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Rejuvenation of Water Resources Management for Sustainable Development: A case study on Mission Kakatiya in State of Telangana

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Abstract: More people are putting more strain on the land, and water-producing ecosystems are disappearing. Water is becoming increasingly unpredictable and limited due to climate change, causing devastation and displacing millions of people. United Nations Sustainable Development Goal-6 (SDG 6) the goal of ensuring water and sanitation for all by 2030, is a national responsibility. Policymakers at the national level need to set bolder priorities When we invest in water, other areas, including health, education, agriculture, and job creation are impacted positively. All facets of society must be represented in national action for it to be effective. Each person has a responsibility. Collaboration between governments, civic society, business, academics, and development aid organisations can result in significant improvements in water and sanitation. By accelerating the development of small irrigation infrastructure, supporting community-based irrigation management, and adopting an extensive programme for tank restoration, Mission Kakatiya seeks to improve the development of agriculture-based income for small and marginal farmers through sustainable irrigation resources. Against this backdrop, this in depth study explores through quantitative and qualitative methods whether strengthening of community based irrigation practices restoration of tanks and lakes in state of Telangana using the data from government of Telangana between 2015 and 2019, lessons drawn from this case study can be helpful to actors and policy makers.

Keywords: Water, Sustainable, Development, Mission Kakatiya, Tank Irrigation, Telangana

Introduction:

Water resource management is the corner stone for sustainable development. Water is one of the many diverse natural resources that India is gifted with. Its growth and management are crucial to the production of agriculture. For the alleviation of poverty, the preservation of the environment, and

sustainable economic growth, integrated water management is essential. Rapid population growth, urbanisation, and changes in anthropogenic water usage, farming patterns, and lifestyles are causing unsustainable ground water abstraction in the majority of the country. The countryhas been placed in the top list of ground water depletion (GWD) with 33.9 % of the global GWD linked with food production and trade. Aside from inefficient water use habits and poorly maintained, irrational irrigation systems, low prices for both energy and water supply are other factors contributing to groundwater depletion. Because of the wide variety in hydrogeologic setup and climatic circumstances, the natural groundwater availability and recharge in the regions is also quite heterogeneous. Planning, constructing, and regulating water resources in terms of quantity and quality across all the water users is considered as water management. It consists of the institutions, facilities, and financial support and information systems that backing and direct water management. Water resources management aims to maximise the advantages of water by ensuring there is enough water of sufficient quality for drinking water and sanitation services, food production, energy generation, inland water transport, and water-based recreation. As well as focus on healthy sustainable water-dependent ecosystems that safeguard the aesthetic and mystical values of lakes, rivers, and all water bodies. In addition, managing water resources, one must be cautious of hazards associated with them, such as contamination, drought, and floods. It takes combined managerial tools by considering the interactions and adjustments across various levels of uses and quantities and qualities of water because of the intricacy of the relationships between water and households, economies, and ecosystems. Water security is achieved when the potential source of water is maximum utilized and the wastage and leakage is controlled. The issue of guaranteeing adequate resource provision for human requirements includes reducing the hazards that water brings in locations where it is not adequately managed, in contrast to the ideas of food security or energy security. The ability to offer dependable water services, manage and mitigate water-related hazards, and assure sustainable water resource use are all examples of water security. The idea of "water security" offers a dynamic framework that extends beyond specific objectives like water scarcity, pollution, or access to water and sanitation in order to think more broadly about societies' expectations, choices, and accomplishments with regard to managing water. Changing societal values, economic success, risk exposure, and risk tolerance all influence this dynamic policy goal. Fairness issues must be resolved.

After evapotranspiration, India has an annual water supply of 1999 billion cubic metres (BCM), of which the country's potential water use is believed to be 1122 BCM. With an estimated 251 BCM of ground water used annually, or more than 25% of the total, India is the world's greatest ground water consumer. Ground water is an essential resource for India's rural areas, with more than 60% of irrigated agriculture and 85% of drinking water supplies reliant on it. Freshwater supply is under severe stress because it is predicted that it would fall to roughly 1400 cum in 2025 and further to 1250 cum by 2050.

The success of the Namami Gange programme and the introduction of the Jal Shakti Abhiyan are two examples of how the Indian government has been pushing integrated water resource management as a key component of its development plan. Conservation and water management go hand in hand. by means of the Jal Jeevan and Swacch Bharat Abhiyan initiatives. India has worked to improve solid and liquid waste management and the infrastructure for piped water supply.

Objectives

The Telangana government began Mission Kakatiya in 2015 with the goal of cleaning up all silt-filled

tanks, ponds, and other small irrigation sources so that rainwater could be collected and utilised for farming and other uses. Compared to medium- and large-scale irrigation projects, tank irrigation systems are more cost-effective.

All the tanks in Telangana are undergoing restored as part of Mission Kakatiya. The objective is to increase the development of agriculture-based income for small and marginal farmers through sustainable irrigation resources by conducting a comprehensive programme for tank repair. (Deshpande Sridhar Rao, 2019) The main objective is to ascertain if and how water tank rehabilitation impacts important outcomes, such as irrigation use, water table levels, water distribution patterns, local water markets, crop yields of rice, cotton, and maize, crop mix, and overall agricultural incomes.

Methodology

Mission Kakatiya rehabilitation project to approximately all of 46,500 tanks in the state in four phases. Priority was given to and rehabilitation work on the largest tanks in the state in the initial stages. The economic evaluation of Mission Kakatiya's advantages for smallholder farmers to comprehend soil nutrient return as well as productivity and profitability.This paper further extends the work of mission Kakatiya employing the Quantitative collecting numerical data and observe trends of four phases.

Data

The consolidated data relating to the mission Kakatiya total tanks constructed district wise data of 33, districts.

SL.No	Districts	No of Tanks rejuvenated	Amount in Lakhs spent
1	Adilabad	681	25,822.20
2	Nizamabad	1310	37,691.75
3	Karimnagar	1417	35,804.93
4	Medak	2727	3,284.25
5	Rangareddy	2054	1,310.50
6	Mahbubnagar	1647	19,008.22
7	Nalgonda	2108	16,167.05
8	Warangal	1080	5,336.16
9	Khammam	1578	20,805.67
10	Kumuram Bheem(Asifabad)	656	6,264.80
11	JayashankarBhupalpally	1080	13,680.40
12	JogulambaGadwal	603	1,541.14
13	Jagtial	1264	27,849.90
14	Jangaon	890	11,549.41
15	Kamareddy	2072	28,583.81
16	Bhadradri Kothagudem	2653	27,402.76
17	Mahabubabad	1669	32,496.34
18	Mancherial	943	4,981.90
19	Medchal- Malkajgiri	521	249.00

20	Nagarkurnool	2192	17,366.18
21	Nirmal	844	39,839.26
22	Peddapalli	1254	41,635.08
23	Sangareddy	2424	4,796.00
24	Siddipet	3568	12,471.90
25	Rajanna Sircilla	741	19,016.03
26	Suryapet	1166	17,595.91
27	Vikarabad	1169	7,727.71
28	Wanaparthy	1408	4,668.50
29	Hanumakonda	679	3,373.00
30	Yadadri Bhuvanagiri	1559	7,127.50
31	Narayanpet	991	2,553.50
32	Mulugu	930	8,836.17
33	Hyderabad	29	0.00
	Total	**45907**	**506,836.92**

(Source: missionkakatiya.cgg.gov.in. Government of Telangana)

Overview of the Mission Kakatiya in Telangana

Between the 12th through the 14th centuries, the Kakatiya dynasty, which had its capital in what is now Warangal, dominated Telangana. To conserve rainfall during the dry season, the Kakatiya people constructed a huge number of tiny reservoirs. The Kakatiya tanks, which were frequently constructed in a cascade, were governed and maintained by local fishing groups, tank command farmers, and cultivators of tank beds. To preserve and boost farmland productivity, communities would band together in the summer to collect silt from bodies of water. Farmers then put the silt to their fields. The catchment's changing land use patterns and the encroachment of tank beds caused the minor reservoirs to be neglected over time, which led to their state of degradation. In Telangana, there are more than 46,500 of these decentralised storage reservoirs.

The state government of Telangana aggressively developed a flagship programme for restoring water bodies and tanks after the creation of the state. A Minor Irrigation Census was conducted in July 2014 as a starting step. Ten Telangana districts have been determined to physically have about 46,500 water bodies.The "Mission Kakatiya" tank restoration programme was created with the goal of carrying on the Kakatiyas' legacy and features the slogan "Our village, Our tank." Following expert consultation, the government created a detailed action plan for Mission Kakatiya and decided to restore 20% of the tanks each year across all districts at once. A census was done before to the start of Mission Kakatiya, and it revealed that the State contained 46531 water bodies and around 5000 chain link tanks. The Mission planned to desilt, restore feeder channels, re-section irrigation channels, rebuild cross masonry and cross drainage structures, repair bunds, and otherwise rejuvenate 9,300 small irrigation tanks annually.

A significant irrigation project called Mission Kakatiya was started by Telangana's state government. It has been determined that there are physically 46,500 water bodies spread over ten Telangana districts.With the motto "Our village, Our tank," the "Mission Kakatiya" tank restoration programme was established with the intention of carrying on the Kakatiyas' legacy. With a budget of Rs 22,000 crore, Misson was established in 2015 with the goal of rehabilitating approximately

1/5 of all tanks across a total area of around 25 lakh acres. Nearly 20,000 tanks had restoration work underway as of February 2017, while about 5,000 tanks had it finished. In the budgets for 2015–16 and 2016–17, the Telangana government approved more than Rs. 4,600 crore for this effort. Desilting, fixing broken sluices and weirs, mending worn-out tank bunds, installing stone revetments, and plugging seepages are just a few of the tasks that are carried out as part of the mission. The objectives of Mission Kakatiya include raising yields, lowering electricity consumption in the agricultural sector, promoting the expansion of livestock, and reviving the rural economy as a whole.

Impact Studies on Mission Kakatiya

(i) Numerous organisations, including I NABCONS, (ii) IWMI, (iii) Michigan, (iv) Chicago University, and (v) Telangana State Ground Water Department, separately conducted studies on the effects of Mission Kakatiya.

Impact Assessment by NABCONS

- The Government of India established NABCONS as a constituent entity of NABARD. Adilabad, Karimnagar, Medak, and Nalgonda are the four districts where the 400 tanks of varied sizes that were erected as part of Phase I of Mission Kakatiya have been selected by NABCONS. The districts are chosen to represent each of the state's four agroclimatic zones. For stratification data of 40 tanks, groundwater exploitation status was also taken into account. Data was gathered through field surveys and interactions with stakeholders and government department officials for the years 2016–17 and 2013–14, and it evaluated the water spread area of the tanks, the extent of the cropped area, the area irrigated, and the cropping patterns. The study's numerous conclusions are listed below.(Deshpande Sridhar Rao, 2019)

- Since the mission Kakatiya-I was put into effect, the gap ayacut has decreased by 19.2 percent. There was an increase in gross area irrigated under tank ayacut 51.5% over the base year.The improvement in water retention capacity in the tanks following restoration work has led to a 45.6 percent rise in irrigation intensity over the base year.

- Despite the fact that there was a considerable amount of rain in the base year, the area under paddy has significantly expanded from 49.2 percent to 62.1 percent in the evaluation year thanks to the increased availability of water in the tanks. Its effects are particularly pronounced in the 2016–17 rabi season, when there was 7.2 percent less paddy than in the kharif season.

- After mission kakathiya-I, there has been an increase in the yields of paddy, cotton, and jowar compared to the base year. The growth in rabi paddy (19.6%%) and cotton is more notable (11.6 percent).

- The effect assessment study reveals a 35–50% decrease in chemical fertiliser consumption, which led to a 27.6% decrease in fertiliser spending over the base year. Depending on the crop, the reduction in costs per acre per season ranges from Rs. 1500 to Rs. 3000. Additionally, the use of tank silt increased crop yields, decreased soil erosion, increased soil moisture retention, levelled plot sizes, etc..(NABARD. al. 2017)

- Despite the fact that the impact year's rainfall was greater than the baseline year's, the impact year's increase in groundwater levels was greater because more water was kept in the tanks for a longer period of time. In the base year, the average increase in ground water level was 6.91 m, but in 2016 it is 9.02 m.

- In the tank ayacut region, household agricultural income has increased by 78.5 percent. Increased yields and irrigated land are two factors that explain the rise. With a 47.4% increase over the base year, agriculture income has increased significantly even at steady MSP.

- In addition to the farmers, the community of fishermen also benefits greatly from mission Katiya. Fish weight has increased as a result of longer water storage in tanks, which has also enhanced yield. In general, yield has increased by 36–39%, especially for the Rohu, Katla, and Mrigala species of fish.

- 63 percent of water customers who responded to the baseline survey said the physical state of the tanks in their neighbourhood is poor, with 3 percent saying it is very poor. After mission Kakatiya I, the public believes that 46.7% of the tanks are excellent. Only 5.1 percent of the tanks are assessed to be less than satisfactory, whereas 28.6 percent are good and 15.8 percent satisfactory. This will serve as a gauge for how transparent and dedicated the government has been to carrying out the programme.

(ii) <u>Findings of Impact Studies by IRMA/IWMI</u>

- Three research academics from the Institute for Rural Management (IRMA) in Anand, Gujarat, spoke on behalf of the International Water Management Institute (IWMI) in Sri Lanka. I visited numerous tanks where the mission kakathiya programme was put into practise, spoke with engineers from the I&CAD Department, and talked with stakeholders in the villages during my long tour of two Telangana districts (Adilabad & Warangal). They have presented a report titled "Report on Assessment of mission kakathiya 2017. The findings are as follows:

- After mission kakathiya, rice cultivation area is practically identical to tank irrigated land, making paddy the crop that benefits from tank irrigation the most. In addition, some villages saw the first paddy cultivation during the Rabbi season.(Deshpande Sridhar Rao, 2019)

- On average, the total area under cultivation expanded by 196 percent in the kharif season and by 160 percent in the rabi season.(Deshpande Sridhar Rao, 2019)

- The increase in productivity varies with the crop by adding silt to the fields. 3.32 quintals of improvements were made (15.51 percent) 3.79 quarts (44.03 percent) Five quintals (26.67 percent) Paddy, cotton, turmeric, maize, and chilies each received 6.08 quintals (27.4%) and 7.13 quintals (30.15%).

- Fertilizer consumption has reduced. Even after accounting for the expenditures associated with applying silt, there is a marginal increase in profit per acre of 14 percent in the case of paddy and 48 percent in the case of cotton due to both yield improvement and fertiliser reduction.

- In Nirmal district and Warangal district, the post-monsoon ground water level has grown by 48 and 40 percent, respectively.
- The amount of water that is available in wells used for irrigation has increased by 3.3 months.
- Other sources of income, including as fishing and grazing cattle, have increased thanks to Mission Kakatiya.
- In many villages, alternative means of subsistence have evolved into institutional forms like societies that protect the tank and its structure.
- In Nirmal district and Warangal district, the post-monsoon ground water level has grown by 48 and 40 percent, respectively.

(iii) Findings and Observations of University of Michigan

A 7-person team from the University of Michigan has been sent to south India to research and evaluate the de-silting of small irrigation ponds. especially in the state of Telangana. The crew spent three weeks touring the Nalgonda district and held a community symposium that drew 700 local farmers from ten villages nearby. They met with the farmers who would benefit from the project and gathered information about the district's pond silt use through surveys. The team went to villages with and without desilted ponds. The former had ponds that had undergone swift and extensive de-silting. The broad findings of the study suggest that desilting benefits both small- and large-scale systems, fosters both temporary and permanent employment, lowers the cost of farming inputs, and reduces total Green House Gas (GHG) emissions from agriculture. Telangana has more than 45,000 ponds spread over more than 11,000 villages, which presents an amazing opportunity. Their analysis, which was based on data from CRIDA, revealed that the use of silt significantly reduced the consumption of fertiliser and pesticides, which resulted in a 95 percent reduction in greenhouse gas emissions (GHG) from 2070 kg co2/acer for artificial fertiliser to 92 kg co2/acer for silt application. They found that utilising silt increased crop yields by an average of 50% the following year while reducing artificial fertiliser use by 36%, according to their survey and conversations with farmers. Their findings strongly imply that de siltation has beneficial effects on the environment and local farmers' health and economic position when it is incorporated into conventional agricultural techniques. (Deshpande Sridhar Rao, 2019)

(iv) Findings of TATA Center for Development in Chicago University

- Mission Kakatiya's effects were assessed in Telangana state by a four-person team (Xavier et al., 2018).The team from Chicago's initial findings are:
- An increase in the amount of water that is readily available in restored tanks when compared to unrestored tanks. Among tanks in a sample where irrigation was not present in 2015. Due to the lack of water, phase 1 and phase 2 tanks have significantly more irrigated areas than non-rehabilitated tanks.(Deshpande Sridhar Rao, 2019)

(v) In comparison to non-rehabilitated areas after the programme, a significant portion of surveyed framers utilized tanks water for irrigation in phase 1 and phase 2 areas. Farmers in repaired regions have a lot of tank irrigation days. More number of days have been added of tank

irrigation among farmers in rehabilitated areas. (Deshpande Sridhar Rao, 2019)

(vi) The Findings of their Study are

In 33 percent of wells, 5-10 Mts bgl water levels are the most usual during the pre-monsoon season, whereas 0-5 Mts bgl water levels are more typical during the post-monsoon season (41 percent of wells).Water levels in the influence zone are shallower than those in the non-influence zone during both seasons..

When compared to November 2017, May 2017 saw shallower water levels; when compared to May 2017, May 2018 saw deeper water levels; and 41 percent of the wells had water levels between 10 and 20 Mts below ground level.

For the water year 2017–18, there are 12.37 TMC of yearly replenishable ground water resources accessible, and 9.86 TMC of ground water is extracted during non-monsoon season, with an overall extraction stage of 80%. The percentage of ground water being extracted reduced by 12% (from 92 to 80), and the category was modified from critical to semi-critical.(Deshpande Sridhar Rao, 2019)

It is advised to extend the desiltation programme more aggressively in the remaining tanks because it has a good impact on the ground water regime and ground water quality. (Deshpande Sridhar Rao, 2019)

1.What Has Worked

Mission Kakathiya's primary goal is to revitalise small-scale irrigation by desilting tanks to increase their water storage capacity and mending irrigation canals, sluices, and weirs. Groundwater recharge from tank seepage has increased as a result of the project, which has also had an impact on groundwater irrigation.

- **Tank Silt Application**: As a result of mission Kakatiya, there has been a 35–50% decline in the consumption of chemical fertilisers, which has led to a reduction of 27.60% in the amount spent on fertilisers compared to the base year. Depending on the crop, cost reductions per acre can range from Rs. 1500 to Rs. 3000 every season. Additionally, the use of tank silt increased crop yields, decreased soil erosion, increased soil moisture retention, and levelled plot sizes.

- **Ground Water**: The mission Kakatiya has had a positive effect on the ground water level in the tank affect zones. Despite the baseline year's (2013–2014) rainfall being comparable to that of 2016, the impact year's (2016) increase in ground water levels is greater due to the tanks' larger and longer water storage capacities. The average increase in ground water level from September to February in 2016 is 9.02 m, compared to 6.91 m on average in the base year.

- **Gap ayacut:** In the year 2013-14, the gap ayacut was 42.40% whereas it is 23.20% in the year 2016-17, after implementation of the mission kakathiya phase I.

- **Irrigation Intensity:** The main cause of the rise in irrigation intensity (total crops are Kharriff & Rabi in ayacut) of 45.60 percent above the base year is the improvement in water retention capacity in the tanks as a result of restoration work that directly enhanced the water retention capacity in the tanks. With the implementation of mission kakathiya,

irrigation intensity increased from 88.40 percent in the base year to 134 percent.

- **Crop Yield**: After mission kakathiya Phase-I, an increase in paddy, cotton, and jowar yields above the base year was seen. In Rabi Paddy, the increase is more noticeable (19.60 percent and Cotton 11.60 percent)

- **Fisheries:** The fishermen's community is another big benefactor of Mission Kakatiya in addition to the farmers. Fish weight has increased as a result of the tanks' longer water storage duration, which has also enhanced yieldProduction has increased by an average of 36-39%, especially for the fish species Rohu, Katla, and Mrigala.

In the tank ayacut region, household agriculture income has increased by 78.50%. Increased yields and irrigated land are two factors that explain the rise.

2. 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. Mission Kakatiya as an on-going program which will require significant public resources perpetually. It is safe to assume that village communities will not be very enthusiastic about maintaining tanks that have life or no chance of filling up due to land useor 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 me window before the monsoons each year if the government can make JCBs available for villagers who want to desilt their tanks, a self-targeting mechanism can take shape.

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 me, the government providing round the clock free power to farmers 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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