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TITLE:Irrigation in India - Management Phases & its Sustainability

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Abstract

From time immemorial to this day it is the states (Kings, Rulers, and Society) to make water available in the substantial quantity. This is possible if water resources are harnessed and managed in the sustainable manner.

Experience has shown that in most of the major irrigation projects (of India), it is not possible unless until more resources and proper implementation of participatory irrigation management (PIM) is adopted.

Old tanks and other irrigation sources are efficiently providing desired water to this day are well maintained. Old tanks, which are in deteriorated condition has to be brought back to its original status so that efficient management system may once again occur.

IRDAS efforts in this regard form a portion of the paper.

1.0. Introduction & Management Prior to Independence

In India, the ideas that water resources are gods gift and as such the common property of all the members of the community is taken as a religious doctrine.

In past no single water user has the right of excess use or neither misuse nor he can deny others the legitimate share. Water is considered a resource common to all to be used for domestic and agriculture purposes. In case of river lets and rivers water was allowed to be captured by all who had access to its course of flow, to meet their agricultural requirements and allow the remaining to flow down its course.

In many communities in India deep reverence and respect for flowing water has been an important aspect of culture. Harnessing of the flow of water for the benefit of the community is considered an act of great merit and any misuse and its contamination and pollution a sin.

Tank construction in the past played a key role in a ritual-based system of entitlement wherein land resources were controlled by the temple priest or by a king. To increase the productivity of these lands construction of a tank or irrigation well used to be the right course. Thus, even to this day tanks are donated to temples as an act of gratitude.

In many cases construction of the tank to generate a resource for temple by the Chieftain or the efforts of the community results in enhancing Brahmin cal and ritual powers and provided material support that left this class ample time to perform not only rituals but also to guide local farmers with regard to use of water for increasing productivity.

To maintain the water balance and help the farmers during the dry season self-discipline was inculcated, rules and regulations with regard to use of irrigation water and penalty for excess use or wastage of water were laid down as early as Vedic times.

The preservation of most of the century old irrigation systems attached to temples till this day bares the testimony to the efficiency of guidance provided by temple priest through the Vedic hymns.

It may not out of place to mention that water has been perceived as non-legal object and as such incapable of becoming someone's property. Roman law does not classify running water as capable of becoming someone's property. No ancient Indian text mentioned property rights of river to anyone including the king.

Kautalyas statement that "a good state does not depend on rain alone for cultivation. The development of water resources is critical for crop growth in some areas and is essential for higher productivity in other" and as such surface and groundwater both are to exploited and used for irrigation in all parts of the country.

Artha Shastra of Kautaliya lays down the responsibility of Kings towards its people, as follows:

1. He should construct tanks / dams across streams and / or construct channels to feed tanks from rivers where the yield from rainfall is not enough.
2. If the community builds reservoirs the King should help by releasing land providing access and material for planting tree etc.
3. If in the community work a person does not contribute his share, the king should forcibly make his men and animal do the work (their share). Such person (who do not contribute and/or forced by the king to contribute) has to share the expenses of running the system but will not get benefit from the water source.
4. The king should keep in good conditions assets created by the other rulers (plantation, reservoirs etc.) and construct new ones.
5. Near the reservoirs and tanks the official in-charge should install rain gauge for purposes of determining whether it is a good or poor year for agriculture and collect taxes keeping this in mind.

The book also mentioned about the punishments to be imposed against those whose action adversely affects the efficient working of the system.

1. Taking water out of turn will be punished by a fine six (6) panna (10% of the annual salary of an unskilled worker, which used to be 60 pannas).
2. Obstructing duly constructed conveyance distributory system or altering it will invite a punishment of 240 Pannas.
3. If a person breaches embankment of a tank containing water, he should be punished by drowning in the same tank.
4. If he breaches the embankment of a dry tank for the first time, he is fined 100 Pannas, if he further destroy breach tank he will be fined 500 Pannas.

Most ancient books of Aryans mentioned rules and regulations with regard to running and managing the irrigation system. For example, the Rig Veda mentioned how reservoirs, canals, and wells were constructed by the wealthy people who used to donate lands as an act of prudence earmarking the same for maintenance of tank system and other irrigation resources. In absence of such endowments panchayat used to organize farmers to take up joint efforts for maintaining the irrigation sources.

Reference is to be found in the Kausika Sutra to the rituals of opening of a canal while Manu advocates the destruction of dams as one of the ways of defeating enemies thus clearly pointing out the existence of huge tanks which can submerge villages after villages once they are breached.

Providing irrigation facilities was considered to be the one of the important function of the state and many Indian rulers undertook the construction of such works. The state recovered water charges for supplying of water for irrigation. Kautaliya laid down that “ordinarily a revenue tax of one-fourth of the produce was paid to the state for the water used from rivers, lakes, and dams, and from wells worked with machines” an official called Jala Sutradi was to

supervise construction and maintenance of irrigation works. Magasthanes recorded that district officer "measured the land, inspected the sluice by which water is distributed to branch canals so that everyone may enjoy his fair share of the benefit".

Fortunately a lot of information has survived regarding the construction of irrigation works in India in the past. Further ruins of ancient irrigation works are found scattered all over India. It is said that many of them "now abandoned or in ruins evince the solicitude of those ancient monarchs for the extension of cultivation even in tracts not favored by natural position or the quality of the soil. Some of them bear witness to the enlightenment of those Hindu Kings while the absence of scientific instruments in those remote times compels the astonishment of the beholder".

The Besnagar canal unearthed in the Gwalior State was a work probably executed for irrigation before the III century BC. Another excellent example of a ruined ancient irrigation work is that of a dam known as Sudarsana Lake, constructed in the region of Chandra Gupta Maurya, located in Kathiawar. The construction of the Grand anicut across the Coleroon river in Tamil Nadu is assigned to the II century AD, and is said to be the greatest engineering feat in the India before the British rule. The Gangiakonda Cholapuram tank built by King Rajendra Chola in the 11th Century AD, is in existence even to this day. The Bhojapur Lake covering an area of about 250 square miles is presumed to have been constructed in the 11th Century.

The Muslim rulers of the country have also been concerned about providing irrigation facilities. They continued the tradition of the Hindu Kings. The Western Yamuna Canal constructed by King Ferozsha Tuglak and renovated by Akbar and Shajahan, the Eastern Yamuna canal constructed by Mohammed Sha, and the Hasli canal built by Ali Mardan Khan, the celebrated engineer of Shahjahan, are all examples of their effort in this direction. "It was the existence of the grand Anicut" in Madras, and the remains of the old Mohammadan channels in the Punjab and the United Provinces, which suggested and led to the construction of the earliest works carried out under British Rule". Thus, "Indian in a great measure, owes to her former rulers the first inception of her present unrivalled systems of State Irrigation Works".

A number of inscriptions dating around 11th and 12th century describe renovation of tanks by kudimaramat and even about construction of tanks by the efforts of the community.

50 centuries ago the Mohinjadaro civilization of the Indus Valley in India enjoyed the benefit of well-designed water supplies and drainage system. Excavated ruins of that period reveal a variety of irrigation works including tanks and channels.

In 16th century the Vijayanagar kings constructed 15 anicuts across the main Tungabhadra River, 12 of which are still operative as its maintenance continued to be on kudimaramat approach and only in rare cases money was

required, which was collected through a small percentage of the yield from the beneficiaries.

In case of local tanks small percentage of yield from all the beneficiaries used to be collected and passed on to the sunkri (waterman) whose job was to supply allocated water to all the fields. During the shortage of water self-discipline was inculcated and reduce volume of water delivered to the fields. The reduced share of water to each farmer was to be decided by all the farmers and all the farmers were jointly responsible for maintaining irrigation system and not interfering in the work of waterman.

Any dispute regarding water allotment or release used to be decided by the members themselves and in rare cases the panchayat is to be involved. Rules and regulations with regard to use of water and penalties for excess use or wastage of water were laid down jointly by the beneficiaries.

Thus, the profusion of small tanks in India can be viewed as the response of the community in the catchment area to stake their claims on the rainfall of the catchment.

2.0. Background for Creating Irrigation Facilities

Extensive need for irrigation is felt in India due to irregularities in the distribution of rains from year to year rainfall is subject to wide variation both in regard to its time and amount. It is a common occurrence that in many places monsoons set late in the beginning and / or withdraw earlier at the end of the seasons. Both the conditions are seriously harmful for the crops; only irrigation can save the crops. Under these circumstances the interest was to create irrigation facilities to avoid crop failure on as large an area as possible and not to irrigate for maximum yield per unit area. As such all irrigation systems that is tanks, wells, and diversion schemes where of low irrigation intensity and large cover of the area.

Since 19^{th} century due to enormous growth of population and tremendous inventions in technology, the concept is to create major irrigation systems in place of depending on conjunctive use of rainwater, tanks, and wells was accepted as right approach. But since 20^{th} century with the increased demand of water in other sectors like industries, power, and human consumption there is a decrease in water availability for irrigation through major and minor irrigation projects which were adversely being affected due to reduced area under forest and rivers receiving along with water more silt thus reducing the storage capacity.

With this change in the dwindling of forest, climatic condition change, depletion of crop area and reduced yield due to urbanization, creation of pollution due to industrial areas, roads and railway tracks, forced the state no more to depend only on major and medium irrigation projects and once again the old concept of village tanks and wells to supplement the irrigation needs revive.

3.0. Present Situation of Irrigation

There are mainly three types of irrigation projects in the country as given below:

Reservoir Projects

Such projects envisage the construction of a dam across a river to create a reservoir. The canals take off from the reservoirs is also constructed for irrigation and other purposes. Village-based tanks envisage construction of small dams to catch the rainwater of catchment of a village or two.

Diversion Projects / Runoff the River Projects

Such projects envisage the construction of a canal by diversion of river water with a diversion structure for irrigation and other purposes.

Lift Irrigation Projects

These projects envisage the construction of a canal, the source of water may be a river, a reservoir, and/or groundwater, water being lifted by the help of device which may be bullock power or electric/oil engine-based pumps.

The irrigation projects based on size of the cultivable command areas are classified as major project if cultivable command area is more than 10000 ha., medium projects cultivable command being 2000 to 10000 ha., and minor projects are with cultivable command below 2000 ha.

4.0. Present Status of Irrigation

At the end of the eighth five-year plan the irrigation potential created through major and medium projects was 32.54 million ha., but the utilization was only 28.43 million ha. leaving a gap of about 4.51 million ha. while due to reasons like water logging and salinity an area of about 5.76 million ha., has been degraded. While in the minor irrigation sources like tanks and tapping of groundwater through open wells no water logging, salinity, and alkalinity was reported. But with sustained and systematic development the irrigation potential through major, medium, and minor irrigation projects has increased 22.61 million ha., in 1951 when the process of planning began in India to about 80.06 million ha. at the end of the ninth five-year plan period, out of which contribution of major and medium projects is 37.05 million ha., and that of minor projects is 43.01 million ha., with greater contribution from groundwater through deep bore wells which was responsible for the first time creating salinity and alkalinity in the well waters.

While tanks of South India being based on protective irrigation system people utilize these tanks with joint consultation adopted cropping pattern to suit to the availability of water in the tank for protective irrigation.

Thus, irrigation technology are socially constructed, this means that:

1. Technology development and design are socially processed in which different stakeholders interact (communicate, negotiate, take decision etc.).
2. The nature of process and the different perceptions and interests of stakeholders shape the technical characteristics of the technology (together with properties of the material used and nature of the physical mechanism involved). Irrigation technology has social affect, for example, irrigation allows more intensive cropping system and may thus generate economic growth and employment. Control flows in the irrigation system may enable intensive cultivation of horticultural crops while continuous flow from gravity canal system spreading water from one farmers field to the other.

With regard to major irrigation projects water management after delivery of the canal outlet has not so far received the attention that it deserves. For development irrigated agriculture through major project it is necessary that the cultivators should be permitted a certain degree of flexibility in cropping and agricultural activities. No doubt there is a general feeling entrusting water management beyond the outlet to the beneficiaries is more congenial to obtain desired flexibility.

Discharge of an individual field channel seldom exceeds one cusec, that extending into a big network spread all over the command area. Neglect and maintaining the same results in excessive loss of water and low irrigation efficiency. The cultivators are usually not able to combine efforts and take timely action to constant maintenance of these channels. Considerable percentage of water is lost by seepage in the field channels. It was noticed that proper alignment grading, construction and maintenance of the field channel lack agreement of all the cultivators.

Inability to obtain land required for the purposes of minor field channels to reduce the flow one cusecs to 0.32 cusecs to 0.50 cusecs, which is often capacity of these minor field channels. This may be also due to unwillingness of small cultivators to part with a portion of landholding. No time all the beneficiaries sit together to decide how much irrigation and depth of irrigation being for different crops.

To achieve self-sufficiency of food in the shorter period without waiting for completion of major and medium projects the right decision taken by the government is to take up improvement and management of minor tanks and advising the farmers to draw groundwater equal to that of recharge of the wells. With regards to the tank improvement and maintenance IRDAS has taken up Gudoor village tank, note on the same is attached which will highlight how a neglected tank revived.

It is expected with introduction of PIM that all these problems can be solved and the fact is that if PIM is practiced in right direction an efficient irrigation system can be attained.

I may add that along with all the gaps mentioned one most important lacunae is shear non-availability of water due to errors in the yield estimation, defects in design, not capable of irrigating the full ayacut for want of water.

Tank Improvement and Management Plan (TIMP)
- District Karimnagar : (NGO – IRDAS)

1.0. Introduction

Tank Improvement and Management Project (TIMP) in Andhra Pradesh aims to promote sustainable water resource use and management of small water bodies like a tank by the stakeholders. The project envisages to build the capacity of the water users association (WUA) of the tank both to restore and improve the system and empower them to manage the system by the stakeholders. In this NGOs are to be associated to facilitate the process and work as a support organization.

IRDAS an NGO is identified to work in the TIMP programme in the district of Karimnagar for providing support services in the selected villages.

2.0. Gudoor Tank

The minor irrigation tank of village Gudoor in Kataram mandal of district Karimnagar is selected for pilot project work.

Kataram mandal is in the north-eastern part of the district and the village Gudoor is about 12 km west of Kataram.

The tank is called “Pedda Cheruvu” and is about 50 years old, with about 4.8 sq.km as its catchment, mostly intercepted. It has a registered command area of 127 ha. The tank details are given in (Annexure – 1).

The registered ayacut is spread out in two villages, the head reach of 55 per cent area being in village, Gudoor boundary and the lower 45 per cent in village Dharmasagar boundary.

The tank has a WUA with six members, three from village Gudoor and balance three from Dharmasagar village. Currently Sri. Potla Bhanu Murthy of village Gudoor is the President of the WUA.

3.0. Socio-economic Status

The village Gudoor has a population of 280 with 73 households. Scheduled Caste (SC) families are the predominate group in the village with 68 households, being around 93 per cent of the total households. The rest belong to backward communities.

The village Dharmasagar has a total of 125 households with a population of 609. Of this, 57 households belong to SC (about 47%), the rest belong to backward communities.

The major occupation of all these households is agriculture.

4.0. Status of the Tank / Its Utilization

The catchment area receives an annual rainfall of around 700 mm during the south-west monsoon period, which provides the inflows into the tank.

Due to various reasons the tank has not been repaired. At present around 55 to 60 per cent of command area is irrigated, all with paddy crop.

Through discussions with the President and TC members of the WUA, the following are reported to be the major items, which require attention for improving the utility of the tank.

1. The tank has two (2) sluices for providing irrigation. Both of them are damaged and do not have shuttering arrangement. There is an urgent need to repair them and also fix shutters for regulating the flows and prevent wastage of water.
2. The feeder channel is choked up with vegetation and needs to be cleared and channel has to be reshaped to enable free flow of runoff water into the tank.
3. The surplus weir of the tank is in a damaged condition and it needs to be brought back to the standards by repairing it.
4. The main distribution channel has many breaches and is badly eroded. This needs to be strengthened. A protective wall on its downstream side needs to be built.
5. The second main distribution channel has to cross a nala. The temporary by-pass structure made by farmers many times collapses. There is need to build a permanent structure to carry the water to the other side of the nala, where there is registered ayacut under this tank.
6. The main bund needs to be strengthened at few locations.
7. Field channels in the lower reach of ayacut have to be developed.

5.0. Awareness

General discussion with the managing committee (MC) members of WUA and few farmers was held regarding the involvement of the WUA, their contribution for attending to the various works (as prescribed in the TIMP), managing the system essentially for distribution of water to all the ayacutdars, and collection of water tax. The President and other members have shown their willingness to take up the responsibilities envisaged.

The irrigation officials at the system level, and others felt the need for taking up the works as indicated by the WUA.

Annexure - 1

Tank System Profile

Name of the Tank / WUA	Pedda Cheruvu				
Name of the Villages	Gudoor				
Name of the WUA President	Potla Bhanu Murthy				
Name of the Competent Authority	Ch. Sreehari, Assistant Engineer				
Name of the Support Organization	IRDAS				
Name of the Sub-division	Mahadevpur				
Name of the Division	Peddapally				
Name of the Mandal	Kataram				
Name of the District	Karimnagar				
Details of WUA & Managing Committee	**Social Groups**				
	SC	**ST**	**OBC**	**Others**	
Members	2	-	4	-	
WUA Management Committee					
Position	**Name**	**SC**	**ST**	**OBC**	**Others**
President	P. Bhanu Murthy	√	-	-	-
Vice President	S. Shankeriah	-	-	√	-
Territorial Constituency Members	T. Mallikarjun	-	-	√	-
	A. Lingaiah	-	-	√	-
	A. Kistaiah	√	-	-	-
	Md. Ibrahim	-	-	√	-

Note: Sub-committees are not formed so far

Salient Features of the Tank

Year of Construction	50 years back
Longitude	$79^{o} – 52^{'} – 43^{'}$
Latitude	$18^{o} – 41^{'} – 5^{'}$
Type of Tank	Rainfed Tank
TBL	+ 30.915
MWL	+ 29.415
FTL	+ 28.915
Catchment Area (km^2)	4.8 sq.km
Independent / Intercepted	-
Nature of Catchment	Average
Average Rainfall (mm)	700
Water Spread (Ha)	30.00
Gross Tank Capacity (MCM)	0.87
Live Capacity of Tank (MCM)	0.63
Designed Ayacut (Ha)	127.00
Present Ayacut (Ha)	98.00
Tank Bund Length (m)	2400
Maximum Height (m)	5.80
Waste Weir	
Type	F.O.F Weir
Length	120 m
Crest Level Discharging	
Lining to Canals: Whether Done or Not	No
Type of Lining: RR Masonry	
Sluice – 1	-
Sluice – 2	@CH 19.00
Sluice – 3	@CH 55.00
Sluice – 4	-

Note: Sub-committees are not formed so far

Details of Members of Managing Committee

Pedda Cheruvu - Gudoor (V) Kataram (M) Karimngar (D)

TC Members	Location	Name of Member (TC)	Position	Voters			Command Area (Acres)
				Male	Female	Total	
TC-1	UR	Md. Ibrahim	Member	30	5	35	30.17
TC-2	UR	T. Mallikarjun	Member	107	1	108	76.25
TC-3	UR	S. Shankariah	Vice President	87	3	90	45.45
TC-4	LR	A. Lingaiah	Member	64	3	67	72.20
TC-5	LR	A. Kistaiah	Member	96	6	102	45.40
TC-6	LR	Potla Bhanu Murthy	President	66	4	70	45.52
			Total	**450**	**22**	**472**	**314.99**