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Rethinking Tanks: Opportunities for Revitalizing Irrigation Tanks

Empirical Findings from Ananthapur District, Andhra Pradesh, India

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FUTURE HARVEST
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Contents

Summary

Incidents reported from many parts of south India indicate that groundwater irrigation, the prominent source in the area, has become unsustainable due to declining water tables. With possibilities of canal irrigation having already reached closure in most areas, planners are forced to look at other options to provide a significant supply-side intervention to fill the gap left by declining groundwater irrigation.

Tanks have been a part of the irrigation landscape of south India for centuries. However, their use has been declining over a period of time—decline is evident in their share of irrigation vis a vis other modes of irrigation as well as an actual decline in the area irrigated by tanks. Tank rehabilitation schemes have not been successful historically but considering the impending crisis of groundwater irrigation, there is a renewed attention towards ways to improve the performance of such schemes.

This study finds that in the Ananthapur district of Andhra Pradesh, tanks were a precarious source of irrigation, even at the peak of their use. Hence, with the use of electricity supply and reduction in the cost of groundwater extraction technology, farmers moved to groundwater irrigation. Along with a rise in groundwater irrigation, however, a steady decline in tank irrigated area was witnessed.

Literature points to several reasons as to why the decline in tank irrigation took place. One prominent reason advanced in the literature is that with the arrival of groundwater irrigation and the take over of tank management by government, people lost interest in tank management. However, it was seen in the study villages that farmers in the command area used water from the tanks to irrigate whenever possible. It was also seen that the inequity in landholding in the command area of the tanks is strongly correlated to the maintenance of tanks. Tanks, which had high levels of inequity in landholding in their command were also the best maintained. This shows that a strong control by a few over the tanks lends to better management. Diffusion of control leads to a decline in performance. A second trend that was seen is that the introduction of groundwater irrigation hastened the decline of tanks by making landholding in tank commands more diffused. This is because the better-off farmers prefer to consolidate their landholdings near their tubewells, even at the expense of relinquishing their landholding in the tank command.

Most of the present rehabilitation programs aim at reviving community institutions for tank management. The conception of community promoted by these programs is that of a harmonious group, which worked together to manage tank irrigation and tank maintainance. However, their conception of community does not gel with the highly inequitable way in which the ownership of tanks was structured in the past. As a result, they end up promoting an entirely new way of managing tanks, the validity of which has not been tested.

There is evidence to suggest that new and innovative strategies for tank management might be the way forward for rehabilitation. There is a need to come out from the notion of tanks as being only gravity flow irrigation structures and start supporting and building upon the innovations happening on the ground.

1. Introduction

Water security is the key to the livelihood security of the Indian rural population, which is largely dependent on agriculture. As a result, with the dread of future water scarcity becoming a reality in many parts of India, the search has begun on a large scale to bring in new irrigation supplies to the villages. Catching rainwater where it falls, hitherto ignored by the planners of large and medium dams, has caught the fancy of the entire nation—primarily due to the fact that many of the river basins in which these water-scarce areas lie have already become heavily over-appropriated—thereby, limiting the possibility of further development of new, major and medium structures. In recent years, western and southern India have been particularly affected by recurrent droughts, resulting in millions of dollars worth of famine assistance going to these areas every year. In response to these frequent droughts, the demand for governmental intervention has also been best articulated here.

Much of south India lies in rain shadow regions, receiving a rainfall of less than 1,000 mm for most of the year. However, south India has had a long history of rainwater harvesting using tanks, which had helped support vibrancy in agriculture in this semi-arid region. If we look at the statistics then, the largest concentration of tanks in the country is found in the three southern states of Andhra Pradesh, Karnataka and Tamil Nadu and also in the union territory of Pondicherry, which account for nearly 60 percent of the tank-irrigated area. Together, these three states and the union territory have nearly 120,000 tanks (out of the 208,000 tanks in the country as a whole), irrigating 1.8 million hectares (Vaidyanathan 2001).

With the turn of the last century, there has been widespread recognition that the tanks are on a decline. This decline can be seen both in the form of decrease in the relative importance of tanks vis a vis other modes of irrigation, as well as a decline in the actual area irrigated by them. From 1900s onward, several programs have been started with the help of the government as well as multilateral donors to revive the usage of tanks, but they have been ineffectual in checking the decline of tank irrigation.

Despite the failures of the past 100 years in reviving tank irrigation, the quest for finding a way to rehabilitate this method continues, now more actively than ever before. This is because incidents reported from over large parts of south India indicate that groundwater, the prominent source of irrigation, has started to become unsustainable due to declining water tables. With possibilities of canal irrigation having already reached closure, the revival of tank irrigation offers a significant supply side intervention to fill the gap left by declining groundwater irrigation.

2. Objectives

Considering the historical failure of programs on tank revival, the overall objective of this research work is to look at ways in which rehabilitation interventions can become more effective. The specific objectives to achieve this are:

1. An examination of the dynamics of tank irrigation, so as to understand why gravity flow irrigation from tanks declined in the first place. This would involve a detailed socioeconomic analysis of tank irrigation.

2. An examination of the reason as to why traditional rehabilitation schemes have failed to work.

3. And finally, to look at new and innovative ways in which tanks can be revived.

3. Data and Methodology

Fieldwork was undertaken in the Hindupur taluk in Ananthapur district in Andhra Pradesh. Hindupur taluk is one of the more prosperous agricultural regions of Ananthapur district. The taluk receives the maximum rainfall in the district and its red soil is also the best suited for cultivation. Society for the promotion of wasteland development (SPWD) and its partner NGO in the region—Chaitanya—were kind enough to coordinate the fieldwork and provide secondary data. Ananthapur district was chosen for the fieldwork because it is one of the important districts in Andhra Pradesh from the point of view of tank irrigation and groundwater depletion has also become a significant problem in the area.

For selecting villages for the fieldwork, purposive sampling was used and five villages were selected from within a radius of 30 kilometres from Hindupur. Literature suggests that the best way to choose tanks is to select them in a watershed context (for example, Vaidyanathan 2001), as such a selection helps to account for the interdependence between tanks. However, the exploratory nature of fieldwork, combined with the decision to study only tanks managed by the Panchayati Raj department, led to the adoption of purposive sampling as the tool for selecting tanks.[1]

The primary level data collection exercise was carried out in all the study villages. Stratified sampling was used within the village to select the respondents for the study. The stratification was done on the basis of castes living in the village. A minimum sample of 20 percent of the total number of households from each caste was taken as respondents for the study. The host NGO, Chaitanya, was able to provide the secondary data on all tanks in the five villages.

Tank Details

	Tank command area (acres)	Tank bed area (acres)	Functioning wells and tubewells
Thumulkunta	60	35	9 (all tubewells)
Gollapalli*	90	70	25 (all tubewells)
Kethigani Cheruvu	70	90	40 (all tubewells)
Khambalpalli	43	40	8 (5 +3)**
Arumakulapalli	67	80	5(3+2)

*The tank command stretches over four villages. The village studied comprises 70 percent of the command area.
**Tubewells + Open wells.
Source: Secondary data on tanks from Chaitanya records.

[1]Care was taken to select only those tanks, which are classified as being governed by the Panchayati Raj Department. This is because there are many differences between tanks governed by the Minor Irrigation Department and the Panchayati Raj Department from the perspective of size, management structure and agency support, and as such merit separate studies. The command area of tanks under the irrigation department is much larger (>40 ha.), and includes multi village tanks. Due to the intensive nature of data collection required for studying minor irrigation tanks and the time factor involved, it was decided to concentrate only on the Panchayati Raj tanks. Also, in the Ananthapur district rain-fed small tanks are more in number as compared to the large tanks.

4. A Review of Evidence

The purpose of this review is to explore the reasons advanced in previous studies as to why the area irrigated by tanks has declined so substantially. This formed the background on which the first level study plan for the field visit was designed. The issues to be addressed by the study were further revised during the course of the fieldwork. This review is not comprehensive as it concentrates largely on journal articles on tanks published during the last 30 years.

There is much literature on tanks—much of it focussing on the dynamics of tanks in Tamil Nadu.[2] A large volume of existing literature focuses on the “decline” of tanks as sources of gravity flow irrigation. The decline in tank irrigation is on two parameters—“relatively” when compared to other sources of irrigation and “absolutely” in terms of gross area irrigated.

Various reasons have been advanced for the decline in the area under tank irrigation. Shankari (1991) points out that poor management of the tanks is primarily responsible for their decline. This is evident in the nonparticipation of farmers in cleaning channels, encroachment of the tank bed, inadequate repairs, weed infestation and siltation. Having surveyed 32 tanks in Andhra Pradesh and Maharashtra, Von Oppen and Subba Rao (1980) indicate that increases in population density resulted in deforestation in catchment areas leading to soil erosion and siltation. According to Sekar and Palanisami (2000), tank bed cultivation and the lack of an administrative structure to provide timely repair and maintenance, contributed to the decline of tank irrigation.

An econometric analysis of the factors responsible for tank degradation (Balasubramaniyam and Bromley 2002) found that variables such as encroachments in catchment and water spread areas and the increase in canal- and well-irrigation, had significantly increased the degradation of tanks. The increasing importance given to modern irrigation systems, larger reservoirs and river valley projects and the spread of private irrigation wells, also have a considerable negative impact on traditional community irrigation systems.

The common view that emerges from these studies is that the decline of tanks can be attributed to a loss of interest (nonparticipation) by farmers of the command area, in the management of tanks. There is no doubt that the tanks are still being used by the farming communities, but there is little investment in the upkeep of these tanks. Some link this loss of interest to the introduction of groundwater irrigation, which offered superior control to farmers (Palanisami 1991; Dhawan 1985), while others feel that the lack of interest is more to do with the erosion of community management structures ensuing the government take over of the management of tanks (Rao 1997; PRADAN 1996). A contrasting view comes from Mosse (1997; 1999), who contends that even in the past, communities did little investment in the upkeep of tanks. It was the zamindars and kings who, not only built most of the tanks, but spent money for their upkeep as well. According to Mosse (ibid), it was the fall of the institution of overlords that led to the decline of the tanks.

With this review in the background, the analysis in this paper is presented in four parts. First, a review of the growth in agriculture and changes in modes of irrigation at the district level is presented. A discussion on the agricultural situation in the study villages follows. This discussion is divided into two sections. The first section analyzes the landholding pattern in the study villages. The second section deals with the cropping pattern of the area and discusses the development regarding the dominant source of irrigation in the villages. The final part deals with issues relating to tank rehabilitation in the study area.

[2]Three-fourths of the literature reviewed on tanks focused on tank dynamics in Tamil Nadu.

5. Agricultural Transformation in Ananthapur

The district gazetteer of Ananthapur of 1905 (Francis 1905) records it (Ananthapur) as one of the most agriculturally backward of the southern Indian states. The main reasons given for this situation are the poor quality of soil in the area and low rainfall. From the perspective of land revenue collection, nearly half of the irrigated land of the district fell in the assessment category of Rs 3.50 to Rs 2.00—the second lowest land revenue collection slab in all of British India. The revenue collection from dry lands too was very low, and the gazetteer records that farmers took a government lease of dry land only after a good rain, in order to allow the soil to regenerate (once in every 3 years).

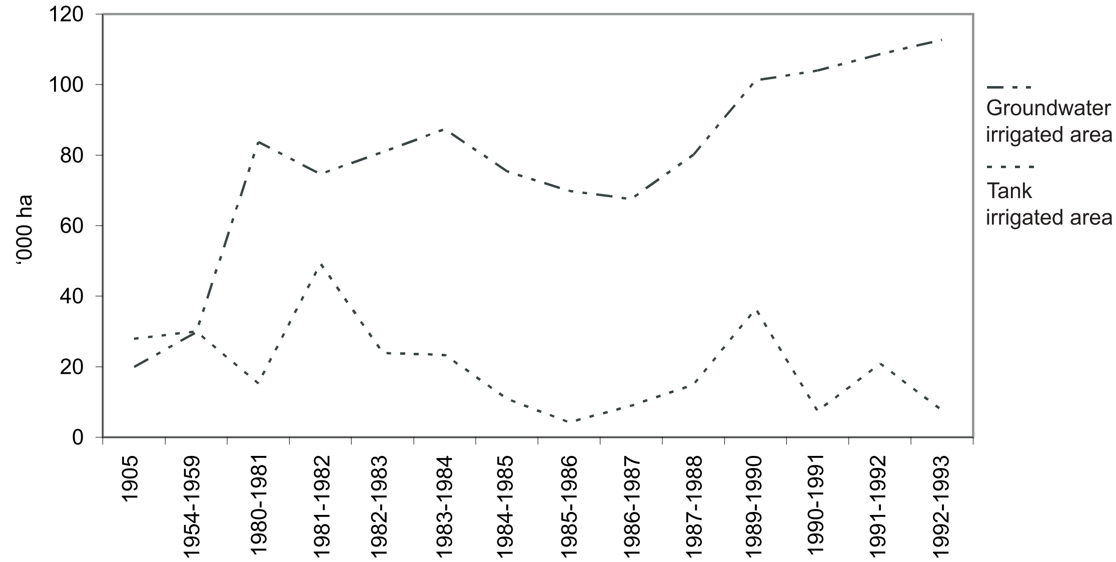
In 1905, tanks and groundwater were the predominant sources of irrigation in the district. As a whole, tanks irrigated 4 percent of the net area cultivated, while wells irrigated less than 3 percent of the net area cultivated. However, the Hindupur *taluk* (the area of the present study) was the best placed, as far as irrigation was concerned, with 19 percent of the net cropped area irrigated by tanks and 2 percent by wells. The cropping pattern within the *taluk* was dominated by paddy, *ragi* (finger millet) and horsegram. The gazetteer records that *ragi* dominated paddy in the tank command areas of the district because it was one crop, which could be grown successfully even when tank water was scarce, due to its minimal water demand. This cropping pattern is different to that of Tamilnadu, where the whole of the command area of tanks is utilized to grow paddy. The choice of crops in the tank command reveals that tank irrigation in Hindupur as well as in Ananthapur as a whole, was highly vulnerable to erratic rainfall in the area and, as such, was hardly an irrigation source of choice for the farmers. This is further corroborated by Francis's statement in the gazetteer (1905), where he says that except for two, all the other tanks in the district were supplied by rainfall or small streams, which are very precarious sources. As a result, an explosion in groundwater irrigation in the area was waiting to happen, and the only thing hindering it was the lack of appropriate and reasonably priced technology.[3]

The Andhra Pradesh government in a scheme, which revised gazetteers from 1958, recorded the initialization of the groundwater explosion. The new gazetteer notes that with the government working to make the well subsidy scheme popular and with the provision of electricity for irrigation, the number of groundwater irrigation structures began to grow steadily. Groundwater irrigation as a percentage of the gross irrigated area in 1958 was more than three-quarters of the area irrigated by tanks. The growth in groundwater irrigation was even more remarkable in the later years. Combining information from the gazetteers and season and crop reports, a remarkable picture emerges of the groundwater boom in the study area.

Figure 1 shows, what can be termed as, a change in irrigation technology that took place in Ananthapur throughout the twentieth century. The period from 1950s onwards, was quite obviously the period of groundwater boom in the region. Discussions in the study villages point to three factors, which were of special importance in bringing about a rapid increase in groundwater irrigated area during this period. One factor was the decrease in the cost of groundwater irrigation technology. This, combined with government interventions through loans and subsidies, helped fuel the boom (more discussion on this will follow in a later section). The second factor was a change in cropping preferences of the farmers towards non-food crops. And the third factor was the provision of electricity for groundwater extraction.

[3]Francis (1905) notes: "… as will be seen immediately, there is little possibility of any wide increase in the area of the district, which is watered by tanks and channels, and the protection of most of it from famines must be secured by wells."

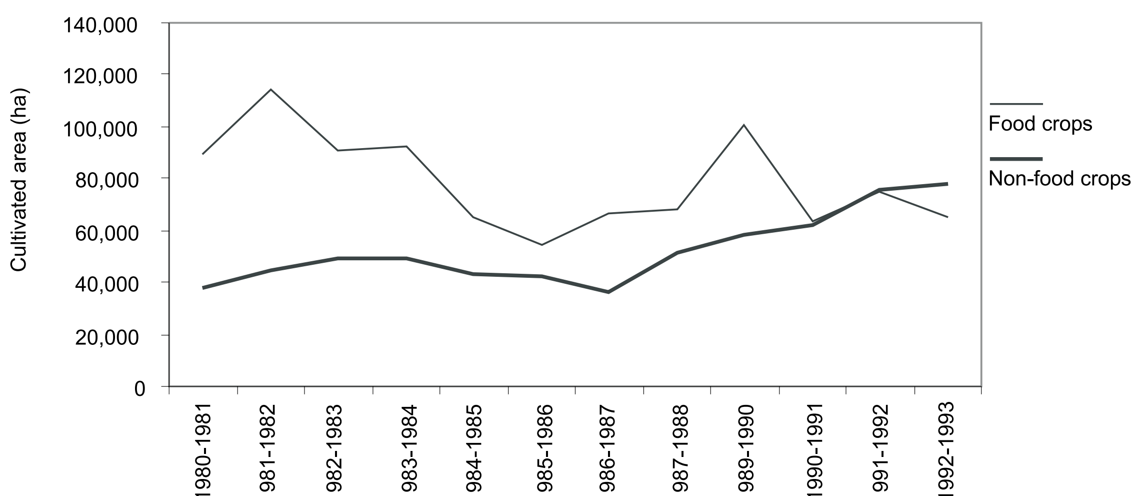
Figure 1. Changes in tank-irrigated and groundwater-irrigated areas in Ananthapur, 1905-1995.



Source: Gazetteers of Ananthapur (1905 and 1958) and Season and Crop Report (several years).

Figure 2 shows the changing preferences of farmers in Ananthapur towards non-food crops.[4] Non-food crops, grown primarily for financial returns, require controlled irrigation for a good crop and, hence, farmers prefer groundwater irrigation for such crops. Evidence of such a shift being the reason for increased tubewell construction, comes from the study villages—where a majority of farmers reported that they sunk tubewells to support the mulberry crop.

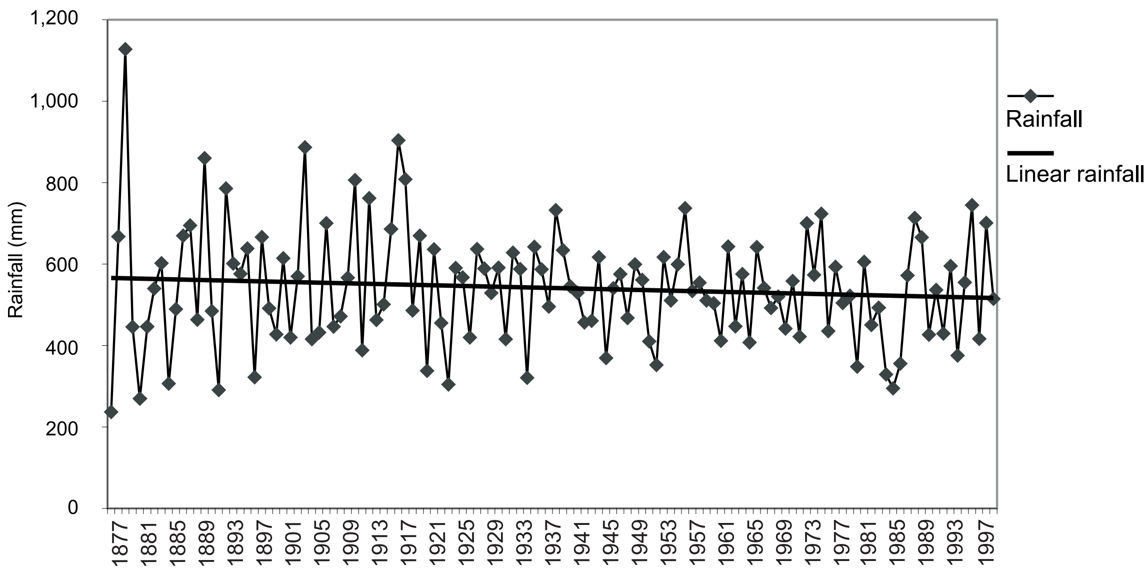
Figure 2. Cultivated area of food crops and cultivation of non-food crops in Ananthapur, 1980-1993.



[4]For the purpose of classification, cereals, pulses and oilseeds are counted under the food crops category, while the rest comes under non-food crops.

Figure 1 shows that simultaneous to the growth of groundwater irrigation, there was a decline in tank irrigation. Farmers in the study area insist that a decline in rainfall in the area is the primary cause of this phenomenon. However, an analysis of the annual rainfall of the district level (figure 3) does not indicate so. As can be seen from the trend line in figure 3, there has been no significant decline in rainfall over the past 100 years. This is also confirmed by the slope of the trend line, which does not slope sharply downward. Thus it can be surmised that what farmers mean by reduced rainfall is actually the reduced inflow to tanks.

Figure 3. Annual rainfall pattern in Ananthapur District, 1817–1997.



Source: Chaitanya records.

There seems to be a causal relationship between declining tank irrigation in Ananthapur and the emergence of groundwater irrigation. The better control and reliability offered by groundwater is always desired by farmers. Therefore, with the reduction of costs in groundwater technology there was a major movement towards groundwater irrigation. However, it is still unclear why an increase in groundwater irrigation was concomitant with a severe decline in tank irrigated areas. While various theories have been forwarded, including the most popular one on farmer and governmental negligence in the maintenance of tanks at the village level, farmers do not seem to think that it is the failure of the tank management institution that led to the decline of tanks. Instead, a majority of them believe that some element of climate change has had a significant effect on inflows to the tanks. In the coming sections, where we analyze the data at the village level, we revisit this issue to make sense of it, because understanding the reasons behind the decline of tanks would also give us clues as to how they can be better managed in the future.

6. Land Control and Tank Performance

Control over land and means of irrigation form the key ingredients of power in an agricultural setting. Thus, the presentation of data collected at the village level starts with an analysis of the landholding pattern in the area. The sampling plan for the study stratified the respondents on a caste basis. Table 1 presents the results from the survey of a community-wise landholding pattern in four villages only. The fifth village, Golapalli, had a multi village tank and data from the other villages, on the parameters of the table, were not collected.

As can be seen from the table, landholding in the villages is of two types: land held in the command area of the tank (*ayacut*) and land held in the catchment area of the tank. The table shows that there exists a high degree of inequality in landholdings in the command area of tanks. The inequality extends to the land in the catchment area as well, but to a lesser extent.

Figure 4 brings out this inequality in relief by presenting the Lorenz curve of landholding in the command and catchment area of the tanks for the 154 respondents in all five villages. As can be seen from the curve landholding in the tank command is significantly more inequitable than the landholding in the catchment area. This is further confirmed by Gini coefficient values for the two categories, with the coefficient for the command area of tanks being a high of 0.74 in contrast to the catchment area value of 0.52.[5] The reason given for the high level of inequity in landholdings in command areas is believed to be the historical nature of land distribution. The land in the command area of the tank has been distributed according to lines of historical landholdings, which respondents claim were even more inequitable in the past. In contrast, most holdings in the catchment area have come about through the granting of *pattas* (land rights) in the catchment, by the government of Andhra Pradesh. Electoral pressure ensured that all sections of the society got a fairer deal in the distribution of land in the catchment than in the tank command area.

Historical records reveal the institutional aspects of tank management by the importance of inequity in landholding for the overall maintenance of tanks. Francis (1905) notes that: “Practically all tanks were made by native governments. The importance, which they attach to their upkeep, is evidenced by the number of them to which *dasabandham inams* (awards or concessions given by rulers to large farmers) are attached. The grants confer certain proportions of the *ayacut* on favorable tenure, on condition that the grantee keeps the tank in order. Other farmers are not exempt from responsibility for the upkeep of the tanks, but are charged a cess called *bijvari*, which is devoted to repairs.”

A disaggregated analysis of inequality in landholding and the maintenance of tanks is carried out in table 2, to examine whether the relationship between landholding and tank maintenance still holds. The frequency, with which the tank fills up across the years, is used in the table as a simple surrogate for tank performance.[6] The table shows a clear correlation between the filling up of

[5]The closer the gini coefficient value is to 0, the lower the inequality: and the closer the value is to 1, the higher the inequality.

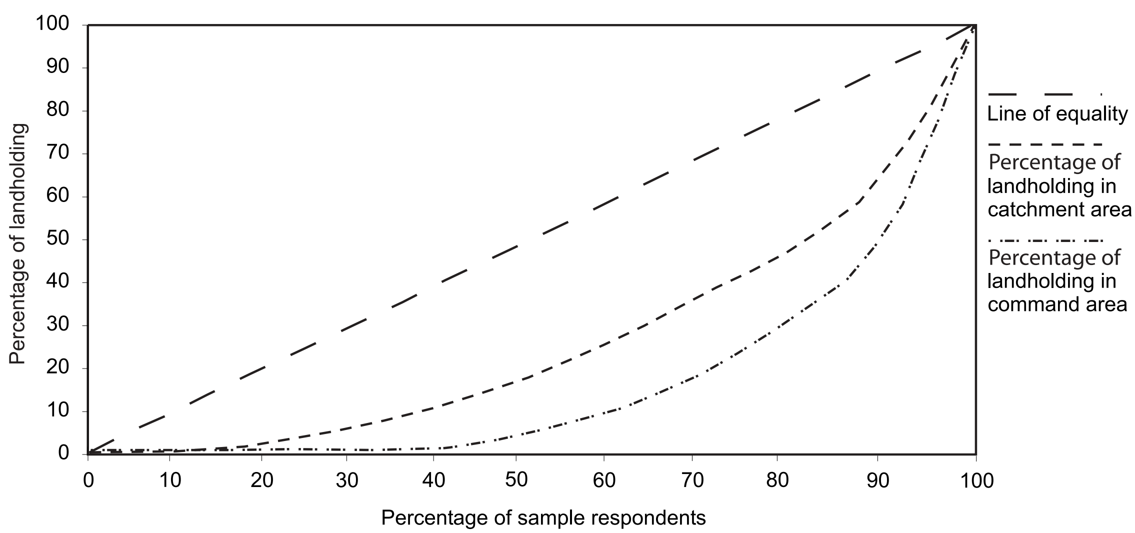
[6]Adequacy of water supply to the tanks is a necessary condition, but not a sufficient condition, for the tank to perform better. A tank may get sufficient water, yet it may not be performing well due to a misfit between physical and technological attributes and institutional arrangements. However, in the study villages it was seen, that tanks with adequate water supply also had clearly defined institutional arrangements for rule conformance, maintenance management and the equitable distribution of tank water. Thus, the frequency with which the tanks fill up can be taken as a reasonably good measure of their performance.

Table 1. Land ownership in command and catchment areas of the study tanks.

	Caste	% of village household	% of land owned in the ayacut	Average land owned in the ayacut	Average land owned in catchment
Thummala Kunta	Muslim	32	50	1.2	5.37
	Reddy	16	15	1.3	5
	Boya	29	9	0.31	2.86
	Other castes	15	13	1	1.5
Kethigani Cheruvu	Uppra	54	70	1.22	6.36
	Harijan	20	3	0.17	3.75
	Reddy	2	10	4.5	18.5
	Other castes	24	26	0.5	5
Khambala Palli	Reddy	16	80	2.7	11
	Boya-Wadda	73	20	0.13	3.6
	Lambda	9	0	0	3.6
	Other castes	2	0	0	2
Arumakula Palli	Reddy	27	55	1.95	7.29
	Boya	39	37	0.83	5.42
	Mangla	24	8	0.23	5
	Other castes	10	0	0	2.43

Source: Primary survey of 154 respondents across 5 villages.

Figure 4. Lorenz curve of landholdings in the catchment and command areas of the study villages.



tanks and the Gini coefficient for land in the command area. Tanks that fill up regularly have very high levels of inequality in landholdings. No such trend is apparent for the coefficient in the catchment area. Field-level data also reinforces this trend. The Thummalakunta tank had a *dasbandham inam* attached to it, which was conferred to a Muslim family in the village. The family treated the tank more or less as their own and spent money on regular repairs. However, fed up with the excessive control that the family exercised on the release of water from the tank, other landowners in the *ayacut* filed a case against them. The court verdict ordered the government to take over the tank. Since then the level of maintenance of the tank has deteriorated. In the Khambalpalli tank, a small number of "Reddy" households control all the land in the *ayacut*. Not only does this tank fill regularly, but also it is surprising to see how wide and neatly maintained the supply channels are. Therefore, it appears that picturing tanks as community managed open access systems is not consistent with the ground reality. Tanks that perform well have been, and in many cases are still, tightly controlled by a few privileged landholders in the village. Reduction in this control—through governmental take over or the waning interest of large farmers due to the generally low levels of incomes associated with agriculture—have proven to be detrimental to the functioning of tanks.

Table 2. Equality in landholding at the village level.

Name of the village	Water availability	Gini coefficient for command area land	Gini coefficient for catchment area land
Kethigani Cheruvu	Tank has not filled up in the last 10 years	0.59	0.48
Gollapalli	Tank fills up once every 6-7 years	0.46	0.34
Thummalakunta	Tank fills up once every 4-5 years	0.54	0.35
Arumakulapalli	Tank fills up once every 2 years	0.67	0.35
Khambalapalli	Tank fills up every year	0.76	0.40

Source: Primary survey of 154 respondents across 5 villages.

7. Agricultural Performance and Irrigation

One of the important questions regarding tank irrigation is the causality between increase in groundwater irrigation and the decline of tanks. Evidence points to the fact that, loosening control of privileged landholders in the tank *ayacut* seem to have an adverse effect on their maintenance. This section attempts to explore the reasons for the causality between the growth of groundwater and the decline of tank-irrigated area.

The cropping pattern of the survey respondents in the study villages is presented in table 3. The table shows that unirrigated crops dominate over the irrigated ones. Within the irrigated crops, mulberry seems to be the crop of choice. As was revealed earlier, many farmers installed tubewells because they were irrigating the mulberry crop. In periods of moisture stress, the mulberry stalks can survive by being dormant for long periods of time, which makes it the cash crop of choice in the region. Till recently, Ananthapur was the largest silk producing district in Andhra Pradesh, and realizations of high returns from silk meant that the farmers took to the production of mulberry in large numbers. However, the recent crash in silk prices, due to the arrival of Chinese silk to the market, has started a drop in the production of this cash crop. Future surveys of the area will reflect this trend.

Table 3. Cropping pattern of sample respondents.

Name of village	Unirrigated				Irrigated			Total land area (acres)
	Groundnut (%)	Gram (%)	Mulberry (%)	Maize/ sunflower (%)	Ragi/sunflower (%)	Chilly (%)	Paddy (%)	
Kethigani Cheruvu	14	19	16	22	1	15	12	185
Gollapalli	28	24	22	4	3	10	3	315
Thummalakunta	27	40	22	8	3	1	1	225
Arumakulapalli	38	46	6	0	0	0	8	240
Khambalapalli	43	33	5	0	0	0	8	210

Source: Primary survey of 154 respondents across 5 villages.

While well irrigation had been present from around 1900s, it is the development of tubewells that brought about an agricultural boom in this drought prone region. Tanks irrigated only a limited area, and one of the immediate effects of the growth of tubewell irrigation was an increase in the irrigated area. This can be seen from table 2, where villages like Khambalpalli and Arumakulapalli, which have mostly tank irrigation and little well or tubewell irrigation, have a very small percentage of crops under irrigation.

Most of the tubewells were sunk in the catchment area because viable large holdings of the farming households were situated only in these areas. The government played an active role in the promotion of the boom through the provision of loans and subsidies. Table 4 shows the way in which wells and tubewells were financed by the sample respondents. As can be seen from the table, most financing was done from multiple sources. In the case of tubewells, crop loans and bank loans were an important method of financing construction. There were a few government subsidies granted to the underprivileged sections of society as well as those reflected in the “other sources” column. On the other hand, well construction was largely privately financed with loans from moneylenders being the most important component. This was because most wells are quite old and many of the government loan schemes did not exist then. A high value in the “other sources” column for well construction is largely due to the advances made by a sugar factory in Hindupur for the construction of wells to the farmers supplying it cane. The factory is closed now.

In addition to government intervention in financing tubewells, another reason for the boom in groundwater irrigation was the drop in the cost of technology by as much as 30 percent or more. Specialized agencies for tubewell drilling also mushroomed all over. Whereas 15 years earlier, one would have to go to the district headquarters to find a hydrologist for well siting and a rig for drilling, now two to three such agencies exist in Hindupur alone.

Table 4. Source of finance for tubewells.

Type of well	Bank loans (%)	Crop loans (%)	Loans from moneylenders (%)	Personal finance (%)	Other sources (%)
Tubewells financed by:	23	76	64	100	13
Wells financed by:	20	8	80	100	35

Source: Primary survey of 154 respondents across 5 villages.

With accessibility to tubewell technology, the focus started to shift from tank-based irrigation, which was essentially precarious, to groundwater-based irrigation. The better off families started to give up land control in the tank command to consolidate their landholdings around tubewells. This, along with land fragmentation due to increases in family sizes, had a significant impact on the "democratization" of landholding in the tank command. In Khambalpalli and Arumakulapalli, where natural conditions like the presence of sheet rock prevented the sprouting of tubewells, the strong grip of a minority on landholding in the tank command remained. The figures in table 5 show a strong relation between tank performance and the number of tubewells, and thereby, corroborate this argument.

Table 5. Tank performance and tubewell concentration.

Name of village	Water availability	Number of tubewells in the village
Kethigani Cheruvu	Tank has not filled up in the last 10 years	40
Gollapalli	Tank fills up once every 6-7 years	25
Thummalakunta	Tank fills up once every 4-5 years	9
Arumakulapalli	Tank fills up once every 2 years	5
Khambalapalli	Tank fills up every year	3

Source: Primary survey of 154 respondents across 5 villages.

There are some who point out that in addition to the institutional factors, there might be a hydrological explanation for the tanks not filling up after the development of groundwater irrigation. While groundwater irrigation boomed in the 70s and 80s, the welfare effects of groundwater irrigation began to wane in the 90s due to the limited nature of hardrock aquifers. The unchecked growth of tubewell irrigation brought with it a total drying up of dug wells. In the tubewell dominated study villages, for example, all the open wells went dry at the turn of the 90s.[7] Along with the decline in wells, there was also witnessed a decline in the performance of tanks. It was witnessed that the performance of the tanks seemed to deteriorate with an increase in the number of tubewells. Discussions in the IWMI-Tata partners meeting (2003) indicated that such a situation might arise from falling groundwater levels—due to the excessive withdrawals made by tubewells—which makes the catchment area aquifer unsaturated.[8] As a result, a lot of the rainfall is absorbed by this unsaturated ground before it is allowed to runoff into the tanks. Singh et al. (2002) in a study of "Gundlur tan" in Karnataka, found that digging a large number of tubewells in the catchment area of the tank, resulted in a reduction of up to 40 percent in runoff to the tank. Thus, the tank, which used to spill once every 2 to 3 years, has not spilled over for the past 11 years.

[7]Farmers in several meetings asked for a government or NGO-led program to fill up the wells.

[8]Despite not receiving sufficient water to the tanks, farmers opting to grow mulberry and other profitable cash crops, and with drilling technology and subsidies being made available, have all contributed to the emergence of a large number of tubewells in the area. Tubewell densities have increased to such an extent that they too, are not getting sufficient water. This is a clear indication of the over use of potentially available surface and groundwater.

In the past few years, the tubewell-irrigated area has started to show clear signs of decline. The area irrigated by tubewells has been hit by two factors simultaneously— decline in discharge due to overwithdrawls and reduction in hours of electricity supply from the Andhra Pradesh State Electricity Board. This has led to a sizeable truncation of the, once vibrant, water market in the region. Table 6 shows the state of tubewell-irrigation at present and compares it with when they were at their peak. As can be seen from the table, water markets have contracted in breadth. There has been a significant change in the water market as water sellers have started giving water only to preferred customers (tenants, friends and relatives), as compared to a time when virtually anyone in the vicinity of a water seller could acquire water.

Table 6. State of tubewell irrigation.

Indicator	Tubewells functioning at their peak	Now
Average own land irrigated per seller	9 acres	5 acres
Average buyers land irrigated per seller	12 acres	2 acres
Average number of buyers per seller	7-8	2
Average number of sellers per buyer	3.5	2

Source: Primary survey of 154 respondents across 5 villages.

Thus, we gather a picture of an area, which is slowly declining after a period of groundwater irrigation led boom. An indication of this is also found in Table 7, which shows the diversification in livelihood in the study areas for the major communities. As can be seen from the table, most of the communities have diversified away from agriculture. This diversification in livelihoods is forced for many communities, as they are left with no stable livelihood option within the village. The Reddy community, which incidentally also owns the largest number of tubewells as compared to any other community, is the only one eking a livelihood from agriculture.

Table 7. Livelihood diversification.

Community	Factory workers (%)	Drivers (%)	Petty shop owners and small businesses (%)	Migrant laborers (%)	Farmers/ agriculture workers (%)
Muslim	35	17	80	7	92
Reddy	5	0	25	10	95
Boyas	2	0	17	80	40
Other castes	9	5	15	87	27

Source: Primary survey of 154 respondents across 5 villages.

8. Policy Options for Tank Rehabilitation

In view of the decline in the area irrigated by tubewells, large sums of donor money are now being made available to the governments of South Indian states for the rehabilitation of tanks. The key point of these tank rehabilitation projects has now become community empowerment to take over the functioning of the tanks. This is because experiences with 50 years of tank rehabilitation projects have shown that physical rehabilitation does not count for much, unless institutional mechanisms for maintaining the improved infrastructure are made. This is why, the US$100 million World Bank sponsored Karnataka Community Based Tank Management Project, for example, significantly stresses on the role of the community in two of the three project components: 1) undertaking tank system improvements; 2) establishing an enabling environment for the sustainable, decentralized management of tank systems; and 3) strengthening community-based institutions to assume responsibility for tank system development and management.

The key assumption behind the community-based tank rehabilitation project is that the communities were managing the tanks in the past and, that restoring the control of the community over the tanks would lead to their continued maintenance (personal communication with Mr. Madan Gopal, former head of JSYS, the body running the World Bank project in Karnataka). This conception of the community, however, does not gel well with the evidence that was gathered from the study villages. As has been seen from the evidence presented, tank maintenance by communities historically meant a high degree of inequality in landholding in the tank command and consequently in the share of benefits that different communities could derive from the tanks. But the conception of equity being promoted in the rehabilitation programs, which aim at an equitable division of benefits within the communities, rebels against this history. What needs to be recognized is that the model of community empowerment that is being supported today, is an entirely new paradigm of tank management that has not existed before. The promotion of such a paradigm needs to be supported by evidence from other areas, where community management of semi-public resources has worked—and the problem is that there are not many such examples.

In areas, as yet uninfluenced by rehabilitation programs, there is a silent movement going on. In these areas new and innovative strategies are being found, thereby redefining the way in which tanks are operated and managed. These innovative strategies are being pursued by NGOs and farmers themselves, in an attempt to improve the utility of tanks in their present condition. Evidences of such strategies coming into vogue have been documented in Ananthapur where Rao (1998), for example, reports the work of Chaitnya, a local NGO, which has claimed significant successes in converting tanks into percolation ponds. It has been found that such a move results in increasing the command area served by the tanks, through recharging of tubewells in the command area.

Shah (2002), in an examination of the economic incentives of various groups of tank users, in the case of the Chandeli tanks of Madhya Pradesh, comes out with the conclusion that fishing contractors have the best incentive for maintaining tanks. His argument stems from observations made in the Chandeli tanks, where the value generated from fishing was a significant proportion of (in some cases, higher than that of) agriculture carried out in the command area. He argues that in such scenarios the fishing contractor would be best suited to manage the tank, as he would provide a little irrigation to the command area farmers for a payment, thus supporting their crops, and use his revenue from fishing and agricultural payments to maintain the tank. With this argument, Shah was trying to restore the way in which tanks were managed historically—through practices like *dasbandham inam*, which gave preferential benefits to one individual in return for the responsibility of maintaining the tank.

Opposition to the argument is raised from the fact that such a move would be inequitable and would result in the "commoditization" of a community resource. However, there are also examples of community participation through which, not only has the water been used more efficiently by the farmers in the tank command, but also, people not owning land in the tank command, have been given the usufruct rights, thus resulting in a more equitable use of tanks. In the Jagraspalli tank in the Ananthapur district, for example, the tank sluice was closed and the tank was converted from a flow irrigation structure into a percolation pond. The tubewell owners in the command agreed to supply water to the non-tubewell owners at Rs 5 per hour when water was in the tank and at Rs10 per hour when no water was available in the tank. In Pednapalli tank, which was also converted into a percolation tank, siphons were used to irrigate the land of the command area by farmers who did not own tubewells, thereby reducing the conveyance losses (Gangi Reddy, personal communication). In Thummala tank in the Gotty *taluk* of Ananthapur Dalit, women were able to get rights over the fish catch from the tank with the help of the district collector. Also, they have been awarded the right to cultivate the tank bed after the water is exhausted. Such a move helped build the stake of non-command area farmers in the upkeep of the tanks (HANDS 2003).

The thrust on "community management" in the current tank rehabilitation programs precludes the possibility of these innovations. This is because most rehabilitation programs have their ultimate focus in restoring the tanks as flow irrigation structures. However the prominence that groundwater has acquired in the past three decades, means that groundwater needs to be built in any scheme of tank rehabilitation. For this we need to break out of the present day thinking, which views the utility of tanks only as flow irrigation structures. Evidence from Chandeli tanks has already shown that fishing can produce more value than irrigated agriculture, while evidence from tanks in Ananthapur has shown that tanks used as recharge structures provide a valuable life line to groundwater irrigation. There is a need to encourage more innovative ideas and solutions and work on them to develop a program of rehabilitation. It appears that viewing tanks in today's context i.e., by taking into account the realities of today, is going to be the way forward as far as rehabilitating tanks is concerned.

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