CHAPTER I

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Water is an essential ingredient for sustenance of living beings as well as developmental needs, may it be irrigation, hydropower, industries, municipal supplies, fisheries and recreation etc. It's availability in nature globally in terms of quantity and quality of usable water for diverse purposes is scare and nearly constant.

Water is referred to as Adam's ale by the Oxford English Dictionary. This describes succinctly the utility of this vital resource. All living things live on, in or by water. Barring air, no other resource, natural or man-made is as crucial to life as water. It is small wonder then that the quality and quantity of water available to man at various locations on the earth are far from ideal. Man's effort to ensure both has opened up new vistas of knowledge. If water technology could be defined as the king, then several other streams of science e.g. Methodology, Hydrology, Hydraulics, Oceanography, Botany, Zoology, Chemistry, Electricity and even branches of knowledge of the like of Sociology, Economics and Archaeology would appear to be "ministrels, feeding his sacred flame" to quote an expression from the immortal poet Samuel Taylor Coleridge. Life-supporting water has formed the home of ancient civilisations which developed along the courses of international and trunk rivers. The problem of availability has been summed up admirably in some quarters as more than required, less than the needs and not clean water. Concisely, the object of water resources development is two-fold; to
increase the gross domestic product of goods and services and to improve the quality of environment.

From the ancient times, India has been an agricultural country. Increased agricultural production is needed to feed its ever growing population which is at present 102 crores (2001 census). Rainfall is confined to a few months in a year and is erratic both in place and time. Moreover, the dependence of agriculture on rainwater renders cultivation precarious and there has been very serious drought at times in the country causing severe famines, which brought untold miseries to the people. There was a severe drought in 1987. Thus, it was to face the menace of drought following the failure of monsoon that artificial systems of irrigation were devised here from ancient times.

In the Vedas, the earliest sacred books of the Aryans, mention is made of wells, canals and dams. In the Rigveda four types of waters are mentioned viz., waters which come from the sky or rain water, those which flow in rivers and streams, those which are obtained by digging and those which ooze out from springs. Mention is also made of the term ‘Avata’ which signifies a ‘well’.

India is basically an agricultural country. Agricultural sector plays a dominant role in Indian economy. It contributes nearly 40 per cent of the net national product and accounts for nearly 35 percent of the total value of country's exports. Besides, it provides employment to about 60 per cent of the work force.
The new technology based on HYV seeds and chemical fertilizers can yield better results only if requisite levels of irrigation facilities are available. Thus water has come to be a key point. A number of steps have, therefore, been taken to augment irrigation facilities. Considerable investment has been made in developing irrigation facilities, more particularly minor irrigation (groundwater). In recent years, ground water has been put to use on a large scale in order to act as a deterrent to drought and also support the water requirements of high yielding varieties in time. It is borne out by the fact that out of the total irrigated area of 73.27 million hectares (as on 1996-97) in the country 30.82 million hectares (i.e., 42 per cent) were being provided irrigation through groundwater resources alone. Groundwater resources thus play quite an important role in the irrigation strategy of the country.

As per a rough estimate by the World Resource Institute, the global renewable water resource is at 41,000 cubic kilometeres (World Development Report, 1992). India sustains about 17 per cent of World’s Population with only 4.6 per cent of the total average annual runoff i.e., 1900 cu. km. but its availability in nature is highly uneven both spatially and temporally.

The importance of water as valuable resource for agriculture can never be over-emphasised. Being so, it has rightly been engaging serious attention of our planners and policy makers. With the result, we have today the world’s second largest irrigated area in the world next only to China. From 23.2 million hectares
in 1951-52 which marked the beginning of planned development, the gross irrigated area in our country has gone to over 70 million hectares, registering over 300 per cent increase during the last three and a half decade of planned period i.e., 1986-87. It now covers nearly one-third of cultivated area.

There are two major sources of water for irrigation-surface and underground. Many people have a wrong notion that surface and underground water is an ultimated resource. They lose sight of the fact that there is a limit to which surface and underground water can be tapped for irrigation.

The value addition by groundwater irrigation has been significant in the Indian Agriculture since the 1960’s. In several regions it has richly contributed to food security. It is estimated that irrigation has contributed 60 per cent to the growth in the agricultural productivity. In India, about 33 per cent of the net sown area is under irrigation, where groundwater and surface water have equal share in the gross irrigation. A major portion of India’s groundwater irrigation wells is in the hard rock areas, where both recharge and discharge potentials are presently at stake. About two-thirds of India is composed of hard rock areas and the peninsular India is predominantly hard rock. These areas have hard non-porous rocks, the igneous and metamorphic rocks, expected to store not beyond 10 per cent of the annual rainfall. In the hard rock areas, groundwater irrigation, due to its flexibility, has helped in commercialization of farming through crop diversification and specialization in high value crops, (low and high water intensive crops).
Groundwater in hard rock areas is abstracted from dug-cum-bore, shallow bore and deep bore wells, dug wells or open wells, typically with a depth of 30 feet and with a diameter of 25 feet. Stone slabs may line the dug wells in order to prevent the well caving, in some areas where the rock and soil strata are loose. For viability of dugwell, the minimum yield of water should be 5,000 gallons per day according to NABARD. The water used to be lifted by traditional labour intensive lifts like ‘yetha’, ‘kapile’ or ‘persian wheel’ till the 1960s. Later the water was lifted by centrifugal pump-sets of around three horsepower capacity. The dug wells continued to be the dominant structures of groundwater exploitation till the mid-1960s. In the early 1970s, one or more bores were drilled inside a dug well (which used to be called as dug-cum-bore well) in order to enhance the water yield. The in bore may have depth ranging from 30 to 100 feet and centrifugal pump was the chief mode of water abstraction. The dug-cum-bore wells were the dominant structures till the 1980s. From the early 1980s, surface borewells with diameter of six inches and depth around 200 feet became popular due to the use of fast rig technology. For viability of borewell, the minimum yield of water should be 1,000 gallons per hour according to NABARD.

The state has promoted irrigation in India on two main considerations: (i) to protect the crops against failure of rains and (ii) to reduce large-scale expenditure on famine relief.
In the matter of providing irrigation facilities, the state was in favour of large-scale irrigation programmes; however, minor irrigation programmes, particularly well irrigation, were not neglected. As early as 1880, the Famine Commission had recommended taccavi loans to help farmers to sink wells. The First Irrigation Commission had, among other things, recommended the liberalisation of taccavi loans and grants-in-aid for the sinking of wells, particularly in famine affected areas; partial remission of loans for wells when there was a failure to strike water; mapping up tracks where well irrigation was feasible; and providing boring tools at nominal rates to the intending farmers. The Government had not only implemented some of these recommendations but, in Uttar Pradesh and Punjab, it also undertook to dig tube wells.

In the drought-prone areas, where perennial rivers are absent, well irrigation is looked upon as an essential tool of agricultural development, for it introduces an element of stability into agriculture, promotes the desired changes in the cropping pattern, utilises available agricultural inputs more effectively, and so on. A precise insight into the impact of (groundwater) well irrigation on rural development is possible only when field studies of local areas are undertaken. Hence the present study is taken up to understand the relationship between groundwater and agricultural development.
Area of Investigation

The study is confined to Anantapur district which is one of the drought-prone districts of the Rayalaseema region of Andhra Pradesh State. Anantapur district is situated between $13^\circ 40' - 15^\circ 15'$ Northern latitudes and $76^\circ 50' - 78^\circ 30'$ Eastern longitudes.

Objectives of the study

To make an analytical study of groundwater irrigation and agricultural development in a drought-prone district like Anantapur and to find out measures for reducing the problems relating to farmers, the objectives of the study are precisely defined in order to bring the valid inferences.

The specific objectives of the study are:

1. To know the importance of groundwater irrigation in agricultural development;
2. To analyse the trends in production and productivity of principal crops and changes in cropping pattern in Anantapur district; and
3. To understand the problems of agriculturists and suggest measures for improving agriculture.

Methodology

The present study is carried out by an empirical investigation conducted by canvassing a structured schedule which was supplemented by an unstructured questionnaire. However secondary data, wherever available was made use of with
given resources, time and man power the following sampling design was used for study purpose.

**Sampling Design**

For the purpose of the study a multi-stage sampling design was adopted as given below:

**Stage I:** With the given time and man-power, it was decided to select a sample of six villages randomly from three Revenue Divisions of Anantapur district. They are Chagallu and Kudair from Anantapur Revenue Division, D. Cherlopalli and Manirevu from Dharmavaram Revenue Division and Edulabalapuram and Kodigenahalli from Penukonda Revenue Division.

**Stage II:** Two villages were selected at random from each Revenue Division. From these selected villages the required number of irrigation borewells were selected at random from all categories i.e., O.C., B.C., S.C. and S.Ts..

**Stage III:** A total of 120 wells were selected – 20 from each village at random. In order to know the impact of groundwater irrigation on farms and farm families, information regarding farms and farm families before and after sinking of borewells was gathered from the selected farmers. Thus the sample size was 120 farmers -20 from each village.
The respondents were approached through the Village Administrative Officers. After establishing a good rapport with them, they were interviewed with the help of schedule and the required information was collected from them. Information relating to wells, extent, cropping pattern etc., in the village was collected from the Village Administrative Officer and Assistant Statistical Officer, Mandal Revenue Office concerned.

Data and Its Limitations

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 bullockdays, output, debts etc might have deviated from the actual values. This is particularly true of the information relating to the distant past. The primary data relate to 1998-99 and covers all the three agricultural seasons.

Chapter Scheme

The sources of irrigation, Agricultural situation, land use pattern and cropping pattern of Andhra Pradesh State are analysed in Chapter II. Chapter III presents the land use pattern, cropping pattern, groundwater and other irrigation systems in Anantapur District. Chapter IV analysis the land utilisation, the
cropping pattern before and after the sinking of borewells and the changes in the land use, cropping pattern after sinking of wells, the impact of groundwater on input utilisation and also deals with the costs and benefits and the problems of the selected respondents. Chapter V offers concluding remarks and the policy implications emerging out of the study.