Chapter - I

Literature Review and Research Methodology
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LITERATURE REVIEW AND RESEARCH METHODOLOGY

1.0 Introduction

Agriculture has continued to be the main source of livelihood for the majority of the population and forms as a backbone of the Indian economy. At present it has engaged over 60 per cent of population in the country. It contributes 57 per cent of G.D.P (Gross Domestic Product) in 1950-51 but at present 29.4 per cent. Agriculture contributes a major share to the national income. Even today some areas in the rural belt a subsistence agricultural economy, and also the dominant occupation of most of the small farmers. 2001 Census estimates show that 72.22 per cent of total population were living in the villages, the rest in urban areas. Over 74 per cent of the population inhabiting over 95 per cent of the geographical area which makes rural India, cannot be take lightly in any strategy that the country may adopt for into socio-economic development.

1.1 The Background and the Setting

In rural India, the present socio-economic condition is not satisfactory due to the presence of many problems like hungry poverty, unemployment and increasing inequality of income in rural India. Seventh Finance Commission estimate, 277 million persons lived below the poverty line in 1970-71, which forms 52 per cent of the total population, 225 million in rural and 52 million in urban areas. The Sixth Plan estimates showed that 46.3 per
cent of population lived below the poverty line. At the end of the Seventh Plan it was estimated that 30 per cent of population would live below the poverty line. At the Ninth Plan it is 36 per cent. The World Bank² has estimated the proportion of population below poverty line in rural areas declined from 53 per cent in 1970 to 44.9 per cent in 1983, but about 42 per cent in 1988 however in absolute term, the number of rural poor was about 237 million in 1970 and it rose to 232 million in 1983 and was around the same in 1988 the over all percentage of the poor was from 52.4 per cent in 1970 to 40 per cent in 1988.. However, the Eight plan aims at reducing the percentage to 10 by 1995. In Ninth plan, specifically designed antipoverty programmes for generation of both self-employment and wage employment will continue.

A large number of workers are forced to remain jobless both in rural and urban areas in the country. It is obvious that the Five Year Plans have failed to achieve the objective of full employment, on the contrary, with every successive plan, the percentage of unemployment has been on the increase. At the end of First Plan, unemployment was about 2.9 per cent, by the end of the Third Plan, it rose to 4.5 per cent and at the end of 3.6 percent the N.S.S data (National Sample Survey 19th round)³, on unemployment has estimate that 8.3 million persons in rural areas working less than 74 hours per week. The planning Commission has preferred to use N.S.S data for making a projection of unemployment for the iD's taking 28 million as the
back log unemployment in 1990, net additions to the labour force during 1990-95 was to 37 million. Thus the total number of persons requiring employment during the Eighth Plan be around 66 million. It is represented that during 1999-2000, labour force would increase by 41 millions. Thus by the year 2000. The total number of Job seekers would be fantastic around 106 million.

India is entering a period of labour force explosion as against the estimated population growth rate of 1.79 per cent the labour force, is respected to grow the rate of 2.54 per cent annually during the Seventh Plan Period. (1985-90). The labour force in rural areas which was estimated to be 206.79 million in 1985 is expected to grow to 264.33 millions by 2000 A.D. Along with back log this would mean creating about 62 million additional jobs in rural areas by the year 2000 A.D. This situation must be urgently resolved. To achieve this fact with in the frame work of the current size of investment, the pattern of growth will have to be reoriented in the direction of higher production through increased labour intensity. Reserve Bank of India found that in rural areas, the bottom 20 per cent of the population has only 9 per cent of the aggregate income while the top 5 per cent has 17 per cent of the income. The top half has 69 per cent income while the bottom half has only 31 per cent. The study by Iyangar and Mukerji and by the National council of Applied Economic Research (NCAER) bring out broadly the same fact. Thus, inequality in income distribution is also a social problem.
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1.2 Farm Trade

Importance of Indian agriculture arises from the role it plays in India's trade. But then, in recent years, the significance of agriculture exports growth has been less than that of agricultural output.

Yoginder K Alogh (1997)\(^6\) in his paper on agriculture trade and policies shows that "the Indian economy has been relatively insular and this is particularly true of its agriculture sector. Its agriculture exports has ranged between 1.28 per cent to 1.82 per cent for her gross agricultural out-put and imports between 1.8 per cent to 3.12 per cent. Growth of agriculture trade has been less than that of agricultural output.

Thus, in India, agriculture is the largest sector of economic activity. It provides not only food, fodder, fuel and raw materials but also employment to a very large proportion of the rural population. Being the dominant sector the improvement or change in the national output depend on the output in agriculture. While the development of agriculture seems to hold the key to the progress of the economy as a whole and should receive due emphasis\(^7\).

After Independence, the Central and State Governments adopted the objective of planned economic growth and social development. Also there was a new aim among the masses who looked forward not only to a higher standard of life but also for an egalitarian social order. Due to rapid growth in population, urbanization and increase in income, the demand for food and agro-based commodities began to rise fast will see a number of problems in future years.
1.3 Status of Andhra Pradesh

It is found that India is an economically low income country in the globe. In South India, Andhra Pradesh is also categorised as low income state. At constant price (1980-81), the per capita income in the state increased from Rs.1380 during 1990-91 to Rs.7155 during 1994-95 as quick estimates. The Poverty Picture in the State is grim. The States Draft Eighth Plan Proposal estimates that 33.8 per cent of the rural population was living below the poverty line in 1987-88 compared to 45.4 per cent in 1977-78. Regarding the unemployment situation has grown at about 1.95 per cent per annum during the 10 year period of 1977-79 to 1987-88 at the all-India level, while this was only 1.44 per cent in the State. Both at the State, as well as the country level, the growth rate of employment has been high with respective percentages of 2.62 and 3.66 in urban areas and low with 1.23 and 1.53 percentage in rural areas.

The immediate need to solve all these economic and social problems is to promote social and economic development. The development of rural areas depends on agriculture and this sector is able to provide employment and livelihood for rural masses. India’s agriculture depends largely on vagaries of monsoon which are uncertain, irregular, and unevenly distributed throughout the year and over an area. In large parts of the country rainfall is to low and un-certain distributed throughout the year and over an area. In
large parts of the country rainfall is too low and uncertain distributed that it was not permit intensive cultivation even during the main crop season. Removal of backwardness to increase agricultural productivity is the only solution. The improvement of agriculture is possible by the assured and regular supply of irrigation facilities. More, recently, the favourable impact of irrigation on creation of additional rural employment for agricultural labourers and self-employed family workers of the cultivating households is being highlighted.

Irrigation is by and large a vital infrastructure of agriculture. It is human beings' effort to substitute for any deficiency in natural rainfall with the objective of a steady expansion in crop output. It averts serious and semi-famine condition. It also supplements supply of rain water, particularly in a country like India, centre and states have taken top priority for irrigation due to "grow more food grains" and "Garibi Hatao" (removal of poverty) programmes. In initial period major and medium irrigation projects were given paramount importance. From 1980s it is found that minor irrigation projects are cheaper and serve quickly to the beneficiaries. In the review of literatures, the first part deals about general in economic development with relevance to irrigation, agriculture poverty and second part emphases on impact of irrigation studies.
1.4 Review of Earlier Studies

Many researchers and specific studies on the criterion of irrigation to improvement of agriculture and against rural poverty are given below.

The Royal Commission on Agriculture (1926)\textsuperscript{12} had examined the improvement of the agrarian economy. It also emphasised the importance of providing a minimum standard of life in villages and controlling the rate of growth of population in promoting agricultural development. This recommendation is relevant today in particularly rural sector.

According to the Irrigation Commission 1972\textsuperscript{13} the First Irrigation Commission of 1901-03 was appointed in the shadow of two famines which had highlighted the need to extend irrigation as a protection against future famines. But the Irrigation Commission 1972 was set up in the context of a rapidly expanding economy and an even more rapidly expanding population, unemployment and disparities. It emphasis irrigation encourages the farmer to adopt more scientific technique. It enables him to show the right strains at the right time and realistic higher profits. It also permits him to go in for more intensive cropping which creates new opportunities for gainful employment\textsuperscript{14}.

Ahluwalia Montek (1978)\textsuperscript{16} has made a comprehensive estimate of percentage of rural population in poverty for 14 major states of India. His analysis shows that "at the all-India level there is a strong support for the
hypothesis that the incidence of rural poverty is inversely related to agricultural performance". His findings also suggest that in Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and Uttar Pradesh agricultural growth offsets the adverse impact of other factors so that if only agriculture can grow fast enough, it is likely to reduce the incidence of poverty.

Robert Chambers (1990) in his paper entitled "Irrigation Against Rural Poverty" has shown that irrigation is an important source of poverty alleviation of rural people. He has also very clearly proved that the well designed irrigation policy could promote employment and income, provide security against improvement, discourage migration and improve the quality of life of the rural poor.

Pradhan H. Prasad (1990) studied the poverty in rural India revealed that the adoption of water fertilizer - H.Y.V. technology has led to a decline in poverty and the decline is also associated with increase in agricultural and food grains production. Therefore, if the decline in proportion of the poor in rural India has been low because agricultural growth has been low and heavily dependent on the vagaries of nature. Irrigation and water management technology has a very small geographical coverage in the respect. Large areas, which could have been brought under assured and productive irrigation remain either unirrigated or waterlogged. He emphasised, a strong case is made out for a widespread geographical coverage in terms of technology oriented agricultural development strategy so that the impact of the vagaries of nature is minimised. As also suggested a solution
to the problem of rural poverty by providing effective water management, and the geographical coverage for water fertilizer H.Y.V. technology if responded rapidly, can go a long way in the eradication of poverty.

Deepk Ahluwalia (1991) studied the growth performance in Indian agriculture, he found that the east (Assam, Bihar, Orissa, West Bengal), the Centre (Madhya Pradesh, Rajasthan) and Uttar Pradesh. These three regions put together, account for nearly half of the total domestic product (47.1 per cent during 1984-87) that originates from Indian agriculture. Also found that these regions a comparative advantage in the production of agricultural commodities due to a combination of factors such as a relatively high irrigation potential and good rainfall and a large rural population would appeal to till the comparative advantage in favour of agricultural growth. Indeed one of the main findings of his study is that accelerate growth in the agricultural sector, he recognized irrigation development may be a laudable long run objective, much of the growth in the short to medium term will have to come through increasing the efficiency and stability of rained farming.

World Bank (1995) study on "Economic Development in India, Achievements and Changes Shows that", emphasised the expansion of irrigation networks has had a major impact on agricultural growth in India. Technical progress made possible by irrigation investments and its complimentary inputs high yielding variety seeds and fertilizer accounted for about 30 per cent of the growth in agricultural output in the Post Green Revolution Period. Irrigation also helped the agriculture sector to lead the reduction in rural poverty during the 1980's. In facts, the incidence of rural
poverty became lower in irrigated areas compared to rainfed areas. This is true across states as well as within states, including those in which agriculture grow rapidly during 1980's. Given indications that India may be close to the ceiling of cultivable land, irrigation will become even more important as a potential contributor to technical progress, improved agricultural performance and poverty reduction.

Ninth Five Year Plan (1997-2002)\textsuperscript{20} emphasised the agriculture sector has a vital place in the economic development of the country as it contributes 29.4 per cent of G.D.P. and employees about 64 per cent of the work force. Significant strides have been made in agriculture production towards ensuring food security. Food grain production registered an annual growth rate of 3 per cent during 1984-85 to 1994-95. There has been a significant improvement in agriculture. Productivity which has helped in reducing rural poverty.

From the above review shows that agricultural sector has a vital place in economic development of the rural areas and there is a strong support for the hypothesis that the incidence of rural poverty is inversely related to agricultural performance. Also some studies indicate a clear advantage of assured irrigation in using alter modern farm inputs in the context of increasing agricultural productivity and raising the level of rural living (Robert Chambers, World Bank, Deepak Ahluwalia, Ahluwalia Mantek). In view of such multidimensional benefits, development of irrigation has become an issue of inescapable emphasis of in Indian agricultural planning.
Government, research institutions, researchers etc., have undertaken several impact assessment studies on irrigation at the district as well as at state levels. Such studies focussed, by and large, on the feasibility of the irrigation schemes, cost-benefit ratio, employment generation, cropping intensity, cropping pattern, yield etc. These studies will be related to the impact of different sources of irrigation on agricultural productively. Some of the studies review is presented below:

Dhawan B.D (1988)\textsuperscript{21} found that productivity of land irrigated by groups was superior to that of canal and tank irrigated lands. When he measured in terms of food grain units per net irrigated hectare averaged between 5-7 to 6.5 tonnes for wells as compared to 2.6 - 3.4 tonnes for canals and 2-2.3 tonnes per tanks in the Andhra Pradesh, Tamil Nadu State. In Punjab and Haryana, the land productivity of wells (mostly private tube wells) was between 5.5 and 5.7 tonnes per hectare, well above the range estimate of 2.9 - 3.2 tonnes per hectare for canal irrigation. Taking a level of 0.5 tonnes per hectare for dry land productivity without irrigation. The output impact of irrigation was evidently substantial, underscoring, the key role of irrigation in Indias agriculture growth.

F.S. Bagi (1980)\textsuperscript{22} in his study found that the irrigated farms had better allocation efficiency than that of unirrigated farms, the large farms had relatively more efficient in allocating land than the small farms. But small farms had able to achieved relatively better efficiency in allocating all
variable inputs and also shows that all groups of farms make very intensive use of labour, but under-utilized of the remaining variable inputs, the unirrigated farms had less successful than the irrigated ones in allocating fertilizer, capital, and other expenses efficiently. He found the main reason for there was the higher uncertainty of crop production on the unirrigated lands, due to which, these farmers have to make resource allocation decisions under relatively more uncertain circumstances.

According to the Irrigation Commission 1972 \textsuperscript{23} irrigation encourages the farmer to adopt more scientific techniques. It enables him to show the right strain at the right time and realistic higher profits. It also permits him to go in par more intensive cropping which creates new opportunities for gainful employment.

G.P. Mishra and M.Vivekananda (1979) \textsuperscript{24} studied the impact of canal irrigation in rural areas a case study of Ballary district of Karnataka their findings shows the pattern of crop cultivation was changes after the introduction of canal irrigation in the villages. In case of yield effects were quick yielding change in the field of production. The canal irrigation was also induced the use of modern inputs and practicing in farming. The income assets, consumption, expenditure and debt position of large farm households were much better off than all others. The effect of irrigation on employment per member working as cultivation was 218 days in dry-cum wet villages. While in perennial villages work as cultivators for 272 and 259 days per person per year. The income of households in the perennial villages have an average income of Rs.26,064 per household. This amount was greater than
Rs.21,493 and Rs.12,627 income of a household in dry cum wet villages. The yields of five major crops grown on irrigated land in dry cum wet villages were more than twice the yields of the same crops on dry land. Their study was based on a single source of irrigation.

T.V. Moorti (1976) studied the impact of different source of irrigation on input output relationship cropping pattern and farm practices in Aligarh district of Uttar Pradesh found that the area under bajra desia on private tube well farms was 16 per cent of the total cropped area as against 10.3, 7.0 and 8.9 per cent of the total cropped are on the state tube wells, persian wheel, and charka farms respectively. The proportion of high yielding variety was always found greater on private tube well farms than other sources. The crop yields on farms irrigated by the private tube well farms were consistently more than 25 per cent higher even for the same variety than farms with other sources of irrigation and also found farmer irrigating from the private tube well invariably used higher doses of nitrogen on almost all crops compared to farms with other sources of irrigation. At present, many areas the private tube wells are over exploitation of ground water this situation was not considered in his study.

D.S. Sidhu, Ramesh Chand and J.K. Kaul (1984) their study to compare the economic analysis of various sources of irrigation in Punjab they found that the yield of wheat was 44 per cent higher under tube well irrigation compared to canal irrigation and also observed that farmers having alternative sources of irrigation applied higher doses of fertilizers, compared
to the farm having single source of irrigation. They proved that the farms among flexible and reliable sources of water supply operated on higher production frontier where they were about to reap the benefits of economies of scale.

The study by A.K. Giri and G. Mallik (1984) on some economic aspects of public source of irrigation a comparison with private source of irrigation the district of Nadia in West Bengal concluded that the gini-coefficient of concentration in the case of shallow tube wells. The value of coefficient were 0.1349 and 0.03955 respectively for shallow tube wells and deep tube well, indicating greater inequalities in land distribution in the area served by private source of irrigation that in the area served by public source of irrigation. But the cropping intensity for the area served by the three shallow tube wells was estimated to be 279 which was much higher than the cropping intensity for any size group of ownership holdings for the two types of deep tubewells. They found the private source of irrigation has merits in that the intensity of cultivation was higher than the public source of irrigation.

Jawahar Thakur and Praduman Kumar (1984) they compared the economic efficiency of different irrigation systems in western Uttar Pradesh. They observed that the water management problems in private tube wells farms had considerably less problems of water control than state tube wells and canal irrigated farms. The intensity of cropping was maximum of private tube wells (172 per cent) and minimum under state tube well (166 per cent). The productivity of land and inputs improved public tube wells farms as compared to state tube wells and canal irrigated farms.
S.K. Ray (1992) studied the development of irrigation and its impact on pattern of land wise, output growth and employment generation during two periods 1951 to 1965 and 1971 to 1985. He found in the pre 1965 period all crops production index recorded a growth rate of 3.0 per cent of which 49 per cent was due to expansion in cropped area, 45 per cent to improvement in yields and 6 per cent of which was due to improvement in yields, 16 per cent to change in cropping pattern, and only around 14 per cent due to expansion in cropped area. This affected adversely employment in crop production. On farm employment in the past 1971 period was also adversely affected because of decline in the employment elasticity with respect to yield.

Saji Joseph (1993) emphasising the need of minor irrigation schemes and also the benefits achieved by minor irrigation projects well help considerably in eliminating rural poverty.

Basavan Sinha and Ramesh Bhatia (1982) their study has successfully demonstrated the emphasized of evolving a co-ordinated and multi-disciplinary approach in planning and appraisal of projects in the irrigation sector and illustrates the process of project evaluation by considering all feasible technical alternatives in view of multiple objectives of irrigation planning. Their study stress the need for a frame work for a detailed social benefit-cost analysis of an individual irrigation project. From the title of the topic one may expect analysis of more than one irrigation projects in India. But there studied only one reservoir projects as a case study.
Karan Singh, H.S. Sandhu, Nirmal Singh and Balbir Kumar (1993) were evaluated the overall impact of Kandi Water-shed development project in Punjab. They found that the crop pattern shifted in favour of more remunerative crops such as paddy, pulses, vegetables and high yielding wheat. The investment in farm machinery and implements increased for example the number of tractors and oil engines, electric motors increased from 5 to 12 and from 14 to 20 per hundred holdings respectively.

World Bank (1994) was conducting a desk study of the tanks irrigation experience. It reviews the economic of scale with irrigation projects. Size has cost as well as benefits. The cost of the complex task that users have in organizing their participation in a project (or the higher cost of not participating)is one such cost. The small is beautiful partisans had pointed out these and many others. Data had from Operation and Evaluation Department (OED) early review of 20 irrigation impact evaluations suggested however that an average the incremental benefits of large irrigation projects out weight their additional costs. The data from the larger sample of 208 projects confirms that project size and evaluation economic return vary directly. The coefficient of correlation is about 3, remarkably high for a complex social phenomena like irrigation. There was a very high confidence level in this figure because of the large member of observation.

Chakroborty, Sudip (1998) analysised the impact of irrigation on the output of agricultural production particularly paddy crops in West Bengal. Data were collected from 79 paddy producing farms in non-project areas and 108 farms in project area from Manyaguri block. The findings of the study are (1) In the study area only 12.36 per cent of the net cropped area is cultivated
under minor irrigation project; (2) big farms have been able to raise the level of output to Rs.3,146.30 per acre; (3) small and tiny farms in the project area have used inorganic fertilizers to raise the level of output; (4) Value of total output per acre in the project area is Rs.2,945.92 and the same in Rs.2,225.17 in the non-project area. Provision of infrastructure facilities including irrigation facilities, and development of animal husbandry and rural agro industry in rural areas is suggested to improve the living conditions of the farmers.

Raju K.V. and Tushaar Shah (2000) their paper is based on a larger study which was carried out to assess the socio-ecological importance of irrigation tank, organisational capabilities of department and local non-governmental organisations on the rehabilitation of irrigation tanks in Rajasthan. This paper provides the back ground of irrigation tanks, and justification for their pivotal role and describes the approach that they have evolved to rehabilitate these tanks in Rajasthan.

Bhakar.R.R. (2002) in his study attempts to examine the irrigation and agricultural development of Rajasthan an analysis of inter district disparities. He found that the irrigation factor is leading factor for agricultural development in Rajasthan. He concluded that most districts of state are lagging behind with respect to irrigation and as a result, they have to depend on the mercy of nature and remain satisfied with dry crops of low productivity. On the other hand, districts having irrigation facilities are flourishing.
From the above reviews, they covered impact of different sources of irrigation like canals, tanks, wells, tube wells, and river lift irrigation. Further the studies have dealt with the different aspects of the impact as such scheme in terms of yields, benefits, cost ratio, cropping intensity, cropping pattern, employment, area income etc. An comparative study about the impact of different sources of irrigation on the cropping pattern, employment opportunities, the household income of the farms and on their standard of living in Chittoor district has not yet been attempted, Hence this study is made to fill the gap in the literature on medium and minor irrigation in with special reference to medium, minor and borewell irrigation in the Chittoor district.

1.5 The Problem

But in reality, when we meet the farmers and visit the field's the most irrigated area is under ground water source (private source) than surface (Public source). It is by now amply clear that the sustainability was embodied in many traditional water harvesting systems in India. But unfortunately, these time proven age old systems has been systematically disappearing in the modern times in particularly last fifteen years. This historical evidences provide many lessons for successful water resource planning especially in water scarce areas. This situation, a negative impression has been felt. It raises a question in the mind of this research scholar whether ground water source irrigation produced an appreciable impact on the socio and economic condition of the individuals farms who have wells and groups representing varied interests and also another interesting question raises why the traditional irrigation sources like tank irrigation has not produced an
appreciable impact on the socio and economic condition of the farms. What is the rational is shifting from a community to individual source of irrigation. It also to be found that which source will being socio-economic equity and sustainability benefits to the rural society. Hence, this study focuses on examining the deeper and wider problem of different irrigation sources and makes some concrete suggestions. Chittoor District, one of the Southern parts and Tamil Nadu border district, in Andhra Pradesh has been selected for the study.

1.6 Focussing on Chittoor District Economy

The study area, Chittoor district is one of the 23 districts of Andhra Pradesh, is characterized by predominantly agricultural economy, 39 percentage of sown area is depending of vagaries of monsoon, This is reflected in the disproportionately large share of population engaged in agriculture as a livelihood. As per the 2001 census the total population of the district was 37.3 lakhs accounting for 4.9 per cent of the population of Andhra Pradesh. It is indeed one of the less urbanized districts in the state. Its urban population was only 21.6 per cent, which is lesser than the states average of 23.27 per cent. Hence, the district is considered as a rural district. Agricultural sector provides employment to 72.7 per cent of the working population in the district. The working population in the district accounts for only 4.6 per cent of the Andhra Pradesh working population. 4.90 lakhs agricultural workers in most of the mandals indicates an over dependence on the agricultural sector. W.W. Rostows traditional agricultural indications like rainfed, non-mechanised and labour intensive are very much founded.
Popular tank irrigation system is slowly disappearing and the farmers are switched over to ground water sources. State government has given medium and minor irrigation projects as an important instruments to prevent further droughts and famines on one side and growing food and non-food crops, on the other.

In Chittoor district, there are no major irrigation projects as such no perennial big rivers. There are eight medium irrigation project. There are 7907 number of irrigation tanks, which are depending on rain. So the mostly source of irrigation is tank and well irrigation. The present study has been undertaken to investigate the functioning of medium and minor irrigation sources and find answers to the following questions in the district.

1. Whether there is any change in the pattern of different sources of irrigation in the district? 2. Whether which source of irrigation has generated more employment and income to the farmers? 3. Whether which source of irrigation has any impact on the socio economic condition of rural community? 4. Whether the standard living of the different source of irrigated household has improved or not? 5. Why the farmers give more priority to private vs public source of irrigation in the district? 6. Is there any source of irrigation damaged to the environment of the district?

1.7 Objectives of Research

From the perspective of the above review the following specific objectives are derived as
To study the nature and scope, of medium, minor and borewell irrigation across different regions of the Chittoor district.

To understand the organisational and operational features of different irrigational facilities in the sample area.

To find out the input-output ratio across sample area.

To examine crop pattern change across variation of sources of irrigation.

To estimate the impact of different irrigation sources on the farm income and employment among farm households in the sample area.

To suggest remedial measures and policy implications.

To give a specific focuses to the above objectives a few hypotheses have been drawn up.

1. The impact of different sources of irrigation seems to have been positive correlation.

2. No positive relation in between tank irrigation and borewell irrigation.

3. To operate personal borewell easier than minor, medium irrigation facilities.

4. Tank irrigation has sustainable development than that of borewell irrigation.

5. Canal, tank irrigation has generated more employment potential than that of borewell.

6. The farm income of households under canal and tank irrigation cultivation is lesser than that of borewell irrigation.
1.8 Research Methodology

To cater the needs of the objectives and to test the hypotheses suitable methodology has been adopted. The present survey covers the three different source of irrigation. For a comparative study of those three types of sources in the district, canal, tank and borewell irrigation are selected. The first and second source are considered as a public source, and the last one considered as an individual source. The study is to analyse the impact of three different sources of irrigation on the different households and the village economy in the district.

1.9 Sampling Design

Keeping in mind the requirements of the above objectives a multi-stage random sampling design has been adopted.

Sampling Stage-I Selection of Revenue Division

Geographically, and administratively Chittoor district is divided into three Revenue Divisions. Fortunately three divisions with three different sources of irrigation in the district are found. One with canal source of irrigated area, the second, minor irrigated tanks area and last one borewell irrigated cultivation have been selected for the study. They have been selected purposively, depending on our Judgment of medium and minor source of irrigation being typical of size - class and approachability.
Sampling stage-II

After selection of Revenue Division, Revenue Mandals are identified according to that source of irrigation. Then from each mandal one village is selected, the selection of villages are as secondary matter here, for depend on the selection of medium and minor irrigation projects. All these villages which have been benefitted from concerned projects, which are chosen for our study.

Sampling Stage-III

A list of the farm households are prepared in each of the selected village. For primary data, a total sample of 191 farm households 78 borewell, 75 tank irrigation and 38 canal irrigation in three different sources of irrigation in the three villages of three revenue divisions are earmarked in random.

Accordingly, all the identified farmers in the villages are arranged in an ascending order of the size of their farms. Then the total area of land of all the farmers is computed. Irrespective of national concepts the farmers are classified by us into three groups, small farmer, (upto 5 acres) medium farmer (5-10 acres) and large farmer (10 above acres). And finally, the farmers from each stratum has selected from the list. The systematic random method is used at this stage. In case where there is none or only one in a stratum, the gap or shortage has been made good by picking up a substitute from the preceding or immediate next stratum.
1.10 Collection of Data

The data source for the present study has been both primary and secondary. The primary data has been collected in a schedule specially designed for the purposes using survey method. The schedule has been canvassed for three different sources of irrigated farm households to identify demographic particulars, occupation, cultivating irrigated source, income, employment, details of irrigation crops and general assessment.

The secondary data pertaining to economic, geographic and details of land holdings have been collected from the records of the office of the Mandal Revenue Office and Chief Planning Officer at district level. Irrigation geographic data of district from public works Department, Irrigation Department, the Ground Water Department, village Administrative Offices, District Statistical Office, State and Union Government Publication on irrigation.

1.11 Analytical Tools

The data collected from the field investigation will be processed for simple frequency counts, cross tabulations, simple statistical methods of percentage and averages. Inter area and intra area wise data comparisons have been using to explain the findings of the study. Regression analysis, 't' test and analysis of variance have been used to test certain hypotheses.

1.12 Scope and Coverage

The study concentrates only on three sources of irrigation, namely, canal, tank and borewell irrigation. It covers the district of Chittoor for the purposes of an in-depth analysis, and makes use of mainly primary sources of data.
The reference year for the purpose of the primary data is 1999-2000 though at relevant places information has been collected for previous years as well.

1.13 Data and its Limitation

Farmers do not maintain farm management records. Therefore, this analysis is based on the reported information by the farmer. The accuracy of such data is subject to the limitations of the memory of the farmers. It is quite likely that the reported information regarding the exact costs involved in the farm operations, the number of mandays and bullock days, output etc., might have deviated from the actual values. This is particularly true of the information relating to the district.

1.14 Chapterisation

The study has been divided into seven chapters. The first chapter contains the review of literature and research methodology. The second chapter gives Indian irrigation and agriculture: problems and prospects. The third chapter introduces development of irrigation in Andra Pradesh. The fourth chapter deals profile of Chittoor district and study area. The fifth chapter contains organisation and operation of irrigation projects and cropping pattern. The sixth chapter deals with the impact of irrigation on income and employment. The seventh and last chapter gives summary and findings as well as the policy implications in the study area.
REFERENCES


10. Ibid., pp. 50-51.


Terms and Concepts

**Net Irrigated Area**

The actual cultivated area for a single crop.

**Gross Irrigated Area**

The actual area irrigated multiplied by the number of crops grown in a year.

**Area Irrigation More Than Once**

By deducting net irrigated area from the gross irrigated area.

**Irrigation Intensity**

\[
\text{Irrigation intensity} = \frac{\text{Gross irrigated area}}{\text{Net irrigated area}} \times 100
\]

**Large Farmer (L.F)**

Large farms with area held more than 10 acres.

**Medium Farmer (M.F)**

Medium farms with 5.01 to 10.00 acres

**Small Farmer (S.F)**

Small farms with area upto 5.00 acres

**Operational Holding**

It is the total holding including based in and based out hands cultivated by a farmer.

**Farm Assets**

Land, farm building, wells, livestock, farm machinery, farm implements.
Manday

It refers to the work accomplished by a normal healthy human being in a day of 8 hours.

Cattle Pair Day

It refers to the work turned out by a pair of cattle in a day of eight hours.

Cost of Production

Cost of various operations done and materials used for raising a crop on an unit area.

Variable Costs

Variable costs refers to the costs that are incurred towards inputs like seed, manures and fertilizers, transportation charges, payment towards manual and cattle labour, repairs and maintenance charges and interest on working capital.

Fixed Costs

Majority of the farmers do not take fixed costs into account while computing the profitability of farm enterprises. However, they have been computed and included in the analysis of different crops as well as farm holding as a whole. In the present study rental value of owned land, depreciation on farm asserts and implements, land revenue, causes and other taxes, and interest on fixed capital are considered render fixed cost.

Total Costs

It is obtained by adding all variables and fixed costs.
Total cost = variables cost + Fixed cost
Farm Management Cost Concepts

Cost \( A_1 \)

This includes the cash and kind expenses actually incurred by the owner (Cultivator). These are cost of manners and fertilizers, cost of owned and purchased seeds, cost of plant protection chemicals, charges for hired human labour, charges of both hired and owned bullock labour, land revenue, irrigation charges and local taxes, depreciation charges on farm assets and interest on working capital.

Cost \( A_2 \)

Cost \( A_1 + \) rent paid for leased in land. In this study no sample farmer is found to be holding leased in land. Hence, cost \( A \) and cost \( A_2 \) are the same which means cost \( A_2 \) in equal to cost \( A \) plus rent paid for leased in land.

Cost \( B \)

Cost \( A_2 + \) rental value of owned land + interest on fixed capital (excluding land)

Cost \( C \)

Cost \( B + \) imputed value of family labour engaged in crop production.

Gross Income

This pertains to the total value of main and by-products, produced on the farm during the year valued at the market price.

Farm Business Income

Farm business income is the differences between the gross income and cost \( A \).
Family Labour Income

The difference between the gross income and Cost B.

Farm Investment Income

It is the farm business income minus the imputed value of family labour.

Net Farm Income

Net farm returns = Gross incomes - cost C

Methods of Computation of Cost Components

Human Labour

Family labour is imputed at the wage rate prevailing for the casual labour in the villages. In case of permanent labour, payments made in kind are evaluated at the prevailing market rates and added to the cash payment. In case of casual labour the actual wage paid is taken into consideration. A manday of 8 hours is used as the basis to calculate the labour charges.

Cattle Labour

Prevailing cattle labour wages for a 8 hours day is taken into account in computing cattle labour cost.

Tractor Power

Generally, payment for tractor power is made on hourly basis. Hence, total number of tractor hours used is multiplied with hourly was rate to arrive at total cost incurred towards tractor power

Seed

The seed whether it is farm produced or purchased is evaluated on the basis of prevailing local market rates.
Manures and Fertilizers

Farm produced manures are charged at the prevailing local rates. Chemical fertilizers and other manures purchased are charged at the rates actually paid.

Land Revenue

Prevailing land revenue, which is actually paid by the farmer for this year is considered. Later, it was apportioned according to acreage under different crops.

Major Irrigation Projects

Those having culturable command area (CCA) of more than 10,000 hectares.

Medium Irrigation Projects

Those having culturable command area (CCA) between 2000 and 10000 hectares.

Minor Irrigation Projects

Those having culturable command area (CCA) of less than 2000 hectares of the study.

Ayacut

An irrigable command of an irrigation activity.

Hectare: 2.471 acres.

Acre

Unit of measuring land area.

Mandal

Sub-division of a taluk.

Lakh: 0.1 million

Crore: 10 million