

Minor Irrigation



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MINOR IRRIGATION



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CHAPTER I

INTRODUCTION

Agriculture plays a vital role in the economy of India. It is our basic industry supporting as it does more than seventy per cent of the people. It is also the principal source of our national income. In addition, a number of agricultural products, such as cotton, jute, lac, tea, tobacco and oilseeds, are exported and earn valuable foreign exchange for the country. Some of our major industries like sugar and textile depend on it for raw materials. Indeed, the prosperity of agriculture is the prosperity of India.

And, yet, Indian agriculture is far from prosperous. Besides feeding our people adequately, we have also to think of the raw materials for our industries. Indeed, it is the weakest point in the country's economy.

Our main problem has always been that of finding sufficient food for our people. After partition, this assumed serious proportions. With the loss of valuable food producing areas, the country was unable to produce sufficient quantities of foodgrains. Foodgrains have had, therefore, to be imported. But this could not solve the difficulty. The foodgrains grew more and more expensive and became a severe drain on our foreign exchange resources. It is obvious that we cannot go on spending huge sums of money indefinitely to buy foreign food. The only way out is to grow as much food as possible.

How can we increase our production? Well, there are several ways. One is that we must have more land for tillage. Then again, we must use better seeds, better ploughs and more manure and fertilizers. Large areas,

which are now covered with weeds, must be cleared and crops grown on the reclaimed land.

Nothing, however, will grow without water. At present, large parts of the country do not have enough water. Before the Plan, about 50 million acres received water from canals, wells, tanks and tube-wells. This was about one-fifth of the total area under cultivation. The remaining four-fifths was at the mercy of rainfall which is seldom adequate and timely. The failure of crops in different parts of the country is thus a recurrent phenomena. Floods and droughts bring in their wake ruin to the crops. The remedy, of course, is not to depend upon the monsoon. Instead, we must try to have more canals, wells, tanks and tube-wells. In other words, we must extend the facilities for irrigation.

CHAPTER II

IRRIGATION WORKS

Irrigation works are generally classified as major and minor. Canals, dams and reservoirs are the major irrigation works. The minor works include wells, tanks, pumps, tube-wells and channels.

Irrigation from wells and tanks has been practised for thousands of years in our country. Wells, canals and dams are mentioned even in the *Vedas*. The large number of tanks to be found in the Deccan have been in existence for ages. The Cauvery delta canals, for instance, date back to the second century. The Sudarshan lake in Kathiawar was constructed during the reign of Chandragupta and Asoka. The Bhojpur lake in Bhopal was built in the eleventh and the Jumna canals about the fourteenth century.

The first major irrigation works built by the British was



An artificial lake in South India

the Ganga canal in Uttar Pradesh. Then came the Upper Bari Doab canal in the Punjab and the Godavari and Krishna delta systems in Madras. A number of other large irrigation works were undertaken later. Among these were the Sirhind and the Lower Chenab canals in the Punjab, the Ken, the Betwa and the Sardar canal system in Uttar Pradesh and the Periyar dam and the Stanley reservoir in the South. The Ekkru reservoir and the Bhandardara and the Bhatnagar dams in Bombay State were other important works. Some very fine irrigation reservoirs were also built in Jaipur and Ajmer.

But these works are obviously not enough to meet the irrigational needs of a vast country like India. Hence, we have undertaken the construction of a number of mighty dams across some of the rivers. The water thus stored will

be used to irrigate the fields. These are our major irrigation works.

To supplement these, a large number of minor irrigation schemes are also contemplated under the Five Year Plan. Old wells and tanks will thus be repaired and new ones constructed. Tube-wells will be sunk to lift water by electric pumps. Pumps will be installed to draw water from rivers and lakes, besides building small dams and digging channels. Clearly, minor irrigation works form an important part of the programme for the development of irrigation.

It is often asked why we give so much importance to minor irrigation. The truth is that major and minor schemes are both necessary. There are regions in India where there is scope for large projects, while in others only smaller works are possible. Each part should be served by the kind of scheme for which it is suited. They are not opposed to each other. In short, major and minor projects are not competitive, but complementary.

The minor irrigation works have many obvious advantages. They provide employment to a large number of people. They require smaller outlay of initial capital. They can be executed in a relatively shorter period. They also yield quicker results than the other forms of irrigation. Again, there is no need to engage foreign experts or to find equipment from abroad. Local manpower and material can easily be employed to build these works.

Finally, the minor irrigation works are a people's programme. The major irrigation works are undeniably valuable as they control floods, generate power and provide water for irrigation. The ordinary villager, however, does not see them before his eyes. To that extent, he has no immediate interest in them. The minor irrigation works, on the contrary, depend primarily on the co-operation of the villagers for their construction. This feature is hard to achieve in the major irrigation works. Considering these advantages, the Five Year Plan has set apart Rs. 30 crore for minor irrigation works.

CHAPTER III

THE PROGRAMME

According to the Five Year Plan, 19.7 million acres will be irrigated by the major and minor irrigation works. Of this area, the minor schemes, undertaken by the State Governments, are expected to bring 8.2 million acres under irrigation. The details are given below :

	(Million acres)
Dams and channels	4.4
Wells (new and repaired) ..	1.6
Tube-wells (excluding those under major irrigation)	0.7
Tanks (improvement and construction)	0.8
Pumping installations	0.7
Total	<hr/> 8.2 <hr/>

A further 3 million acres will be irrigated through supplementary minor irrigation schemes, for which Rs. 30 crore have been provided. In this way, the minor irrigation works will bring under irrigation 11.2 million acres at a total cost of about Rs. 77 crore. Moreover, as about a third of the expenditure on development in a community project is devoted to irrigation, an area larger than the one indicated above will receive irrigation from minor works.

CHAPTER IV

PROGRESS

Among others, the minor irrigation schemes include the construction of and repairs to wells and tanks, the installation of pumps, the construction and improvement of dams and channels and similar other works.

In the first three years of the Five Year Plan, i.e., 1951-54, the Central Government sanctioned a loan of Rs. 40.47 crore for minor irrigation schemes. This included Rs. 11.69 crore for 1951-52, Rs. 11.93 crore for 1952-53 and Rs. 16.85 crore for 1953-54. If we assume that seventy per cent of the amount allotted for 1953-54 has been utilized, the total expenditure on minor irrigation works during the first three years amounts to Rs. 28.5 crore.

Out of the 11.2 million acres to be brought under irrigation during the five year period of the Plan, about 4.7 million acres received irrigation during 1951-54. The benefits occurring from the various schemes are as follows:

Names of schemes	Target for 5 years	(In million acres) Achievement (1951-54)
Construction and repair of wells ..	1.65	0.6
Tube-wells ..	0.66	0.4
Pumping installations, in- cluding Persian wheels, etc.	0.70	0.3
Dams, channels, tanks, etc.	5.22	2.3
Additional minor irriga- tion programmes ..	3.00	1.1
Total ..	11.23	4.7

It has been estimated that the total net and gross area brought under irrigation increased in 1951-52 over that for 1949-50 by 2.8 and 4.1 million acres respectively, as would be clear from the following table :

Year	Net Area irrigated	(In million acres)	
		Net	Gross
1949-50	48.7		52.4
1950-51	51.5		55.7
1951-52	51.5		56.5

Oxen drawing well water in a bucket to pass into the irrigation channel





A Persian wheel worked by bullocks

A part of this increase may only be statistical, since the area increased from 266 to 296 million acres between 1949-50 and 1951-52. It is, therefore, not easy to state correctly to what extent the benefits from the minor irrigation schemes are actually reflected in the area irrigated. Also, the area irrigated fluctuates considerably from year to year owing to the changes in climate and rainfall. A correct assessment of the expansion of the area irrigated will thus be possible only over a period of several years.

WELLS

Among the various types of minor irrigation schemes, the construction of and repairs to wells have been receiving particular attention in all States. The only exceptions are

Assam, Orissa, West Bengal, Manipur, Tripura and Himachal Pradesh, as this form of irrigation has little scope in these regions.

During the first three years, i.e., 1951-54, a sum of Rs. 7.00 crore was spent by the States on the construction of and repairs to wells. The progress made is indicated below :

State	No. of wells constructed or repaired	Remarks
Andhra	4,315	
Bihar	10,205	(includes open boring)
Bombay	11,391	
Madhya Pradesh	2,194	
Madras	7,394	
Uttar Pradesh	18,467	(figures for two years)
Hyderabad	4,688	
Madhya Bharat	17,024	
Pepsu	6,659	
Rajasthan	3,291	
Saurashtra	18,594	
Mysore	1,973	
Ajmer	598	
Delhi	918	
Vindhya Pradesh	81	
Total	107,792	

The progress has been particularly rapid in Madhya Bharat and Saurashtra. This is accounted for by the fact that owing to the scarcity of rainfall, these States undertook to construct or repair wells on a large scale.

It has been found that wells yield better results if they are equipped with suitable appliances for lifting water. The cost is also lower. The mot or charsa, which is a bucket made of leather, and the Persian wheel are generally used. But a pump, worked by a diesel engine or electric motor,

is more economical. The State Governments have, therefore, arranged to supply pump sets to the cultivators and co-operative societies. During 1951-52, a sum of Rs. 2.31 crore was spent for this purpose. The progress made up to March 1954 is shown below :

State	No. of diesel or electric engines supplied	
Bihar	..	2,365
Bombay	..	1,200
Madhya Pradesh	..	792
Madras	..	946
Madhya Bharat	..	1,304
Mysore	..	3,154
Pepsu	..	832
Rajasthan	..	346
Vindhya Pradesh	..	113
Total	..	<u>11,053</u>

Good progress has been made in Mysore in installing electric motors. During 1951-54, as many as 3,154 engines were set up as against 2,166 in the past twenty years. The State Government has a separate section in the Department of Electricity which attends both to the construction of transmission lines and the supply and installation of electric motors and other accessories.

TUBE-WELLS

Under the Indo-U.S. Technical Co-operation Programme, three projects have been undertaken for the construction of 2,650 tube-wells. Bihar has been allotted 385 tube-wells, Punjab 530, Pepsu 460 and Uttar Pradesh 1,275.



A tube-well with a measuring tank

The total cost of the programme is about Rs. 25 crore. The progress made so far is as follows :

State	Total programme	Wells drilled	Wells completed
Bihar	350	293	213
Punjab	355	162	61
Pepsu	300	249	59
Uttar Pradesh	995	450	335
Total	2,000	1,100	668

EXPLORATORY TUBE-WELLS

The programme for tube-wells has so far been carried out in the Indo-Gangetic basin. There are other parts in

the country, too, where this method of irrigation cannot be adopted economically. In such regions, groundwater irrigation may prove more suitable. Before any large-scale programme for the sinking of tube-wells is undertaken, it would be wise to explore the possibilities for groundwater. A programme has, therefore, been undertaken for the drilling of 350 exploratory tube-wells in the following States :

State	Region	Approximate number of exploratory borings
Madhya Pradesh	Purna basin	15
Bombay	Tapti valley	15
Madhya Pradesh	Narbada valley	10
Kutch		10
Saurashtra		10
Travancore-Cochin		5
Madras	South central belt	50
Andhra	Krishna Godavari delta	25
Orissa	Coastal area	20
Bengal		37
Bihar		16
Assam		15
Rajasthan	Bikaner	5
Punjab		46
Pepsu		5
Uttar Pradesh		47
Other areas		14
		<hr/> 350

The committee for the selection of sites has already visited Madhya Pradesh, Bhopal and Bombay. Meanwhile, the India Supply Mission in Washington has been asked to supply five drilling rings, vehicles and other equipment. The total number of items ordered is about 120. Most of the equipment for the Geological Survey of India has already been obtained.

STATE TUBE-WELLS

In addition to the Indo-US Technical Co-operation Programme, some State Governments have taken up the construction of tube-wells on a large scale. Thus, 1,029 tube-wells have been installed in Uttar Pradesh at a cost of Rs. 3.35 crore and 552 tube-wells in Bihar at a cost of Rs. 1.58 crore. Of the latter, 289 tube-wells have been installed in north Bihar and 263 in south Bihar. A similar programme has been undertaken in the Punjab.

The Bombay Government undertook to sink 400 tube-wells in north Gujerat at a cost of Rs. 2 crore. Only 47 have, however, been completed during the three years of the Plan. The slow progress is attributed to the fact that the work was done on a contract basis. The Government has now decided to do the work on its own.

Private parties and co-operative societies were also given loans and grants for the construction of tube-wells. During 1951-54, the co-operative societies in Uttar Pradesh thus constructed 232 tube-wells, while 36 and 72 tube-wells were completed by private parties in Bihar and Pepsu respectively.

SPECIAL PROGRAMMES

To enable the States to undertake minor irrigation works on a large scale, the Central Government has made provision for special loans amounting to Rs. 30 crore. Of this, a sum of Rs. 10 crore was allotted to meet the cost of TCM tube-well project. The remaining Rs. 20 crore were

set aside for other minor irrigation works. Of this sum, about Rs. 7 crore were given to the following States in 1953-54:

State	Amount sanctioned (Rs. in lakhs)
Bihar	50.00
Bombay	176.38
Madhya Pradesh	53.39
Madras	82.02
Punjab	25.00
Uttar Pradesh	76.14
West Bengal	17.82
Hyderabad	30.00
Madhya Bharat	33.70
Mysore	50.00
Rajasthan	75.00
Saurashtra	25.95
	<hr/>
Total	695.40
	<hr/>

It is too early to assess the achievements of this programme. However, some idea can be had from the work done so far in Bombay, where Rs. 1.50 crore were spent on 55 minor irrigation works in the scarcity areas. These works are expected to provide irrigation for 1.72 lakh acres. Furthermore, Rs. 30 lakh were given in loan to the Bombay Government for the construction of 466 works in non-scarcity areas. These will irrigate an area of 54,000 acres. A sum of Rs. 76 lakh was also given to Uttar Pradesh to undertake 26 works affecting about 3 lakh acres. Under this programme, Rs. 10 crore were given as loan for 1954-55.

To enable the States to utilize the special loan assistance, the usual standards regarding cost and productivity have been relaxed to some extent. The State Governments have thus been able to take up schemes which would not have otherwise been possible. Accordingly, a

number of States, such as Bombay, Madhya Bharat, Hyderabad, Rajasthan and Madhya Pradesh, have set up special organizations for these works. As it took time to set them up, the progress has been rather slow, although large sums of money had been sanctioned. Some of the States like Bihar, Bombay, Punjab, Uttar Pradesh and Mysore were, however, able to utilize the assistance to a considerable extent.

A bund being built round a tank



CHAPTER V

THE ECONOMICS OF MINOR IRRIGATION WORKS

The economics of minor irrigation works may be examined from two angles. The first concerns the additional yield of foodgrains; the second the net revenue.

The extra yield from irrigation is approximately 5 maunds per acre, the cost varying from Rs. 60 to Rs. 80. In areas of low and uncertain rainfall, the increase would be several times more. Hence, the cultivator would benefit to the extent of Rs. 40 per acre. In other words, any type of irrigation work would be economical in terms of the cash value of the extra yield of crop.

Irrigation works, however, need not necessarily be paying. The net revenue or income obtained as water rate depends not only upon the extra yield of foodgrains, but upon what the cultivator can or is willing to pay.

FLOW IRRIGATION

Tank Irrigation

The digging of major tanks ordinarily costs about Rs. 200 to Rs. 400 per acre of the irrigable area. Minor tanks cost somewhat more. The working expenses of an irrigation tank would range from Rs. 10 to Rs. 15 per acre. According to the present rates, the schemes for tanks will not generally be self-financing, unless a betterment fee is levied on the area. This will bring down the capital cost. In the drier parts of Rajasthan and Ajmer, the loss of water owing to percolation and seepage through the subsoil is considerable. The cost per acre is consequently much higher,



Widening the Sirhind canal for irrigation

In South India, owing to difficult topographical conditions and the larger quantity of water required for the crops normally grown there, the cost per acre is much higher, being up to Rs. 1,000 in some cases.

Canal Irrigation

Canal irrigation costs about Rs. 50 to Rs. 150 per acre. The maintenance and working charges would cost anything between Rs. 3 to Rs. 8 per acre. It would, however, be possible to recover the water rate equal to or in excess of this amount. The schemes would, therefore, not only be self-financing, but also remunerative.



Lifting water by means of
a pitcher

Flood Irrigation

Where the flood water is diverted into the fields for wetting the land and keeping it submerged for the duration of the rains, the cost will come to 4 annas to 8 annas per acre or even less. Although the amount spent is little, the advantages are many. The scheme is self-financing and the people would willingly pay for the working expenses.

LIFT IRRIGATION

Lifting Water by Mote or Charas

The cost of digging a well is about Rs. 2,000 in the alluvial plains. The leather bucket and the rope are the only movable articles. Generally speaking, a pair of bullocks and two men can work the mote. The lift is 20 to 30 ft. and the discharging capacity varies from 1,000 to 1,500 gallons per hour, in accordance with the lift. A third or a fourth of an acre is thus irrigated per day. The working cost of the mote would come to about Rs. 48 per acre.

However, the cultivator believes that irrigation by mote is cheaper, the fact being that he does not calculate

either the cost of labour or the bullocks in the irrigation charges. Thus when pump irrigation is suggested to him, his first reaction is that he would be unable to bear its recurring and maintenance costs. What will happen, he sometimes asks, to his bullocks and the manpower of his family when all these have been replaced by a pump and a pump driver?

It is only recently that the cultivators have started realizing that by conserving their bullocks they would be given a longer life and by conserving the manpower it would be possible to do more intensive cultivation. While, therefore, irrigation by animals could be gradually replaced by mechanical methods, the village economy is so closely linked with that of the bullocks that it would be wrong to introduce pump irrigation indiscriminately.

Rahat or Persian Wheel

This is a much better method of lifting water than the mote, even though animals are used in both cases. Here the labour and the animal power can lift water to the extent of 2,500 to 3,000 gallons per hour for a lift of 20 to 30 ft. The cost of a Persian wheel ranges from Rs. 600 to Rs. 800, leaving aside Rs. 200 for other expenses. The cost of digging the wells and installing Persian wheels thus comes to about Rs. 3,500. The area irrigated per day is about half an acre and above, depending upon the depth from which the water is raised. The irrigation charges work out to about Rs. 22 to Rs. 25 per acre.

Pumps

A common practice now is to use pumps for irrigation. This method makes irrigation more efficient. It also reduces the cost of lifting by making use of coal, gasoline, crude oil or electricity for the pump.

Tube-wells

Irrigation by tube-wells has been practised most extensively in Uttar Pradesh and has recently been introduced in the Punjab also. Each tube-well unit of 1.5 cusec costs Rs. 39,000 with a diesel engine pumping set.

CHAPTER VI

THE ENGINEER'S ROLE

About 49 million acres of land are under irrigation in our country. Of this, about 22 million acres are irrigated by State-owned tanks and canals, the remaining 27 million acres receiving irrigation from the minor works owned privately.

It is interesting to note that the minor works irrigate a larger area than the major works. For thousands of years people have fought against famines, droughts and the vagaries of the monsoon. A network of minor irrigation works has thus been built up in the country. The innumerable wells in northern India, the *dongs* in Assam, the *koohls* of the northern hills and the large number of minor tanks in southern and central India are examples of efforts to bring water to thirsty fields.

Our engineers can play a very important part in guiding and helping the cultivator to plan his irrigation works. The cultivator's works, it is true, cannot always come up to their standard. It may also be difficult for them to deviate from standard practices. But, it is clear, that a strict adherence to the blue prints is not always desirable.

What is required is how best to assist the cultivator in carrying out his schemes a little better than what he is used to. We could, for example, tell him how water could flow into the fields by aligning the irrigation channel along the watershed. Then again, we could demonstrate how the bunding of the stream by bamboos, brushwood and earth could be avoided by constructing a masonry diversion weir. We could also show him how a simple channel could

let out a controlled supply into the irrigation channel instead of allowing it to be choked by flood water.

We are pledged to build up a Welfare State. We must, therefore, approach our task in a new spirit of co-operation. It is for the villagers to tell us what they want and for us to help them by advice and financial assistance. The initiative must come from the villagers. As our work progresses, we shall find that the villagers have perhaps more to teach us than we to teach them.

Water flowing into the fields



CHAPTER VII

CONCLUSION

The community projects and the national extension service are an important part of the Five Year Plan. The minor irrigation works form an integral part of these schemes.

Irrigation programme may, however, prove to be unproductive in some cases. Technical personnel may be lacking. The projects may have little or no appeal to the cultivator because he has no land of his own to till. In some regions, the programme may thus have to be dropped or slowed down. Nonetheless, irrigation has many benefits to offer. It would, therefore, be worth investing money on irrigation works even in areas less favoured by nature, or where, owing to land and other economic problems, the cultivator is in no mood to pay for water.

The deficiency of technical staff could be made up by starting short-term training centres and turning out technicians who would be able to help in designing and constructing minor irrigation projects. Land reform, too, should be expedited at the same time. In short, we must utilize all our resources to speed up the irrigation programme. Indeed, with the expansion of irrigation, more and more food is bound to be produced in the country. We shall have an era of plenty and our people will be happy and prosperous.

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