been possible under a free-trade scenario. This set would include domestic support price policies, tariffs, quotas, export enhancement programmes, price stabilization measures and import licensing as well as canalizing of policies related to external trade. If these policies push domestic price higher than the corresponding border reference prices, then the cultivators are 'protected', or implicitly ' subsidized'. On the contrary, if domestic prices are lower than they would be under a free-trade scenario, cultivators are deemed to be 'disprotected' or 'taxed'. The second way of subsidies to cultivators is by providing them input prices below their cost of supply (import-export parity price in case of tradable, cost of production in case of non-tradable), or at prices that are lower than that being charged from other consumers of the same product (particularly in case of non-tradable) (Gulati and Sharma, 1995, pp. 106-109). Examples would be the subsidies in electricity, credit, fertilizers, transport and irrigation. The third way would be to provide direct payments to cultivators to produce through deficiency, diversion and disaster payments and marketing loans. World agriculture is subsidized to the nine of 18% of its value. Producers' subsidy equivalent stretches from 54.5% in Columbia to *72.5%* in Japan (see table 7.1).

TABLE- 7.1: DEGREE OF STATE SUPPORT MAJOR COUNTRY GROUPS(AVERAGEFOR 1982-87)

Country	Producers' Subsidy Equivalents (%)	Share In Value Production (%)
United States	26.17	18.74
Japan	72.50	6.43
EC-10	37.00	19.08
Cairns group	14.11	8.40
Developing group	26.91	24.02
Less developed group	-25.04	23.34
All	18.4 !	100.00
Total value of production (in $ billions)	532	

Source: Rased on Gulati and Sharma, 1995, p. 109.

At the macro level, Japan emerged as the highest protector of its farm sector, followed by the European Community, the US and finally the developing group (see Table 7.1). The less developed group of countries appeared to tax its producers but not consumers. India will be one of the gainers from the lowering of protection levels in world agriculture.

IV

Trends in Subsidies in Irrigation Sector in India

7.4.1 Irrigation Subsidies: India:

The trends show the actual volume of subsidies was large, amounting to Rs 42,324 crores or almost 15% of the G.D.P in 1987-88. Subsidies in economic services amounted to Rs.25,564 crore or about 60% of the total volume of subsidies. A little over one-half of this flowed through the central budget Costs were not fully recovered in any economic service and the average recovery rate was less than 44%. The cost of these sendees, taken along with irrigation and flood control was close to Rs. 15,000 crore. Only about Rs.3000 of this cost was recovered, leaving a subsidy element to around Rs.l1,554 crore (Government of India, 1992, pp.47-50). The un-covered costs of economic services such as irrigation, power, agriculture and transport have risen faster than those of social services, such as education, health, water supply, sanitation and roads the difference being more pronounced in the states. At the state level the un recovered costs have consistently exceeded plan outlays during the last two decades. But the ratio widened dramatically from 1.28 in 1977-78 to 1.75 in 1987-88.

Two alternative estimates[2] of the unrecovered costs of providing irrigation service from major and medium works in the two years of 1977-78 and 1986-87. based entirely on the Central Water Commission's compilation, except for adding depreciation at the rate of 1% and using the figures of gross receipts and working expenses from the same source, but taking the capital base with a three year lag interest at the average borrowing cost and depreciation at 1%.

TABLE- 7.2:Estimates of Unrecovered Costs on Account of Major and Medium and Multipurpose Irrigation Projects of 14 Major States of the Indian Union (Rs. In Millions)

Item	C.W.C		1992 Report	
	1977-78	1986-87	1977-78	1986-87
Working expenses	1272	4927	1272	4927
Interest on capital (average borrowing of cost)	2155	8506	2113	10589
Depreciation @ 1%	600	2023	385	1406
	4027	15456	3770	16922
Gross receipts	969	1667	969	1667
Un-recovered costs	3058	13789	2801	15255

Source: Government of India, 1992, Planning Commission, pp.48-50.

On the basis of the estimate of 1992 Report, the total unrecovered costs of major and medium irrigation works increased more than five fold in a 10 year period from Rs.2800 million in 1977-78 to Rs. 15250 million in 1986-87 (see Table 7.2). If so much of the country's resources were not spent on these recurrent subsidies, productive investment including investments in irrigation could have been stepped up to achieve and sustain income and employment.

Unrecovered costs are essentially subsidies but one must not assume that the entire subsidy accrues to users of irrigation. Part of it represents the costs of inefficiency in producing and distributing irrigation services on account of defective design, inordinate delays in completing projects, over-extended distributary systems, waste, and other factors which inflate capital costs; and over-unarming, relatively high administrative costs, avoidably high costs repair works and other factor which raise operation costs, and affect the efficiency of assessment and collection of revenue (Government of India, 1992, pp. 49-53). It is not possible to determine how much of the implicit subsidy is attributable to inefficiency and how much really benefits the fanners because of the under-pricing of water.

7.2.2 State-Wise Subsidy in Irrigation:

State-wise irrigation subsidy[3] per hectare of gross irrigated area (through major and medium irrigation) consists of the annualized capital cost at 10% of capital outlay invested per hectare of gross irrigated area (8.44% as interest cost and the rest as depreciation charges) plus operation and maintenance expenses incurred on these schemes per-hectare of gross Irrigated area (GIA), and minus the gross receipts from the schemes on per-hectare basis (Gulati A; 1989; P A-59). Multiplying these resulting estimates by gross irrigated area under major and medium irrigation projects, obtains subsidies.

TABLE-. 7.3: Total Irrigation Subsidy on the Major and Medium Irrigation Schemes of Major Stales from 1980-81 to 1986-87(Rs. In Crores).

State	Year							Total Average
	80-81	81-82	82-83	83-84	84-85	85-86	86-87	80-81 to 86-87
AndhraPradesh	660.61	579.74	619.46	659.90	686.10	705.77	725.91	662.50
Assam	13.36	16.30	19.83	23.55	20.79	28.93	38.17	22.99
Bihar	368.37	412.80	468.24	529.59	593.06	666.21	746.88	540.74
Gujarat	148.60	173.15	208.62	248.65	268.26	308.86	354.46	244.37
Haryana	239.40	267.14	296.54	328.88	369.27	419.90	476.86	342.57
Himachal Pradesh	0.32	0.32	0.48	0.63	0.63	0.63	0.79	0.54
Jammu & Kashmir	18.34	20.01	21.70	23.41	19.75	20.97	22.23	20.92
Karnataka	242.41	251.22	267.20	283.50	249.19	263.16	277.45	262.02
Kerala	108.02	108.34	116.44	124.48	130.79	141.88	153.26	126.17
Madhya Pradesh	304.11	312.77	365.47	424.59	465.87	535.13	612.84	431.54
Maharashtra	171.93	190.52	217.05	250.80	294.46	339.60	390.35	264.96
Manipur	1.00	1.93	3.23	4.71	6.93	9.16	11.68	5.52
Orissa	293.44	322.48	353.91	388.43	404.38	442.15	483.26	384.01
Punjab	332.89	374.08	418.30	467.64	511.19	567.40	629.90	471.63
Rajasthan	345.19	387.85	432.12	481.41	480.06	592.45	665.16	483.46
Tamilnadu	267.14	270.25	276.10	281.84	287.96	291.40	294.96	281.42
All India	4953.73	5234.16	5825.75	6473.88	6943.81	7658.60	8438.62	6504.08

Source: Based on. Gulati; A; 1989. pp. A-57-60.

It may be noted that during the eighties' (1980-81 to 1986-87) on an average at all India level irrigation subsidy amounted to Rs.6500 crore per annum (see Table 7.3). Uttar Pradesh accounted for more than Rs.1000 crore, along with stales Andhra Pradesh Rs.662.50, Bihar Rs.540.74, Rajasthan Rs.483.46) and Punjab Rs.471.63. Their share came to almost one-half of all India irrigation subsidy. Break-up of subsidies into economic service reveal that at the level of the centre, economic services, consist of agriculture and allied activities, irrigation and flood control, power, industries, transport and other economic services, dominate accounting for Rs.33,668 crores i.e., nearly 93% of the total subsidies provided by the centre(Government of India,1997,p.7). The recovery rate of economic services was 11.7%(see Table 7.4). Among this, the subsidy given to irrigation and flood control was Rs. 133 crores. At the level of the States, irrigation is the major component accounting for a subsidy of Rs.12,421 crores(Government of India, 1997.pp. 7-8). The recovery rate at the level of centre was 3.8%. While at the level of State was merely 4.2%.

Table-7.4 Sector-wise Estimates of Non-merit Subsidies: 1994-95

Economic services	Centre Rs.Crores	Recovery Rate(%)	States Rs.crores	Recovery Rate(%)
Agriculture and allied activities	8214	4.5	7925	22.7
Irrigation and Flood Control	133	3.8	12421	4.2
Power	3929	36.8	5957	15.0
Industries	10878	9.0	1959	5.9
Transport	1486	14.9	647	39.8
Other economic services	4988	4.5	2214	5.32

Source: Government of India,May, 1997.

7.4.3 Irrigation Subsidy : Andhra Pradesh :

The expenditure of the Andhra Pradesh Government on subsidies increased from Rs.122.87 crore in 1981-82 to Rs.478.03 crore in 1986-87. registering a compound growth rate of 31.2% (see Table 7.5). Agriculture occupies an important place as a receiver of subsidies. However, there is a decline in its share from 95% in 1981-82 to 60% in 1986-87. This decline is due to the decrease in the share of irrigation and electricity subsidies. The share of irrigation subsidy declined from 75% in 1981-82 to 48% in 1986-87. The extent of subsidy given by the irrigation department to the agriculture sector is computed as the rate of return on the invested capital and working expenses are added, and from gross receipts, the total costs are deducted in order to compute net profits (losses). If the department incurs losses, the losses are treated as the extent of subsidy given to the agriculture sector. The implicitly means that capital cost of major and medium irrigation schemes should be treated as sunk and goes in the form of subsidy.

TABLE-7.5.Financial Results of Major and Medium Irrigation Works in Andhra Pradesh (Rs. In Crores)

Item	Year		
	1976-77	**1977-78**	**1978-79**
Capital outlay to end of the year	222.19	253.51	278.79
Total revenue during the year	10.92	9.92	10.78
Working expenses during the year	9.85	9.30	8.11
Net surplus before meeting interest	+ 1.07	+ 0.62	2.67
Interest on Capital	7.70	9.76	11.07
Deficit after meeting interest	- 6.63	- 9.14	- 8.40
Percentage of deficit to capital outlay	- 2.98	- 3.60	- 3.0
	1987-88	**1988-89**	**1989-90**
Capital outlay to end of the year	2335.42	2625.16	2898.37
Total receipts during the year	54.37	54.41	35.21
Revenue expenditure during the end of the year	134.64	490.98	315.54
Depreciation	23.35	24.80	27.62
Expenditure (excluding depreciation) over receipts	129.20	485.54	280.33
Expenditure (including depreciation) over receipts	152.55	510.35	30.7.95

Source: 1. Reports of Eighth and Ninth Finance Commission 1984-85 to 1989-90 and 1989-90 to 1990-95, Dec. 1989, Annexure III-10.

2. Report of Comptroller and Auditor General of India, 1980-81. Work expenditure, Chaptcr-iv,p. 105-126.

It was further depreciated at the rate of 1% on mean capital outlay in 1987-88 to 1989-90(see Table 7.5).

The recent white paper (1996), published by the Andhra Pradesh Government gives a dimensional perspective to the issue by indicating the relative magnitudes of direct and hidden subsidies (Subba Rao and Madhava Rao, 1996, P.4). The high profile Rs.2——— per kg rice scheme by far the largest food subsidy programme by any state government accounts for over Rs. 1300 crore. Even this is largely estimated at Rs.4366 crore based on current costs. The water rate charged at Rs.60 per acre, as opposed to the average cost of delivery of water of Rs. 8150 per acre, does not cover even the operative and maintenance expenditure, let alone yielding a return on the huge investment made. These subsidies in irrigation sector might decrease the national dividend, mounting the fiscal deficit and misuses the input.

The impact of subsidy in irrigation based agricultural growth has diverted bulk of input subsidy to irrigated areas with serious implications not only for inter-crop parity but also inter-class and inter-region and equity, (i.e., irrigated versus un-irrigated farmers and irrigated versus dry land regions (Subba Rao. 1985; PP.523-46). It has been found that most of the share of input subsidies has been appropriated by fewer well-watered and well developed regions.

The application of principle of equating prices with marginal cost with a view-to maximizing social welfare which when applied to a decreasing cost industry like irrigation would yield deficit (Ansari, N. 1968, P.8). All these works reveal that subsidy in the irrigation sector hinders the further expansion of irrigation development. While substantial price increases of most publicly provided goods and services are necessary, the adjustment has to be gradual. In the case of surface irrigation, it is needed even to recover the current operation and maintenance costs and a small part of the capital charges.

V
Effects of Subsidies

The total volume and composition of government subsidies in India affects the allocation and distribution of resources and macro-economic stabilisation policies. The fiscal deficit of the Centre and the States combined was 6.5% of GDP in 1996-97 (Government of India, 1997, Discussion Paper). A 50% reduction in subsidies rate will by itself reduce the overall deficit to less than 2% of GDP. Therefore, unnecessary subsidies are causing a wastage of scarce resources and lead to much inefficiency in their use. Extremely low recovery rates in sector relating to irrigation may lead to its wasteful use, having been drawn away from other sectors in which its marginal productivity would have been higher. The argument here is in favour of increasing user charges in area, such as irrigation sector, emphasises the need to focus on reducing the overall scale of subsidies; making subsidies as transparent as possible; using subsidies well-defined economic objectives; focusing subsidies to final goods and services with a view to maximising their impact on the target population at minimum costs; and instituting systems for periodic review of subsidies.

The Dagli Committee (1979) on the question of subsidies, had stated that subsidies were necessary in the Indian economy for three major reasons; first to mitigate the effects of extreme inequalities of income and wealth in the country and to raise the consumption level of the vulnerable sections of population; secondly to protect and promote the growth of employment oriented production in the decentralised sector, and finally, to temporarily subsidise what may be termed as infant industries (Government of India, 1979, pp.25-27). Subsidies cause inefficient and wasteful use of resources. Dagli committee conceived them as instruments of development to fulfill certain basic social objectives such as reduction of inequality of wealth and income, promotion of employment in the decentralised sector and protect infant industries. But from the stabilisation point of view, to keep fiscal deficit low, subsidies can not justified to continue.

VI
Conclusion

Public owned utilities have financial advantages which make it impossible to determine their relative structure with privately owned utilities. The lower financial burden allows public irrigation provided at the same economic cost to be sold for less than private irrigation. As the difference between the project revenues and project costs must be recovered from other tax sources, low rates shift the financial burden from the irrigation user to the tax payer.

Subsidies affected the development of irrigation in two ways : inefficient maintenance of the irrigation works and it discouraged the new investment. A sharp rise in subsidies may cut into the resources available for productive investments. This is what seems to have happened in flic Indian context Budgetary loss on account of operation of government subsidies in irrigation systems were estimated ma Rs. 133 crore (recovery rate

3.8%) and Rs. 12,421 crores (recovery rate 4.2%) at the centre and the states respectively in 1994-95. If so much of the country's resources were not spent on these recurrent subsidies, production investment including investments in irrigation could have been stepped up to achieve and sustain high levels of income and employment

NOTES:

1. When the economy's resources and output are allocated in such a way that no reallocation can make anyone better off without making at least one person worse off, then pareto optimum is said to exist(Pearce, W.David, 1986,p.320).

2. The Report of the Committee on pricing of irrigation water (1992) takes the data of unrecovered costs made by the National Institute of Public finance and Policy (MPFP) based on an independent tabulation of figures from the budget documents of State Governments for two years, namely 1977-78 and 1987-88. The NTPFP tabulation covers not only major and medium irrigation projects but also figures relating to minor irrigation and Command Area Development. To this extent its coverage is widen than that of the CWCs compilation. However, the NIPFP figures on gross receipts and working expenses relating to major and medium irrigation projects are substantially at variance from those in the CWC compilation, though both draw upon the same source. Moreover, NIPFP tends to understate the unrecovered cost because it takes credit for the interest receipt figuring under the head 'interest' in the accounts, which is the result merely of a book adjustment and does not represent a genuine interest amount received from the beneficiaries. They also take into account the loans given by the government to tube well corporations, farmers, etc. The pricing of Irrigation Committee (1992) feel that direct government expenditure and loans to others should be kept distinct. However, the pricing of Irrigation Committee (1992) followed NIPFP in including depreciation in 1992 committee calculations and adopting the average borrowing cost rather than the interest rate used in the accounts As regards the capital-base, the 1992 committee adopted a 3 year lag instead of a one-year lag as in the NIPFP tables (Government of India, 1992, P.49).

3. The Committee on pricing of Irrigation Water *(1992),* presented the data on uncovered costs for more recent years from the accounts of State Governments, there are problem of

comparability between these figures and the figures relating to earlier years because there was a change in the classification scheme in 1987-88. Moreover, the interest calculations in the later years are based on the rates adopted by the State Governments which vary widely from State to State and are significantly different from the average borrowing cost which the committee (1992) adopted in their own calculations.

CHAPTER-VIII

CONCLUSION

Section -1

Management of water resources, their use, and macro-economic policies are closely related to each other. Economic policy instruments influence water use across different economic sectors as well as between local regional and national levels and among households, farms and firms. These economic attributes of water resource projects determine the charges for project outputs. Developing effective water use policies is difficult for a number of reasons - the nature of its physical properties, complex economic characteristics and the important cultural features. Therefore, management of water resources involves legal environmental, technical, economic and political considerations. But in most societies, economic and political considerations, dominate decisions of water resource use. Economic benefits provided by water may be commodities, waste assimilation, aesthetic and recreational objects, fish and wild life habitats. However, along with these benefits, marry pressing irrigation issues reflect the various economic, social and political influences affecting the economic conditions in one way or other. The overall performance of many irrigation projects in India is disappointing, including costs, time over-runs, poor management, and non-realisation of full cost recoveries. The overall objective behind government intervention and involvement in the development and management of irrigation is to be evaluated according to the efficiency and equity objectives. Projects naturally involve large financial outlays. Hence, the necessity of pricing of irrigation water is considered as financially productive and economically sound. Therefore, the necessity arises for proper and appropriate pricing of irrigation water.

Prices are charged chiefly for two reasons - financial and economic. Large amount of outlays must be raised to pay the costs incurred in providing goods and services. The other is economic, the quantity of goods including water people buy depends on the price. The financial and economic functions of water charges are satisfied simultaneously under pure competition. In reality, under certain conditions, the pricing policies are not satisfying the financial and economic functions. Pricing policies are generally motivated by national objectives of achieving economic efficiency and income distribution. If the goal of a pricing policy is economic efficiency, then economic principles must be applied. The economic principles of pricing of irrigation are; first, having limited availability of irrigation water, the objective is to maximise the net benefits to society. The social marginal value of irrigation water across different groups of users would be the same. If not re-allocation of water can increase net social benefits. Secondly, increasing the supply if the additional social benefits exceed the additional social costs. Thirdly, pertaining to the medium term, it is the question of expanding the supply system by allocating capital resources to bring in new irrigation projects. Such additional investments are warranted if the social returns exceed the social costs of those investments at the margin to expand the given resources for further development. And finally, when water is very scarce, or if marginal cost is very high, water losses are reduced by carefully preparing the land and maintaining the field channels. In all of the above situations, water pricing can play a critical role in determining the levels of demand and supply and the amount of resources invested. In a strictly economic sense, a water user can afford an irrigation fee as long as that fee is smaller than his or her additional net income that is attributable to irrigation. If the goal is to redistribute the income to particular groups, then the principle of subsidised pricing is used. The conventional notion is that the equity objective always conflicts with the efficiency objective owing to the political power of the various interests. The changing economic conditions of the different countries of the world through globalisation and privatisation, the equity objective is not well valid at present conditions. The economic efficiency goal is generally pursued where that water should be treated as an economic good.

Considering the principles of water rate fixation, several theories of water charges are in operation in several countries. The chief are the cost of service, ability to pay, opportunity cost, marginal cost, market driven pricing, net benefit principle and free service policy. In India none of these methods is being strictly followed and tile policies are fixed on an adhoc basis from time to time without any logical method. The present study suggests that the fixing of water rates based on the gross income of the farmers from irrigated crop areas as a viable alternative.

Development and management of water and related land resources on a satisfactory level are essential for the achievement of the required rate of economic development. It is essential to take into account the water resources development while fixing the prices of irrigation. India is a country[1] of great geographical diversity. There are fifteen agro-climatic regions in the country. Andhra Pradesh region stretches over the Deccan interior and Eastern coast, covered with alluvial soils deposited by the Godavari, the Krishna, and the Pennar. It is mostly a humid region. Rice is the principal crop. Most of the rainfall in Andhra Pradesh takes place under the influence of the South-West monsoon. Thus, the location, rainfall nature of terrain, temperature and the availability of irrigation determine the land use pattern of the country.

The reported catchments area of Indian rivers is 3.05 million sq.kms against the total geographical area of 3.28 million sq.kms. The major river basins form 83% of the total drainage area, and the sources of water supply are significant. Major river basins like the Ganga, the Indus, the Godavari, the Krishna and the Cauvery have a number of canals, tanks and wells. These basins have large storage capacity. The average flow in the river systems of the country has been estimated to be 66,371 T.M.C. and the present storage of water in India have been estimated to be 5185 T.M.C. By 2007 A.D., 102 crore of people are estimated to use water resources directly, and the required foodgrains are estimated to be around 276 million tonnes as against the requirements of 198 million tonnes in 1996-97 The required development in agriculture can. in the long-run, be achieved only through a regionally broad based pattern of growth by devoting sufficient facilities of irrigation and maintaining a continuous flow of economically viable and improved techniques. The ultimate irrigation potential of the country has been estimated to be 113.50 rjtQHon hectares. Irrigation using surface water is 31.12 million hectares. The future of increased agricultural production lies with more intensive agriculture, especially by increasing the efficiency of the existing irrigation systems as well as spreading irrigation facilities to other hitherto unirrigated areas. The total surface water from the entire river systems of Andhra Pradesh is estimated to be in the order of 2,746 T.M.C. The ultimate irrigation potential is assessed at 87.80 lakh hectares. But the creation of these irrigation facilities needs large amount of investments.

In a developing economy, investment is influenced by economic and non-economic variables. This is mainly because in many a developing country like India, government plays a very important economic role. And programmes that affect investment assume a dominant role in the process of infrastructure development such as irrigation. Indian irrigation sector is inflationary in nature. The data show that wholesale prices of all commodities including food and non-food items, and manufactured products have increased 8 times in the country between 1939 and 1970-71 at 1939-40 prices. This had further increased to 3 times at 1970-71 prices upto 1983-84, and 2 times at 1980-81 price upto 1990-91. This has obvious effects on the cost of construction, repairs and maintenance ofirrigation sources.

Irrigation works in the British period were mostly diversion works across the rivers and streams, which were of low cost in their nature. Investment in irrigation started during the British era, although it was only in the post-Independent period that a concentrated effort was made in developing irrigation networks on a major scale. The capital COST of building up such schemes had increased substantially. It is interesting to note that the average cost of creation of irrigation potential per-hectare from the Godavari delta system in Andhra was just Rs.62 in 1890. The average cost per-hectare in respect of 22 works executed upto the end of 1900 A.D., in the century worked out to mere Rs.84. During the plan period 1951-95 as much as Rs.54. 044 million has been spent by the Andhra Pradesh state on the development of major and medium irrigation schemes. Investment in irrigation had increased from Rs.4870 per-hectare of irrigated area in the first plan to Rs.40, 682 in the Eighth Plan. Progressive deterioration in the standards of operation and maintenance of sources has been the result of several factors. This gives the room for evaluation of the existing water rates in India as well as in Andhra Pradesh.

The irrigation policy of the British rulers was marked by an apparent change in the fixation of water rates. The basis of charging of water in the British period, when supplied by government works, was chiefly the area irrigated. But different systems charging different rates were in operation in different parts of the Madras Presidency at different points of time. There were fundamentally two main considerations in fixing water rates, namely the considerations of the cost involved in the construction of an irrigation project and the benefits accruing from irrigation to the users of water. During the 19th century the test for economic soundness of an irrigation project in India was based chiefly on the direct returns of the investment. This issue of the economics of irrigation pricing was received the widest attention in the 20th century especially after Independence. Water rates in Independent India varied not only among the states, but also among canal systems of the same state. The situation changed during the period of Five-year plans. The attention has shifted from the question of investment decisions to that of recovery of costs. Considering the principles of water rate fixation, contrary pulls were developed with regard to the rate fixation. One emphasised the need to raise rates to recoup all the costs and the other pleaded for keeping down the level of rates to facilitate the full utilisation of the newly created capacities.

The present study highlighted the central idea of fixation as the supply of water to a number of farms. This is the actual service rendered by the government when it constructs an irrigation project. It might, therefore, be expected that the benefits of this operation would be measured by the productivity, prices and the rates which the farmers would be willing to pay for the supply of the water.

The productivity and prices of wet crops including rice rose by a large extent in the present one-half century beginning with the second world war. The productivity increased by a large extent during period 1968-69 to 1996-97 in the delta areas of East Godavari, West Godavari, Krishna, Guntur, Kurnool and Nizamabad. The yield per-acre of rice increased by 51%, *63%,* 46%, 40%, 53% and 54% respectively in the above districts(see Appendix VI-4). The prices of paddy(Rs. Per Quintal) had also increased in above districts by 38% in the period 1980-81 to 1997-98(see Appendix VI-5).

The benefits from irrigation are far higher than the actual rates of return from irrigation. The ratio of water rate to gross value of output was around 20% during the period 1861-1880.

It has been decreasing steadily and continuously since then. The gross value output per acre of rice increased through the period of 1955-56 to 1996-97, by Rs. 100 to Rs.5,400 whereas water rates increased only by Rs. 5 to Rs. 200. And the cost of production increased by Rs. 598 to Rs. 3211 during the period 1970-71 to 1989-90. Thus the low water rates in relation to the gross value of output are due to low assessment of water rates and providing subsidy in irrigation sector.

Subsidies in agricultural production play a crucial role in stimulating development of an economy through increased agricultural production, employment and investment. They are advanced either to promote the use of new inputs or to transfer income in favour of farming community. These are some reasons for which subsidies on inputs arc normally preferred.

Costs of input subsidies have to be evaluated against the loss of potential benefit if the same amount was invested in creating productive potential of agriculture. It is argued that incentives like subsidies are short-term measures and they *an* not meant to be substitutes for the long-term measures. Hence, a sharp rise in the subsidies may cut into the resources available for productive investments. The budgetary loss on account of the operation of government subsidies on irrigation systems were estimated at Rs. 42,324 crores(1987-88). The amount of subsidy per-hectare of canal irrigated area had been increasing.

The average recovery rate was less than 44%. The cost of these services, taken along with irrigation and flood control was close to Rs. 15,000 crore. Only about 20% of this cost were recovered. The expenditure of the Andhra Pradesh government on subsidies increased from Rs. 122.87 crore in 1981-82 to Rs.470.03 crore in 1986-87. registering a compound growth rate of 31.2%. Therefore, these subsidies in irrigation sector might decrease the national dividend, resulting the mounting fiscal deficit and misuse the input.

Section - II

Since the inception of the planning in India, the cost of providing irrigation has been mounting on the government. This prohibitive cost and low returns have discouraged the government from expanding irrigation schemes. Many scholars in this field have emphasised the cost and expenditure incurred on the major and medium irrigation schemes neglecting the benefits accrued from them. The reasons are not far to seek.

During the British period, the government paid much attention to the cost of providing irrigation and also imposed differential rates of cess for different regions considering their cost of construction and productivity. But most of the scholars studied the aspect of minor irrigation development and their water rates in British India. Water rates under canals were noted only partially and neglecting the causative factors like productivity, prices, etc. (Subrhamanyam Chetty, 1989). Some of these studies highlighted the indigenous irrigation institutions such as dasahandam and kudimaramat during the crown period (1859 to 1947), and discussed the effectiveness of the policy implementation. One such study partially covered the irrigation water rates in the Ceded Districts of the Madras Presidency (Subbalakshmi,1988). However it could not grasp the water rates of the canal areas.

Some studies on the economics of irrigation and water rates under Godavari and Pravara canals and Cauvery-Mettur projects were conducted around 1948 and 1961 (Gadgil and Department of Agriculture, University of Madras). These studies noted the gross value and incremental cost comparison as the basis for fixing the water rates but they were almost ignored by the government authorities for obvious reasons of self-sufficiency in foodgrains and eradication of poverty.

The economic benefit criterion should be adopted for sanctioning irrigation projects instead of the financial criterion. This point was raised by Nijalingappa Committee in 1964. The study concluded that those irrigation projects with a benefit-cost ratio greater than 1.5 were considered acceptable from the economic point of view.

It was imperative that irrigation works be made to pay for the maintenance, operation and depreciation charges and also yield some interest on the capital(Second Irrigation Commission, 1972). The Commission stated that the economic benefit criterion was more suitable than the financial return for evaluating irrigation projects.

The benefit-cost ratio by the internal rate of return (IRR) criterion was suggested by the Nitin Desai Committee, 1983. The Committee's main argument was that projects should normally earn the minimum IRR of 9%.

The prevailing water rates were too low to meet even the operation and maintenance charges, and wanted the rates to be increased gradually taking into consideration the rising costs of irrigation projects, in regard to both capital outlays and operation and maintenance charges(National Conference of Irrigation and Water

Resource, 1986). The Conference felt that the rates should be such as to provide signals to the beneficiaries regarding the previous value of scarce water supplies.

The Study of Economics of Water Rates in the Punjab and Uttar Pradesh has highlighted the demand side factors as against supply side factors Eke cost of providing irrigation (Ansari, 1968). Demand factors like water availability to an irrigation work, the extent of area, volume of water, cropping pattern and rainfall have been taken into account while fixing the water rates. But this study ignored the productivity and prices of particular crop in irrigated areas.

There was a study on water rates, which covered the productivity, prices and gross value of output extensively until 1973 (Andhra Pradesh Irrigation Commission Report, 1973). And the present study has covered the period comprehensively till 1997.

The legal provisions for water laws both to purge the lingering colonial vestiges in the realm of water laws and to make them relevant to the current and future socio-economic requirements(Maria Salcth.1997). The study further suggested that the water institutions need to be based on water rights system, ecological security, economic efficiency and social equity. This study has ignored me importance of water rates for economic efficiency in irrigation sector.

The financial management of public irrigation works was unquestionably dismal. A major factor in this in the policy of gross under pricing of canal water by every state government (Dhawan, 1989). Water tariff is presently linked to crop area only. The study found that poor quality of administration, a sizable part of the reported investment in all public works in India is of a fictitious nature and inefficiencies in project execution time over-runs leading to cost over-runs are some of major factors for low assessment of water tariffs.

Raising the issue of water rates, water rates in South Asia are paid not in proportion to water received, but according to the land area, which receives water (IRRI and ADC. 1976). Water rates can serve as an allocate devise only if they are based on the volume of water used. At the present time this is not the basis anywhere in Asia, rates are imposed instead on an area basis. But these studies ignored the efficiency and equity objectives.

The cost of recovery should be the main consideration in determining water rates(Vaidyanathan Committee Report 1992). It also pointed out the necessity of phase-wise rationalisation of water rates, which should include crop-based rates, volumetric assessment and full cost recovery.

This study similar to those of Ansari,1968, Andhra Pradesh Irrigation Commission Report 1973, Vaidhyanathan Committee Report, 1992, in areas where cost of irrigation, principles of water rates, productivity and prices. But the present study highlighted the issues superior to those of mentioned studies such as the origin, evolution and rationalisation of the water rates in the British period as well as in Independent India in general and Andhra Pradesh in particular, comparison of water rates with relation to gross value of output and budgetary loss on account of operation of government subsidies in irrigation systems.

The present study has found that the British government introduced separate and uniform systems of charging the irrigation water. The present study has analysed productivity, prices, and gross value of output and water rates since 1865 to 1996. The available works on water rates did not give much importance to the aspects of productivity, prices, gross value of output and water rates.

The present study found that the gross receipts in general had fallen short of the working expenses and this wide gap resulted in the paucity of funds for operation and maintenance, and not to speak of any sizable flow of new investments. The average cost on the cumulative irrigation potential created through major and medium schemes over this period increased the per-hectare development cost. The study found that the gross value of output per acre of rice increased throughout the period(1955-56 to 1996-97), whereas water rates increased marginally, leading to a declining proportion of the share of the water rates in the total output of the crops irrigated.

Section - III

India with a population of nearly one billion may find it difficult to feed and clothe herself without the corresponding and proportionate rate of growth in agricultural production in the next century. The country had adopted several food self-sufficiency programmes especially with regard to rice and wheat in the 1970s. It indicates that output from the irrigated lands should expand at a high rate so as to meet the projected food needs of the next few decades. Also there is need to increase the ability of poor people to purchase food, and therefore, the growth in foodgrains is to be sustained through irrigation. Hence, what is needed is a search for realistic and pragmatic policies, which can ensure food security and self-sufficiency in foodgrains. This underlines the importance of the development of water resources for irrigation in India. A large number of major storage works were undertaken and the country embarked on a large number of new irrigation projects. The direct impact of such a large number of on going projects has been the abnormal cost over-runs. Besides such huge investment without any significant financial returns, there is also a financial loss of approximately Rs.4300 crore per year on account of loss in incremental foodgrain production which would have otherwise come from this area, had it been under irrigation. This had discouraged furthur investment in agriculture. The percentage of costs recovered from farmers has been very low. The revenue collections had not been sufficient even to cover the costs of operation and maintenance of the irrigation systems. The actual receipts varied from less than 1% to a maximum of 3.5% of the value of gross output during the present decade of the 1990-2000.

The results of the present study reveal a rising pattern of per-hectare/ acre capital costs of major and medium irrigation schemes over the period. The study revealed that there were several systems of charging irrigation water in different parts of the country during the British administration. The British tried to rationalize the high water rates by searching for principles of fair returns to investment by both the government and farmers. At present in Andhra Pradesh there seem to be no rational economic principles to determine the water rates. The productivity and prices of rice had increased to a large extent in the selected districts of East Godavari, West Godavari, Krishna, Guntur, Kurnool and Nizamabad. The ratio of water rates to gross value of output was 20.08% during the period 1861-1880. It has been decreasing continuously. In 1918-19 it was 11% and in 1946-47 it was 8% and in 1966-67 it was 2.6% and in 1995-96 it was near to 1%. The low wilier rates in relation to gross value of output may be low assessment of water rales, while benefits are well recognized owing to the irrigational development. Finally, the present study highlighted the issue of budgetary loss on account of operation of government subsidy in irrigation sector. Subsidies were justified to mitigate the effects of extreme inequalities of income and wealth in the country and to raise the consumption of the vulnerable sections of population, to protect and promote the growth of employment-oriented production in the decentralised sector and finally to protecting infant industries. But from the stabilisation point of view to keep fiscal deficit low, subsidies can not be justified to continue. If so much of the country's resources were not spent on these recurrent subsidies, production investment including investments in irrigation could have been stepped up to achieve sustained growth, increased income and employment.

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GLOSSARY

F..P.W : Economic and Political Weekly
U.A.E : Indian Journal of Agricultural Economics
Anicut :A dam. generally of masonry, to retain or divert running water for irrigation purposes.
Abi :.Paddy crop sown at the commencement of rainy season, irrigated by tanks, wells and other irrigation sources.
Dufassal or Dofasal :Crop which remains on ground for more than sis months and is irrigated. When applied at means a double crop a land entitled to raise two heavily irrigated crops or a crop which remains on ground Dreariness both the seasons.
Fasaljasti :The charge for water for the irrigation of a second crop irrigated crop on a wet land entitled to raise only one heavily irrigated crop.
Inam :Grant of land free of land revenue or at a favourable rate of land revenue.
Kharif :Early dry crop harvested in Autumn.
Manavari :Rainfal land on which Paddy is grown by in pounding rain water.
Rabi :A *dry* crop shown in October and November and harvested in Summer in March and May.
Tabi :The Paddy crop which is grows in Summer season.
Tirwajasti :Water-rate collection dry lands irrigated from a government sources of irrigation.
Paddy(Vadlu) :Orya Sativa
Jawar(Jonnalu) :Sorghum Vulare
Bajra(Mokkajonnalu) :Zea Maise.
Ragi(Ragi and Chodi) :Eleusine Cora Cana
Korra(Korralu) :Setaria Italika
Varagu(Arikelu) :Paspalum Serobiculatum.
Tobacco(Pogaku) :Nicotiana Tobacum.
Cotton(Pratthi :Gossypium SP.
Groundnut(Verushenagalu) : Araculus Hypogoca.
Bengal Gram(Shanagalu) : Cicer Arictinum,
Green Gram(Pesarlu) :Phaseolus Arureus.
Red Gram(Kandulu) : Cajanus Cajan.
Black Gram(Minumulu) : Phaseolus Munso.
Horse Gram(Ulavalu) : Dollichose Biflorus.
Chillies(Mirapakayalu): Capsium Annum.