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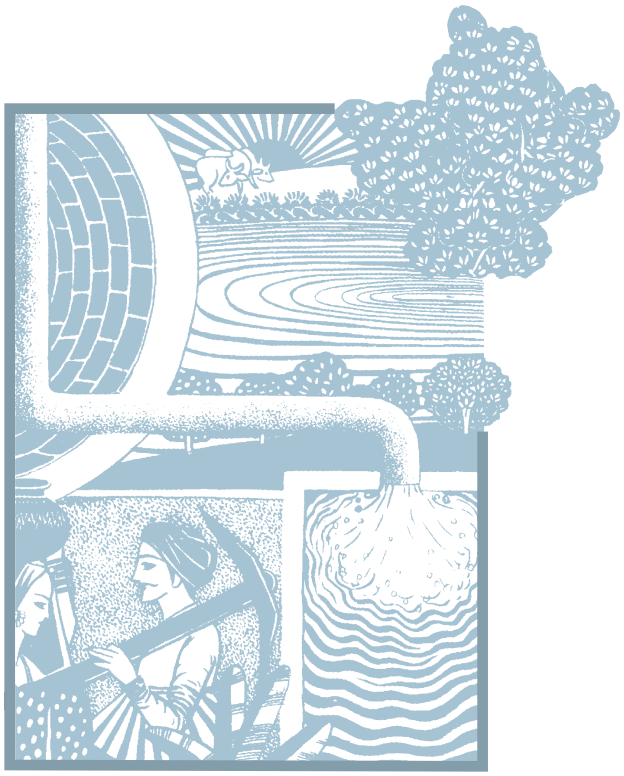

Mission Kakatiya is the flagship program of government of Telangana, a state whose formation itself was catalysed by perceived regional injustices in water distribution for irrigation. Launched in 2014, the mission aims to harness benefits of tank irrigation by increasing command area, water supply for irrigation and opportunities for agriculture. Based on multiple field studies, this Highlight presents a midterm assessment of the project's impact on increasing irrigated area, farmers' incomes, groundwater recharge, opportunities for agriculture and associated livelihoods and shares insights on improving implementation and maximizing net positive benefits.

IWMI-TATA
Water Policy Program

Water Policy Research
HIGHLIGHT

Reviving Minor Irrigation in Telangana

Midterm Assessment of Mission Kakatiya

Manisha Shah,
Bharti and
Shilp Verma

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Reviving Minor Irrigation in Telangana

*Midterm Assessment of Mission Kakatiya**†*

Research highlight based on Kumar and Kumar (2015); Bharti (2016); and Aryan et al. (2017).

1. Tanks in Peninsular India

Over the last half-century, tank irrigation has taken a back seat in peninsular India's minor irrigation landscape with tubewells revolutionizing the way farmers irrigate their land. In spite of being plagued by issues of power policies, frequent well failure and rapid groundwater depletion, pump irrigation has been able to provide 'on-demand' irrigation access to farmers and helped them grow multiple irrigated crops. Country-wide share of tank irrigated area, which accounted for more than 15 per cent in the 1950s (Thenkabail *et al*. 2009), has shrunk to a mere 3% in 2011-12 (MoSPI 2015). Flow irrigation from tanks, used for centuries to grow rice, has declined because of increased number of wells in tank commands. Accounting for 65 per cent of the country's territory, Peninsular India sits on hard-rock formations, primarily Deccan trap basalts and granitic basement complex; yet extensive areas are irrigated with groundwater. Tamil Nadu, where tank irrigation dominated in the earlier century, saw flow-irrigated area from tanks fall by a third, from 9,40,000 ha to 6,01,000 ha (Palanisami and Ranganathan 2004), reducing irrigation tanks to percolation tanks. Availability of cheap pumping technology and the provision of highly subsidised or free farm power catalysed a shift in farmers' irrigation preferences towards pumping water accumulated in wells recharged from tanks instead of using flow irrigation even in tank commands.

The Kakatiyas were a prominent dynasty in south India that shaped the history of Telangana between the 12th and 14th century from their capital in present day Warangal. The Kakatiya rulers built thousands of small reservoirs or tanks across Telangana to store rain water and make it available to people and their farms in the dry season (Kothavade 2017). Often built in a cascade, these tanks were managed and maintained by the communities through a system of decentralized governance. The tradition was to de-silt the water bodies in summer and apply the silt on farm lands to maintain and improve land productivity. Over the years, land use changes in the catchment, encroachment of tank beds, and reduction in their relative importance for irrigation eroded the decentralized governance institutions and led to their neglect. The fifth Minor Irrigation Census (GoI 2017; reference year: 2013-14) reports 46,531 such decentralized storages or tanks in Telangana.

The state government in (undivided) Andhra Pradesh too recognized challenges surrounding the lack of access to irrigation in the Telangana region, but it took a state reorganisation to germinate a comprehensive project aimed at reviving Kakatiya tanks to improve access to irrigation. In 2014, India's youngest state Telangana launched '*Mission Kakatiya*' to harness the benefits of tank irrigation by increasing command area, water supply available for irrigation and opportunities for agriculture. One of the major slogans of the Telangana movement was "*Mana Ooru*, *Mana Cheruvu*" (our village, our tank), which essentially became the tagline for Mission Kakatiya. The five-year long program intends to uphold the vision of *Kakatiyas* through revival and restoration of minor irrigation sources to their original capacity by effectively utilizing 265 billion cubic feet (7.5 BCM) of water allocated for minor irrigation sector under Godavari and Krishna River basins, achieving the basins' irrigation potential of twenty lakh acres.

2. Study Locations and Methodology

In 2015, not long after Mission Kakatiya was announced, the IWMI-Tata Program recruited two students from the Institute of Rural Management, Anand for an exploratory study of Mission Kakatiya. During their fieldwork, Kumar and Kumar (2015) visited 12 villages in Rangareddy and Warangal districts to understand Phase I implementation of the program. Largely based on qualitative enquiry and open-ended discussions, Kumar and Kumar (2015) reported on the several technical and institutional challenges the program was facing on the ground, including variability in community enthusiasm and participation across villages and legal disputes around encroachment of tank beds.

The following year, Bharti (2016) conducted another study for ITP in Warangal and Karimnagar which included detailed household interviews with 90 respondents in 5 villages and village-level focus group discussions (FGDs) in the command areas of 25 tanks in Warangal and Karimnagar districts during Phase II of the program. Bharti (2016) also conducted fieldwork in tanks where *Bala Vikasa* had worked with village communities to implement tank desilting. Besides looking at the impact of tank desiltation, Bharti (2016) made an interesting comparison between the implementation

* This Highlight is based on research carried out under the IWMI-Tata Program (ITP) with additional support from the CGIAR Research Program on Water, Land and Ecosystems (WLE). It is not externally peer-reviewed and the views expressed are of the author/s alone and not of ITP or its funding partners.

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protocols of *Bala Vikasa* and that under Mission Kakatiya.

In June 2017, ITP again recruited three IRMA students to assess the progress of Mission Kakatiya and its impact on the agrarian economy and on tank dependent livelihoods. Thirty seven villages in old Adilabad (Nirmal district) and old Warangal district were selected using purposive sampling to study examples of best implementation on the ground (see Figure 1). The selection of these two districts was done in order to focus on most successful tank de-siltation under the program in the last two phases. Officer on Special Duty, Irrigation and Superintendent Engineer (Godavari Basin), and officials from Irrigation Department were consulted for study area selection. Given that both districts have good rainfall and good project completion rates, the preconditions for best performance are met. For village selection within those districts, district level officers like Executive Engineers and Assistant Executive Engineers were consulted. From each *mandal* (block), 3-4 villages were selected. Tank repairs in 59 per cent of beneficiary villages covered were completed in phase I and remaining in phase II of the mission. A final round of fieldwork was undertaken in December 2017 where 11 of these tanks were revisited and 4 other tanks in Karimnagar and Nalgonda districts were studied. Data for *Kharif* and *Rabi* seasons of 2014-15 was taken as the base year (before) and compared with the two previous seasons from the time of survey – *Rabi* 2016-17 and *Kharif* 2017-18 (after).

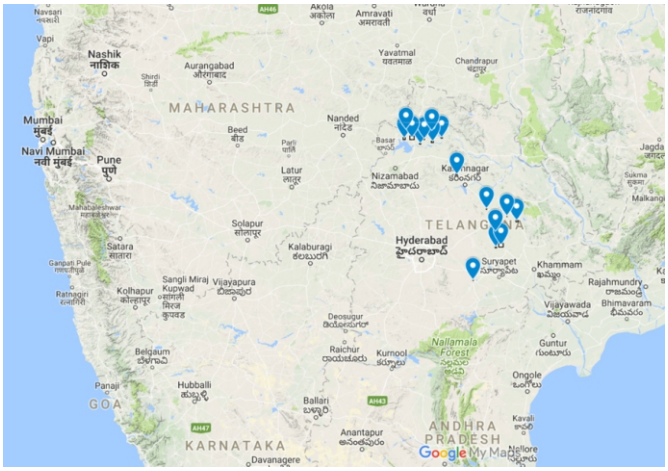


Figure 1: Study locations for Aryan *et al.* (2017)

3. Implementation Protocol

NGOs like *Bala Vikasa*, Lodi Multipurpose Social Service Society (LMSSS) and Modern Architects of Rural India (MARI) have also been implementing tank-desilting programs in Telangana; *albeit* on a much smaller scale. One estimate puts the total number of tanks desilted under NGO programs over the past decade at around 1,000 (Bharti 2016). The approach followed by these NGOs, especially *Bala Vikasa*, is quite different from the implementation protocol adopted in Mission Kakatiya. Bharti (2016) compared the two approaches on different aspects, as shown in Table 1.

Table 1: Implementation protocols of Mission Kakatiya and NGO Tank de-silting programs

Process	Mission Kakatiya Implementation Protocol	Protocol followed by Bala Vikasa and other NGOs
Institutional Arrangement	I&CAD is the implementing agency; it works in coordination with other line departments	A 5-7 member committee is formed for approvals, negotiating rates, scheduling silt lifting and supervision
Identification of Tanks	AE and DE (I&CAD) take lead; *Gram Sabha* passes resolution	Villagers identify tank and approach NGO
Selection of Tanks	AE and DE (I&CAD) select according to "*guidelines for prioritization of tanks*"; consult local political representatives	Villagers select; NGO provides technical support and guidance, feasibility study
Silt Testing	Mandal Agriculture Officer and District Soil Testing Lab involved; report sent to I&CAD	Community uses traditional knowledge and wisdom and selects area to be desilted
DPR Preparation	AE and DE (I&CAD) prepare DPR	NGO prepares DPR
Tendering and Contracting	Online tendering by I&CAD; selection based on least cost [₹ 120-150 per load]	NGO invites quotations and negotiates rates with contractors [₹ 40-50 per load]
Desilting	Contractors responsible; work under I&CAD supervision [Average desilted depth: 3 feet]	Contractors responsible; accountable to "*Supervision Committee*" [Average desilted depth: 5-6 feet]
Silt Lifting	Contractor responsible for organizing 12 tractors; thereafter farmers' responsibility	Committee includes tractor owners, ensures availability for silt transportation
Awareness about silt application	Contractors are responsible for awareness creation	NGOs undertake awareness creation through wall paintings and posters
Community contribution	Farmers contribute tractor cost only; rest funded through Mission Kakatiya	70% of the cost is borne by community; 30% by NGO / grant
Maintenance Fund	No 'maintenance fund' created for future desilting or repairs	Farmers who take silt contribute ₹10 / load towards a 'maintenance fund' used for plantation and repair works

Source: Adapted from Bharti (2016)

4. Impact of Mission Kakatiya

4.1 Impact on Irrigated Area

The main objective of Mission Kakatiya is to revive and boost minor irrigation in the region by increasing water storage capacity of tanks through de-siltation and repair of sluices, weirs, and irrigation canals. The project also has an impact on groundwater irrigation through increased groundwater recharge.

Field data shows a positive change in tank irrigated area for all tank sizes. Aryan *et al*. (2016) surveyed 37 "*best implemented*" Mission Kakatiya tanks and found that, on average, cultivated area increased by 196 and 159 per cent in *Kharif* and *Rabi* seasons respectively. However, a closer look at the data suggests that such an increase cannot solely be explained by increased tank storage capacity. Aryan *et al*. estimated that less than 10 per cent of the increase in *Kharif* area and less than 50 per cent of the increase in *Rabi* area can be explained by additional tank storage; to explain the additional area, they offer three explanations: [a] deficit rainfall in base year, 2014-15; [b] increase in area not only due to increased storage but also due to repair of tank sluices, bunds and weirs preventing any leakage to render floodplains around tanks cultivable; and [c] these numbers do not represent the "*average*" scenario as their sample was purposively biased. Aryan *et al*. (2016) also found that much of the increase in cultivated area was owing to expansion of paddy cultivation – both within and outside the tank command (Figure 2).

A local newspaper (Namasthe Telangana 2017) reported that out of 20,814 tanks across 17 districts, around 10 per cent were overflowing after monsoon 2017 and more than 40 per cent were more than half full, predicting a water sufficiency scenario for 3-5 additional months and attributed it to tank de-siltation. In the two phases of the mission, 130 million cubic metres of silt was removed from tank beds till February 2017 (Chintala 2017), creating an equivalent additional water storage capacity. At 2,500 m^3 per acre per season, this would irrigate an additional gross area of less than 21,000 ha. However, the assurance of water availability owing to better monsoon increased the area cultivated in *Kharif* season by 300,000 ha (Chandrashekhar 2017). Thus, it is safe to conclude that much of the additional area lay outside tank commands and was not attributable directly to additional water storage in tanks.

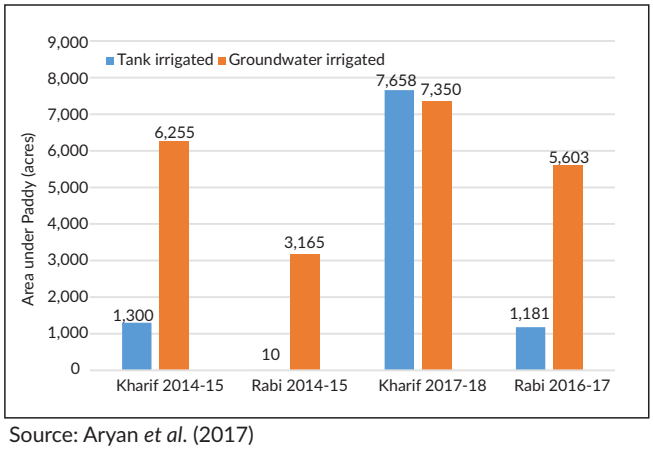
4.2 Impact on Farm Economics

Besides increasing cultivated and irrigated area, Mission Kakatiya has also significantly changed the farm economics by reducing cost of cultivation and increasing productivity. The silt removed from tank beds was lifted by farmers, transported and applied to their fields. Several studies (see, for instance, Mohammed *et al*. 2009; DHAN-CPP *nd*.) have noted, application of silt on farmlands adds valuable nutrients and improves the soil's moisture retention capacity. This helps farmers attain higher crop productivity while reducing their expenditure on fertilizers.

Our field studies report that the quantity of silt removed from a tank was a function of the farmers' demand for silt rather than the size of the tank. Farmers could avail the silt removed from the tanks free of cost but had to bear the transportation cost. Transporting a tractor-load of silt cost between ₹100-500, depending on the distance of the field from the tank, accessibility of the tank and tractor availability. Bharti (2016) reported 30-40 per cent increase in crop productivity and roughly ₹5,000 saving in fertilizer and pesticide cost per acre of cotton. Aryan *et al*. (2017) too reported improved productivity in paddy (15.5%), turmeric (22.2%), maize (26.9%), *mirchi* (28.5%) and cotton (41.8%) (Figure 3). The reduction in fertilizer and pesticide cost also varied with crop – ₹1,915 per acre (46.4%) for paddy and ₹3,490 per acre (45.8%) for cotton.

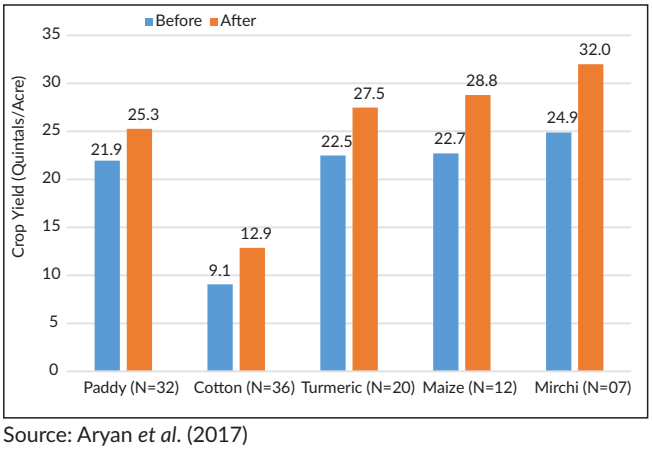
Aryan *et al*. (2017) calculated that the overall impact on profitability per acre after accounting for reduced cost of cultivation, improved yield and transportation costs. They estimated that profit per acre increased by 14.3 per cent for paddy and 47.8 per cent for cotton. Bharti (2016) also estimated the Benefit-Cost ratio of silt application for

Figure 2: Paddy area irrigated by groundwater and tank in base and study years



Source: Aryan *et al*. (2017)

Figure 3: Productivity change of major crops in the second year after silt application



Source: Aryan *et al*. (2017)

different crops and found that the ratio was highest for *Mirchi* (ranging from 6.2 to 13.7) and lowest for paddy (0.8 to 2.2). These results perhaps explain the farmers' preference for silt application in high-value cash crops, rather than in paddy.

The silt removed from the tank beds is supposed to be lab tested by the Agriculture department. However, our field studies found no evidence of lab testing in 7 of the 15 tanks visited in December 2017; the villagers relied on visual inspection and local knowledge to assess silt quality. Some farmers also faced shortage of tractors, found it difficult to pay transportation cost (as it often requires upfront cash payment) and even scarcity of silt to carry. Those who could apply silt, however, reported positive results. Kumar and Kumar (2015) also reported variable farmer interest for lifting silt and positive impact of silt application on farm economics.

4.3 Impact on Groundwater

Bharti (2016) noted that as a result of tank desilting, water levels in nearby open wells and borewells improved by 10-15 feet. Farmers from 14 blocks also reported additional 3-5 months of water availability in their wells, which has helped them irrigate crops in *Rabi*. Without accounting for rainfall variation across years, secondary data sources show a pre-monsoon water level decline of 4.5 m and post monsoon water level improvement of 2.7 m between 2014 and 2016 (Table 2).

A survey by the Telangana Groundwater Department comparing water table in May 2016 and 2017 reported an average year-on-year increase in ground water level by 3.45 m (The Hindu 2017). There was a rise in water levels in 22 out of 31 districts while remaining 9 districts reported water level decline. The number of tanks completed and expenditure for districts with highest water level rise (Medak, Nizamabad, Karimnagar, Warangal (U), Nalgonda) and highest water level decline (Jogulamba Gadwal, Vikarabad, Adilabad, Nirmal, Mancherial, Jagtial, Kumarambheem Asifabad) are shown in Figure 4. The districts with water level rise (the increase in levels ranging between 3 m in Warangal (U) to 11.46 m in Medak) mostly have a high number of tanks repaired and de-silted compared to the districts reporting decline in water level; the range of both rise and fall of levels, however, is wide. This is perhaps due to rainfall deviations, soil and aquifer conditions, proximity to water bodies; which vary across districts.

4.4 Impact on Related Livelihoods

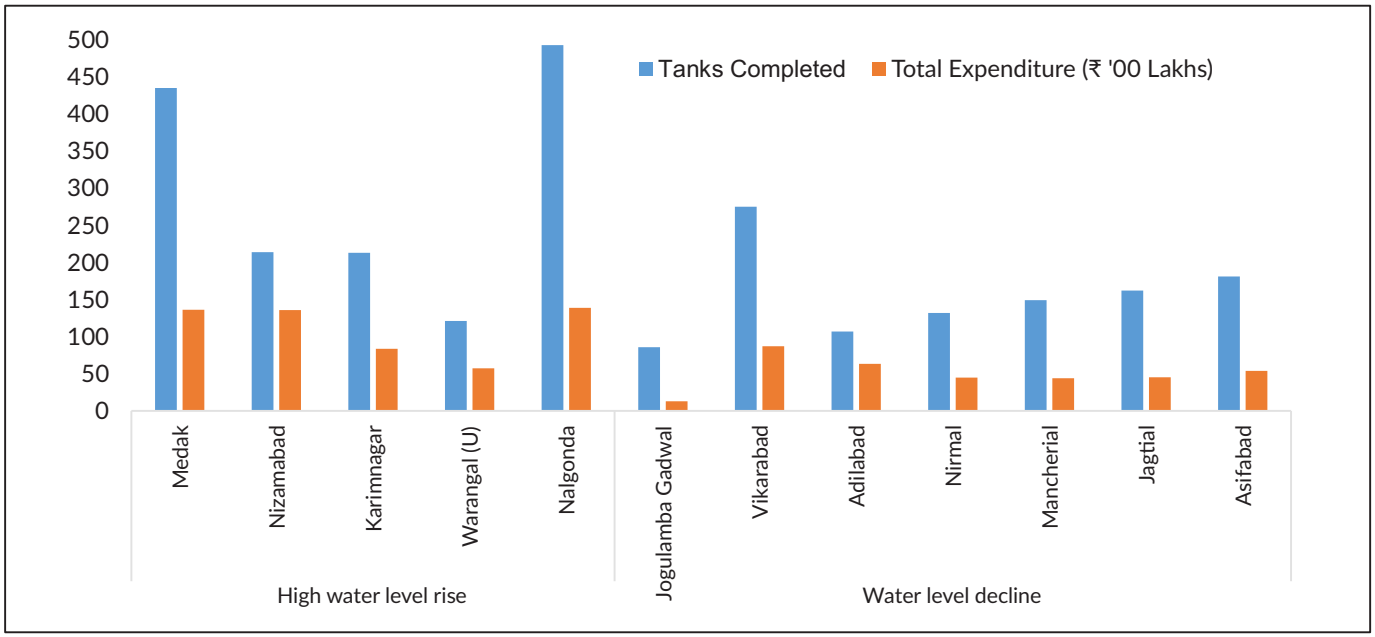
Though agriculture has a major share of benefits derived from tanks, other livelihoods like fishing, toddy tapping, and cattle herding are also benefitted by it. Telangana government's programs such as *Haritha Haram* (tree plantation drive) to plant *Toddy* and *Etha* trees around the tank bunds, distribution of fingerlings and goats at subsidised prices have ensured the ownership of the tank not only from the *ayacutdar* but also from the other stakeholders like cattle herders, toddy tappers and fishermen communities. Moreover, all informal cattle herders' societies and fishermen societies in every village are being formalised. Fish farming in the study area has emerged as a profitable venture where even non-fishermen community is willing to invest and harness the benefits from the tank in the village. An impact assessment study shows 62 per cent increase in fish production in the tanks across the state (NABCONS 2017). This additional source of income has helped them diversify their livelihood.

Table 2: Groundwater levels recorded in different *mandals*

Mandal Name	Pre-monsoon water level (m bgl)		Change (m)	Post-monsoon water level (m bgl)		Change (m)
	2014	2016		2014	2016	
Sarangpur	13.55	18.76	-5.21	13.68	8.80	4.88
Laxmanchanda	1.65	11.68	-10.03	2.53	1.25	1.28
Nirmal	3.31	4.02	-0.71	7.80	1.95	5.85
Khanapur	7.50	10.38	-2.88	6.86	5.27	1.59
Dilwarpur	9.40	18.42	-9.02	8.30	6.00	2.30
Pembi	4.25	7.48	-3.23	4.54	2.68	1.86
Mamda	3.07	5.23	-2.16	4.60	1.60	3.00
Kaddam	4.22	8.22	-4.00	3.83	1.45	2.38
Nallapalli	7.36	9.36	-2.00	7.88	4.20	3.68
Narsampet	6.28	12.72	-6.44	4.97	2.78	2.19
Wardanapet	7.93	11.41	-3.48	7.67	5.69	1.98
Wardanapet/ Ayanaval	7.93	11.41	-3.48	7.67	5.69	1.98
Elkathurthi	11.42	12.96	-1.54	10.00	11.11	-1.11
Thorrur / Pedha Vangara	8.02	16.62	-8.60	9.13	3.24	5.89
Average Values	**6.85**	**11.33**	**-4.50**	**7.10**	**4.40**	**2.70**

Source: Groundwater Department, Telangana

Figure 4: Tanks completed and expenditure incurred in districts with high water level rise and decline



5. Discussion and Conclusion

Mission Kakatiya, undoubtedly, has set the ground for technical innovations, tender reforms, online procurement, billing and payment, and created a noteworthy example for other state interventions. Our field studies strongly indicate that when implemented well, it has the potential to bring significant positive benefits to the village agrarian economy – in terms of expansion of irrigated area; enhanced groundwater recharge; reduction in cost of cultivation; improved crop productivity; and positive spill over impacts on fisheries, toddy tapping and cattle herding. However, the quality of implementation and responsiveness of the village community has not been uniform across the districts.

Our field studies threw up some insights on how Mission Kakatiya implementation can be improved:

[a] *Work Planning*: Bharti (2016) and Aryan *et al*. (2017) note that the work planning process was unduly focussed on civil works such as bund and sluice gate construction rather than on desilting for field application and groundwater recharge. The planning also seemed to give lesser priority to repair of feeder channels, distribution network, waste weir and removal of encroachments from tank beds and feeder channels.

[b] *Planning for Silt Uptake*: Bharti (2016) noted poor or complete lack of coordination between I&CAD and Agriculture departments; this often meant that the results of the silt tests were available only after the detailed work planning had been done. Bharti (2016) also reported that due to poor planning, tank desilting works were sometimes interrupted by rains.

[c] *Conflicting Interests*: The tank user community is a diverse set and comprises of command area farmers, non-command farmers, tank-bed cultivators, fishermen, washerwomen and toddy-tappers among others. This means that the interests of the community are not always aligned – e.g. fishermen prefer that the tanks remain full for as long as possible while command area farmers want the water to be released for irrigation. Optimizing tank operations to maximize net positive impacts needs the different stakeholders to work together – something that Mission Kakatiya has not put emphasis on.

[d] *Supply-driven Implementation*: Contrasting with the work done by *Bala Vikasa*, Bharti (2016) described Mission Kakatiya as a supply-driven, rather than demand-driven, program. As discussed in Table 1, in the case of *Bala Vikasa*, the community identifies and initiates the tank desilting process. This not only ensures their contribution, but also their commitment to the work. This is not the case in Mission Kakatiya where nearly all tanks in the state were taken up for desilting.

[e] *Sustaining Benefits*: By the time desilting work in the last tank under Mission Kakatiya is over, or soon after, tanks desilted in Phase I would be ready for another round of desilting. Traditionally, the operation and maintenance of tanks was managed by the community through the institution of *Neerudu / Neerkatti*. Mission Kakatiya seems to have missed out on an opportunity to revive this important institution to ensure that the gains achieved during implementation are sustained after the 5-year program.

This last insight is crucial unless the Government of Telangana sees Mission Kakatiya as an on-going program which will require significant public resources perpetually. In a scathing critique of Mission Kakatiya, Kumar *et al*. (2016) argued for the need for a scientific assessment of the hydrology of catchments in Telangana to better understand which tanks will benefit from desilting, and which might not. One way to address this critique, and also ensure local ownership of tank management is to turn the program into a

truly demand-driven project. It is safe to assume that village communities will not be very enthusiastic about maintaining tanks that have little or no chance of filling up due to land use or other changes in their catchment. On the other hand, tanks which do offer direct and indirect economic benefits through command area irrigation, enhanced groundwater recharge and positive impact on fisheries and other livelihoods should be routinely desilted, ideally by the local communities with support from the state.

Desilting of tanks needs to be done in a small time window before the monsoons each year. During this time, if the Government of Telangana can make JCBs available for villagers who want to desilt their tanks, a self-targeting mechanism can take shape. Just as *Bala Vikasa* enters a village only after a village community comes together and shows willingness to contribute, such a mechanism can ensure that where village communities see value in tank desilting, the government can extend a hand of support. The idea of having a maintenance fund through small contributions from farmers can also be effective in covering part of the desilting costs and/or clearing feeder and distribution channels. To encourage this and incentivize farmer contributions, the government can offer to top up the *Tank Maintenance Fund* through a matching contribution.

Finally, the government must also ensure that its policies do not result in conflicting outcomes. Through Mission Kakatiya, the government is investing heavily in improving groundwater availability and at the same time, the government announced 24*7 free power to farmers (Balakrishna 2017) – which will undoubtedly lead to groundwater over-exploitation. Such steps are likely to negate any long-term positive impacts of Mission Kakatiya.

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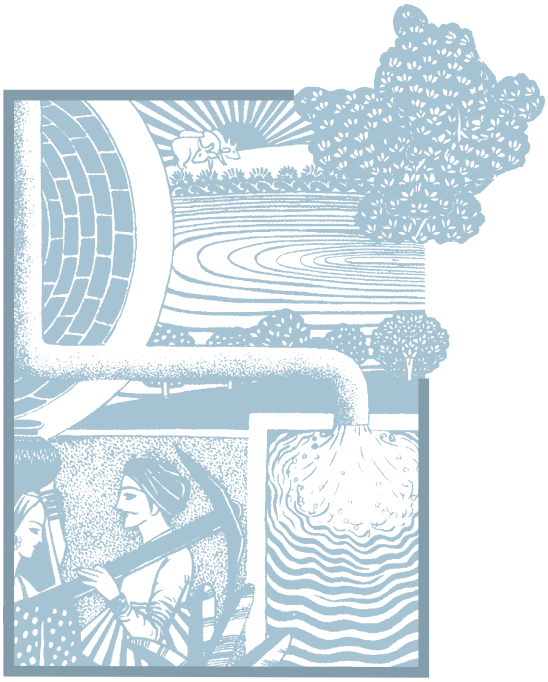

About the IWMI-Tata Program and Water Policy Highlights

The IWMI-Tata Water Policy Program (ITP) was launched in 2000 as a co-equal partnership between the International Water Management Institute (IWMI), Colombo and Sir Ratan Tata Trust (SRTT), Mumbai. The program presents new perspectives and practical solutions derived from the wealth of research done in India on water resource management. Its objective is to help policy makers at the central, state and local levels address their water challenges – in areas such as sustainable groundwater management, water scarcity, and rural poverty – by translating research findings into practical policy recommendations. Through this program, IWMI collaborates with a range of partners across India to identify, analyze and document relevant water management approaches and current practices. These practices are assessed and synthesized for maximum policy impact in the series on Water Policy Highlights and IWMI-Tata Comments.

Water Policy Highlights are pre-publication discussion papers developed primarily as the basis for discussion during ITP's Annual Partners' Meet. The research underlying these Highlights was funded with support from International Water Management Institute (IWMI), Tata Trusts, CGIAR Research Program on Water, Land and Ecosystems (WLE) and CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). However, the Highlights are not externally peer-reviewed and the views expressed are of the author/s alone and not of ITP or any of its funding partners.

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