Chapter I

THE PROBLEM STATED

> If irrigation projects are to be spectacular success they should be physically possible, economically gainful (viable), socially acceptable and legally permissible.
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> -- Leonard W. Bowden

1.0 What is Irrigation ?

" Irrigation is defined as the application of water, by human agency, to assist the growth of crops".[1] The rainfall, which is a natural source of water for the plant growth, is not always sufficient to grow enough crop output to support a population within a given spatial unit. The supply of water from this source is beyond the control of human beings. The supply of water through rainfall follows a set pattern and hence cannot be availed as and when required by the farmers. When the same area has to be recultivated after a crop has been grown in rainy season, the fields have to be supplied with water by the human agency. The intensive cultivation of land thus necessitates the harnessing of water that is either available on surface or deep down the soil in the form of ground water.

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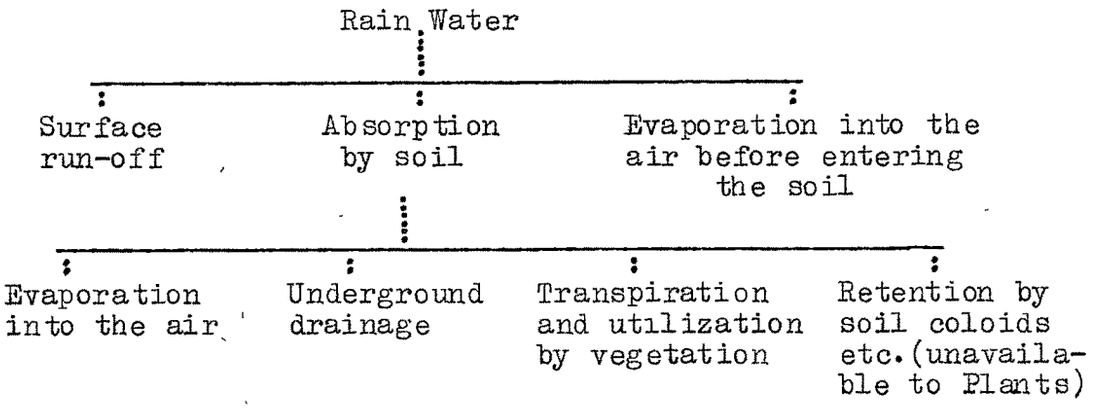
1 Colin Clark: The Economics of Irrigation. Pergamon Press, London, 2nd Edition, Chapter 1, page 1.

Man has been harnessing water for crop growth from time immemorial. Whether Princely States, colonial rule or the independent federal state one or the other source of irrigation has been created and maintained. The ways and means to tap water from various available sources have been changing along with the developments in the science and technology. Man has attempted successfully to tap the ground water sources by digging wells and tubewells. He has successfully checked the surface water flows from draining and has diverted it to his fields. More and more water is being conserved and used for irrigation purposes. The material prosperity of the societies in the pre-industrialization era is best explained by the systems of irrigation. The flowing water in the fields drawn through gravity channels, lifting devices and network of pipelines not only provides life and vigour to the thirsty plants but also changes the entire socio-cultural milieu.

1.1 Basic Systems

Total precipitation that falls on ground(s) gets distributed in various ways. The growing crops in the rainy season utilize only a small proportion of the total rainfall. The rain water gets distributed in the following way[2] :

Dr. Girija Sharan, "Some Physical Characteristics of Drought in Panchmahals". Mimeo, Feb.1980. People's Centre for Education and Development - Ahmedabad.



The proportion of total precipation that is expended in each particular form depends on the area specific topographical, vegetational and climatic conditions as well as the rainfall pattern (shower intensity, frequency etc.)

The surface run off and the water retained by the soil are the two basic sources from where water can be tapped for irrigation purposes. Corresponding to the source of water availability are the two basic systems of irrigation that have been evolved. These two systems are :

1. The Lift system
2. The flow system

1. <u>The Lift System</u>

Under this system devices are put to use by the farmer or group of farmers to water their fields which are placed at a higher level as against the source of water. Thus water has to be lifted from the source and then is to be supplied to the fields. For instance, irrigating the fields from a well falls under lift system since water is lifted from a certain

depth and then flown to the fields. Under this system water from both the sources - Surface as well as groundwater, can be tapped by lifting devices. Water can be lifted from shallow dug wells, deep tube wells, Streams, Kotares (Ravines), Rivers, Ponds and other sources to irrigate the fields.

2. The Flow System

Under this system water is carried to the fields by gravitation process. Water is released from the source of supply into the channels which are laid out in a planned way so as to reach the field. These channels known as canals, branchs, minors, distributaries are concrete lined, brick lined, stone lined or earthern structures.

Since inception, both these systems have been improving in techniques. Use of improved devices using motive powers such as diesel and electricity have taken irrigation a long way. Improved water management techniques have helped is better conservation and effective utilization of water. In the water scarce areas, water has been lifted to significant heights and plants are irrigated by sprinkling methods so as to reduce the wastage. Controlled flooding, flooding the basin area only and laying out proper drainage in the fields are some of the modern management techniques which have been developed to secure better water utilization.

The fundamental difference between the nature's scheme of watering the plants through rainfall and application of water to plants by human agency (irrigation) is that of cost. Under the nature's scheme, the plants are watered during a

particular season without any direct cost to the cultivator. The cultivator has only to sow the seeds and prepare the bed for receiving rainfall. The only cost that the farmer has to bear is in the form of uncertainty. The rainfall, its quantity and timeliness is beyond his control. In case of irrigation, it is a planned endeavour to tap water from the source and then take it to the fields. This process involves cost. Cost of materials used for building structures, labour costs and costs incurred to operate and maintain the structures. Thus, decision to irrigate fields entails investment decisions on the part of the farmer, group of farmers or the society.

1.2 Investment in Irrigation - Past and Present

Hitherto, in Indian agriculture, three types of investment have been made for irrigation - Private, Corporate and Public. These investments have generally been in correspondence with the source and area brought under irrigation. Private investments have been made to dig wells and setting up water lifting devices for irrigating areas in the range of 0 to 20 acres. Corporate investments have been very few and they have been made to tap water either from ground water (to construct tube wells or deep wells) or from streams flowing from nearby areas (installing ~~map~~ Pump sets). Public investment has been made for all kinds of sources and devices.

Private and corporate investment in irrigation have had a long history. Since centuries, farmers have been digging wells and small check dams across the streams to draw water for irrigation. What have changed in this field are the techniques and devices. Over a period of time much more sophisticated techniques and devices have been put to use to maximise the yield of water from the sources. Public investment, too, has been made in the past by royal dynasties, and colonial rulers. In 300 B.C., Maghasthenes seems to have noted that the then Chandragupta dynasty asked the district officials to inspect the sluices by which water was distributed to farmers via branch canals. The South India also has had a long history of tank irrigation. The now Tamilnadu, under the Chola Kings in 11th century A.D. had earthen dams with long embankments. Sir Arthur Cotton and Proby T. Cautely were two famous British engineers who pioneered the efforts of building dams on the major rivers of Northern and Southern India.[3] After independence the Indian Federal State paid much more attention towards public investment in irrigation.

The public investment has chiefly been made in harnessing the water from sources like perennial or seasonal rivers or it has been made to build storage capacities (reservoirs) in the form of tanks. Right from the First Five Year Plan the state undertook responsibility of building huge dams extensively covering all the major and medium river basins of the

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3 For detail history kindly refer, Dr. K.L.Rao in India's Water Wealth, Chapter VII Orient Longmans Ltd., 1975.

country. In the Pre-Plan era the colonial rulers had spent about Rs.1396 million creating a potential command of 8361 thousand hectares. By 1970 the completed projects had cost the federal state an amount of Rs.7,090.13 million and enabled to create a command of 5,494.5 thousand hectares and the estimates for the ongoing projects showed the cost to the tune of Rs.30,649.72 million and a command of 15,017.7 thousand hectares.The era of investment in irrigation had begun. Since the beginning of the Five Year Plans, irrigation became a dominant theme in Indian Planning. It was continued to believe that if the Indian agriculture had to increasingly contribute to the general prosperity, irrigation was the key. Along with the major and medium irrigation projects some of which were multipurpose projects, the Plan outlays were envisaged for tapping the minor sources of irrigation also. The construction of dams, checkdams, wells, etc. were either taken up by the government agencies themselves or the private individuals and agencies were subsidised. The share of investment for irrigation in the district level outlay has been growing ever since then.

There is no documental evidence which would suggest that irrigation projects were evaluated before taking the investment decisions during the time of princely states. The dominant idea in those days must have been of showing benevolence towards the subject by spending the public money for creating

irrigation facilities. It was under colonial rule that some thinking went in the direction of irrigation project appraisals.To quote Dr. K.L. Rao, "The beginning of the 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 a report in 1903. This valuable report laid down sound policies for irrigation works. It states that "As regards new works, the main question is not whether they will be likely to prove directly remunerative, but whether the net financial burden which they may impose on the State in form of charges for interest and maintenance will be too high a price to pay for the protection against famine which they may be relied on to afford. It is from this point of views that the Commission should consider proposals for the extension of irrigation in districts in which cultivation is very insecure and precarious".[4]

It was thus, suggested that the benefits had to be weighed against the costs before taking the investment decisions. Much more detailed studies of the projects already in operation, under construction and the proposed ones were taken up by the governmental as well as other research Institutions. Eventually, the Second Irrigation Commission was set up which submitted its Report in 1972. This Commission laid down

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4 op.cit., Chapter VII, p.116.

comprehensive guidelines for the development of irrigation in the country. The 20th century also witnessed improvements and innovations in the techniques of project appraisals. These techniques were suitably translated into the guidelines which the project authorities at various levels had to follow before taking the investment decisions.

The Research Programmes Committee of Planning Commission sponsored studies on irrigation which were taken up by professional Institutions. Influence of Mettur Irrigation and Hydro-Electric Project on Agriculture and Agro-Industries (S. Krishna Murthy, 1960, Annamalai University), Some Economic Aspects of the Bhakra Nangal Project (K.N. Raj 1960 Asia Publishing House), Evaluation of Damodar Canals (1959-1964) (S.K. Basu and S.B. Mukherjea 1963, Asia Publishing House), Benefit Cost Evaluation of the Cauvery - Mettur Projects, (K.S. Sonachalam, 1963, Annamalai University), Benefit-Cost Analysis of Sarda Canal System (Baljit Singh and Shridhar Misra, Asia Publishing House), and Evaluation of the Benefits of the Nizamsagar Irrigation Projects (Mrs. M.F. Jussawala, 1965 Osmania University), are some of the major investigative studies that were conducted untill the appointment of Second Irrigation Commission. The ~~main~~ main focus of these studies was to evaluate a particular source of irrigation and to draw attention on their individual problems. All these studies relate to the major irrigation works.

The advent of planned investment in irrigation also witnessed the size classification of the irrigation projects. The rationale behind classifying the irrigation works into major, medium and minor is not explicity mentioned anywhere. However, it seems that the classification was done mainly to determine the authority of the centre and state to formulate, appraise, implement and monitor the irrigation works of different sizes. The huge works were supposed to be in direct control of the central government whereas relatively smaller works were left to the imagination and the choice of States and the districts. Initially, the classification was done on the basis of cost of the project. The Planning Commission classified the irrigation works into the following three categories :

1. Minor Irrigation Projects (Costing Rs.10 lakhs or less than Rs.10 lakhs).
2. Medium Irrigation Projects (Costing Rs.10 lakhs to Rs.5 crores).
3. Major Irrigation Projects (Costing Rs.5 crores and above).

With the increasing costs, the classification started losing relevance, since, almost every small project irrigating more than 100 hectares cost more than Rs.10 lakhs. The latest Central Government resolution on this issue states that an irrigation project with a potential command area of 2000 hectares and less should be considered as the Minor Irrigation

Project.[5] Similar changes have been introduced for medium projects also.

The Planning Commission's size classification of irrigation works helps determining the works to be undertaken by Central Government and the works to be planned and executed by the state government. The medium and minor irrgation works have to be allocated the funds from State Plans. However, the State has to seek an overall technical sanction for the medium works from Planning Commission. The minor works are under complete control of states. Here too, the central government passes on guidelines for project formulation from time to time. The investment decision for major and medium works, thus, are made at one centralised place i.e. Planning Commission. The powers have been decentralised in case of minor irrigation works with the states. Within the states then, according to the suitability, the individual states have either further decentralised the power with the districts or have kept it with themselves. For instance, in Gujarat State, the planning and execution of minor irrigation works is left to the District Panchayats. The State intervenes only in cases where the investment exceeds certain given minimum.For the projects costing above Rs.3 lakhs, the district authorities have to seek an overall technical sanction from the state government.

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5 Government Resolution No.II - 11(42)/75 - I & CAD
Govt. of India, Planning Commission, 21st January,1978.

1.3 Issues in Investment Decisions

A vast literature is available on the studies of technical feasibility and economic viability of major and medium irrigation projects. There are two reasons for this. Firstly, the public investment in irrigation through plans has been growing absolutely as well as relatively. This necessitated the viability studies before investment decisions were made. A non-viable project would not only be a burden on exchequer but would also blow the plan objectives, strategies and targets into pieces. It is not true to say that all major and medium projects have passed the test with flying colours but at the same time the commitment of the size of the amount warrants viability studies. Secondly, most of the major and medium projects proposed, were multipurpose in nature. Along with irrigation, power generation (hydro-electricity), inland waterways, pisciculture were jointly proposed under one project. This escalated the amounts to be invested and benefits to be drawn. Obviously, a study on viability of such multipurpose project proposals had to be taken up. Since, the projects involved huge financial resources, studies also have been conducted after the commissioning of bigger projects. These studies have been done mainly to obtain a feed back on project's functioning and suggest changes in operations and management for better.

The studies on minor irrigation works have been limited both in number as well as coverage of the issues. The public

investment in minor sources of irrigation has been done only in recent past. Under the colonial rule not much attention was paid to this. It is only after independence that the state governments were asked to enhance the minor irrigation works. The private investment in minor sources such as wells etc. had been there for long. For quite sometime therefore, the studies on minor works focused their attention mainly on problems[6] and comparative advantages and disadvantages among various sources.[7]

Hitherto, the minor irrigation works have become popular with the state governments. These works include two types of works: First type of works are those where government invests completely in construction as well as management. These works are Minor Irrigation (MI) Tanks, Check dams, Bandharas (weirs) and Lift Irrigation (LI Schemes). Second type of works are wells, where government provides subsidies to individual farmers. The investments in both the type of works have been growing. It is a common belief that whatever water resource can be harnessed should be done at every feasible location. The MI works have been concentrated more in areas where perennial sources of water do not exist. Technical feasibility is checked for each and every proposed location. In the process of moving fast in these matters with unabated enthusiasm, what has been overlooked

6 Planning and Evaluation Organization: Studies of the Problem of Minor Irrigation. Planning Commission, Govt. of India, 1963.

7 Sridhar Misra: A Comparative Study of Economics of Minor Sources of Irrigation in Uttar Pradesh. Oxford & IBH Publishing Co., 1968.

is the economic viability. Again there seem to be two reasons for this. Firstly, there is a general belief that no irrigation work built at a reasonable cost proves to be uneconomic to the society and even if it does the total commitment in minor irrigation is only a trivial part of the total Plan expenditure of the state or the district. Secondly, since the MI works, especially the MI Tanks, provide temporary employment to the labourers nearby the location and the works can be undertaken under scarcity conditions, they have become popular among the local politicians. These politicians have better and in most cases final say in the matter of choice of location of the MI works. The investment decisions therefore, have not always been based on technical feasibility much less the economic viability.

The fifties and sixties did not cause much concern in this field, since the works were in the stage of planning and construction. It was in seventies that most of the newly built works were commissioned. It was then realized that the popular beliefs had started proving wrong. The potentials created in the projects could not be utilized to full extent. The hasty decisions were boomeranging. It is no longer true that investment decisions for minor irrigation works can now be arrived at with minimum care and caution. The public investment in minor irrigation works thus necessitates a fully study.

A major difference between the MI works and others is that of the process through which water is harnessed for

irrigation. In case of bigger works the water is generally stored in a reservoir which is in a river bed itself. A dam and/or a weir is built across a perennial source of water. The flow of water is otherwise draining either in bigger rivers or in the sea. This flow or stream is obstructed and collected in an artificial reservoir and is supplied to the fields by canals and their net-work. In case of MI works the process is different for different type of works. Wells are the simplest way of lifting the ground water and supplying to the fields. Check dams again help in obstructing the small streams which enhances the water table and hence the yield of wells in the command area. Under LI Schemes either the ground water or the surface water is lifted by motive power and is supplied to field. MI Tanks are again mini reservoirs which are built on a location where water that flows in the nearby areas during monsoon, can be collected and stored. It is the MI Tank works where the investments have been made substantially and which have been un/under utilized. Apparently, the MI Tank works seem to be a miniature of dams and reservoirs that are built on rivers. Hence, it may appear that these projects may be a success if the bigger ones perform well. However, it is not the case. The very first difference between MI Tanks and other major and medium works is that in case of MI works, there is no original and perennial water source. There is some natural arrangement (or artificial arrangement is made) based on the topography of the area which enables the rain water to flow to

a particular location from the nearby catchment. This then is systemetized with the help of additional structure like earthen bunds and weirs which form a reservoir. It is from this reservoir that water is supplied to the fields through canal. Such works are generally resorted to in hilly or undulating areas. These areas may also happen to fall under Arid and Semi-Arid zones. The proposition to build a MI Tank in a plain area is therefore not the same thing as building a MI Tank in undulating topography. Though it is true to some extent that MI Tanks are good substitutes to wells in undulating hilly areas where tapping the ground water is difficult for various reasons, which means that well yields are not always impressive. This, however, should not imply that the MI Tanks should be taken up without judging the overall viability. The Arid-and Semi-Arid zones have also other features which determine the viability or non-viability of agriculture in that particular zone.It is also true that in Semi-Arid zones the rainfall behaves in a peculiar fashion. Not only that the total precipitation is less in these zones, it also has relatively a higher degree of variation. The extent of storage in reservoir is directly affected by the behaviour of the rain fall in the catchment which is generally small. The MI Tanks, therefore, are seldom perennial source of irrigation. Depending upon the area and behaviour of rainfall, the command area of MI Tanks have to be determined with different criteria. It has also to be verified whether the tank will irrigate the fields in Kharif alone, Rabi

alone, or in Kharif and Rabi both. No uniform appraisal should therefore, be considered valid for investment decisions. The practice however shows such a trend.

The present study intends to focus attention on this important issue of investment decisions for MI Tanks. It intends to explore (i) how investment decisions are taken for MI works in general and MI Tanks in particular, (ii) if the decisions are taken, how are they being implemented, (iii) Once implemented how are they operated and maintained, (iv) what is the extent of utilization and finally, (v) whether investments in minor works are socially gainful.