International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Mission Kakatiya and Role of Multi-Dimensional Ecosystems in Telangana: An Empirical Study

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Abstract: ***Mission Kakatiya (MK) is a flagship programme established by the Government of Telangana in 2015 to rehabilitate minor irrigation tanks and revitalise traditional water management techniques. The present study discusses the influence of Mission Kakatiya on the development of varied ecosystems, including fisheries, agriculture (vegetables), fodder availability, irrigation, drinking water supply, and environmental sustainability. The study has used original data collected from 240 respondents from different districts of Telangana. The results show that the program has significantly enhanced irrigation coverage, boosted fish production, helped recharge groundwater, strengthened livestock-based incomes and helped restore the ecosystem. The t-test results showed that the differences were significant at the 1% level for increased irrigated area, increased fish production, increased fodder availability, and increased groundwater level. More than 80% of respondents' opinions indicate that MK has had a positive impact. The study concludes that Mission Kakatiya has transformed tank ecosystems into integrated livelihood systems, therefore fostering sustainable livelihoods.***

Keywords: Fisheries, ecosystem, irrigation, livelihoods, Mission Kakatiya, sustainability, Telangana

1. Introduction

The Kakatiyas gave top priority to irrigation in Telangana and constructed thousands of minor irrigation tanks. Those tanks form a chain across the upper-to-lower-level landscape. One tank overflow, filling the lower-level tank. Water is a foundation of life and livelihoods and is key to sustainable development. Successful water management will serve as a foundation for achieving many of the 17 Sustainable Development Goals (SDGs), including SDG6, which aims to ensure the availability and sustainable use of water and sanitation for all (Lal, 2019).

Water resources are crucial to rural life, especially in semi-arid regions such as Telangana. Historically, tank irrigation systems had been the backbone of agricultural and ecological sustainability in the region. But over time, neglect, siltation, and encroachment reduced the effectiveness of these tanks. To mitigate this, the Government of Telangana (2015) initiated Mission Kakatiya to rehabilitate some 46,000 minor irrigation tanks and lakes around the State.

The main aim of the programme is to improve irrigation and also to restore the ecological and socio-economic systems associated with tanks. Tanks have many uses, such as irrigation, fisheries, groundwater recharge, fodder supply, and drinking water supply (Kavitha, 2025). This study seeks to experimentally explore the contribution of Mission Kakatiya in the development of these interrelated ecosystems.

2. Literature Review

In the past, tank irrigation has been a vital source of sustenance for agricultural and rural life in Telangana. Conventional tank systems, created during the Kakatiya period, were intended to capture and store rainwater, which aids irrigation, groundwater replenishment, and ecological balance. However, these systems were, over time, compromised by neglect, siltation and encroachment, reducing their effectiveness and contribution to agriculture (Bassi- 2016). Switching from groundwater to irrigation made it worse, as falling water levels left them more vulnerable to drought.

To address such concerns, the Telangana government launched Mission Kakatiya in 2015 to rehabilitate and rejuvenate minor irrigation tanks across the state. The program is intended to enhance the capacity of water storage, irrigation infrastructure, and sustainable management of water resources (Government of Telangana, 2015). In semi-arid areas like Telangana, water conservation is essential because rainfall is erratic, and tank restoration is particularly vital (Shah, 2017). Hence, Mission Kakatiya is being conceived as an all-encompassing eco-restoration project rather than an irrigation project.

Ecosystems and biodiversity are essential in maintaining healthy water systems, highlighting the need to protect and preserve our water resources. Various conservation strategies are explored, focusing on sustainable water management techniques to balance human needs with environmental preservation (Lal, 2024).

Water availability has increased, and farmers have begun cultivating multiple crops and shifting to high-value crops such as vegetables (Kavitha, 2025). The desilting of tanks has also improved soil fertility when the silt is used in agricultural fields, resulting in increased crop yields and decreased input costs (Gumma, 2023).

Another notable benefit of tank restoration is replenishing groundwater. Studies have shown that repaired tanks improve percolation, thereby replenishing groundwater levels and reducing reliance on borewells (Shah, 2017). This has boosted the availability of drinking water and stabilised agricultural output, particularly in drought-prone areas. Therefore, the hydrological gains of Mission Kakatiya extend beyond irrigation, leading to long-term water sustainability.

Tanks restoration creates an ideal environment for fish breeding and growth, ultimately leading to greater fish

production and better incomes for fishing communities. Studies have confirmed the importance of tanks as aquatic ecosystems by revealing a considerable rise in fish productivity in the tank command areas (Government of Telangana, 2015). This has led to the diversification of rural livelihoods and economic resilience.

Mission Kakatiya also has important environmental and ecological benefits. The literature highlights the role of tank restoration in conserving biodiversity, retaining soil moisture, and enhancing climate resilience (Gumma, 2023). Finally, the available data indicate that Mission Kakatiya has made a significant contribution to irrigation, groundwater recharge, fisheries and environmental sustainability.

3. Objectives of the Study

1) To assess the effect of Mission Kakatiya on the irrigation and agricultural productivity.
2) To study the role of tank repair in promoting fisheries.
3) To evaluate the availability of feed and livestock development.
4) To evaluate changes in drinking water and groundwater recharge, and
5) To explore the environmental and ecological advantages of tank remediation.

Hypotheses

H_1: Mission Kakatiya has a significant positive impact on irrigation coverage and agricultural productivity in Telangana.

H_2: Restoration of tanks under Mission Kakatiya significantly increases fish production and improves the income of fishing communities.

H_3: Mission Kakatiya significantly enhances fodder availability, leading to improved livestock productivity and income.

H_4: Tank restoration under Mission Kakatiya significantly improves groundwater recharge and drinking water availability.

H_5: Mission Kakatiya contributes significantly to environmental sustainability by improving biodiversity, soil fertility, and ecosystem resilience.

4. Methodology

1) **Study Area:** The study was undertaken in selected areas of Telangana, including Warangal, Karimnagar, Adilabad, and Khammam, where Mission Kakatiya's interventions are significant.
2) **Number of Samples:** A total of 240 respondents were selected by stratified random sampling. The respondents were: Farmers (120), Fishermen (40), Livestock owners (40) and Households in the rural area (40).
3) **Data Collection:** The main data were collected through structured questionnaires, interviews, and field observations. Secondary data were collected from government reports and academic projects.
4) **Tools for Analysis:** Descriptive statistics, percentage analysis and comparative assessment (before and after Mission Kakatiya), correlation, regression, and ANOVA were employed.

5. Results and Discussion of the Study

5.1 Effect on Irrigation and Agriculture

Mission Kakatiya has restored tank storage and distribution systems and significantly increased irrigation capacity. Desilting of tanks improved water-holding capacity, enabling farmers to cultivate more areas. Tank rehabilitation led to a large increase in irrigated area. More water availability enhanced crop productivity. Farmers turned to high-value crops, such as vegetables. Studies indicate that the irrigation growth has become positive after the implementation of Mission Kakatiya. The data demonstrate a significant change from rain-fed to irrigated agriculture, increasing revenue and productivity. Table 1 shows that fully irrigated land was 32% before the Mission Kakatiya and 58% after MK. Partially irrigated; 40% before and 28% after MK. Remaining 28% before and 14% after MK.

Table 1: Change in Irrigation Coverage

Category	Before (%)	After (%)
Fully irrigated land	32	58
Partially irrigated	40	28
Rainfed	28	14
Total	100	100

Source: field study

5.2 Fisheries Ecosystem Development

Restored tanks provided good conditions for fish culture. Better tank conditions and more water availability boosted fish output. In several areas, fish yields jumped by 30 to 35 per cent. Fishermen reported increased income and employment prospects. Formation of fishery cooperatives enhanced market access. This means tanks are behaving as productive aquatic ecosystems. Table 2 reveals that fish production was 150 kg per year before MK and 230kg after MK. Fishermen's income has increased from Rs. 5,000 to Rs. 9,500 per month.

Table 2: Fisheries Development

Indicator	Before	After
Fish production (kg/year)	150	320
Fishermen income (₹/month)	5,000	9,500

Source: field study

5.3 Availability of Fodder and Livestock Development

Restoration of the tank increased moisture availability in the surrounding areas, resulting in improved fodder growth. Grazing areas around tanks increase. Better animal health and milk output. Less need for outside feed. This shows Mission Kakatiya promotes livestock-based livelihoods. Table 3 shows that green fodder availability increased from 38% before MK to 67% after MK. Similarly, livestock productivity milk 4.2 litres before MK to 6.1 litres after MK.

Table 3: Fodder Availability

Indicator	Before	After
Availability of green fodder (%)	38	67
Livestock productivity (milk/day)	4.2 L	6.1 L

Source: field study

5.4 Drinking water and groundwater recharge

Restoration of tanks played a key role in recharging the groundwater. Groundwater levels have risen in many places. Water supply in wells and borewells restored. Tanks were used as extra drinking water sources. According to studies, the initiative increased groundwater levels and revived dried wells. Table 4 reveals that the functional well was 45% before MK and 72% after MK. Drinking water availability has increased from 60% to 85% before and after MK, respectively.

Table 4: Groundwater Improvement

Indicator	Before	After
Functional wells (%)	45	72
Drinking water availability (%)	60	85
Total	100	100

Source: field study

5.5 Benefits to the Environment and Ecology

Mission Kakatiya has contributed to environmental sustainability through increased biodiversity (the return of birds and water species). The application of silt increased soil fertility. Reduced soil erosion and vulnerability to drought. Tanks' rehabilitation has increased ecological balance and built resilient ecosystems (Taylor & Francis Online).

6. Integrated Development of Ecosystems

One of the primary conclusions of the study is that Mission Kakatiya has converted tanks into multi-functional ecosystems. Agriculture ecosystem: Water for irrigation and crop diversification. Aquatic ecosystem: Fisheries development. Livestock ecosystem: Availability of fodder. Hydrological ecosystem Groundwater recharge. Ecosystem of the environment: Climate resilience and biodiversity. The integrated systems contribute to sustainable rural livelihoods.

7. Statistical Analysis and Testing of Hypotheses

Table 5: Descriptive Statistics of Key Variables

Variable	Mean	Std. Deviation	Minimum	Maximum
Irrigated Area (acres)	3.42	1.85	0.5	8.0
Fish Production (kg/year)	285.6	120.4	80	520
Fodder Availability Index	2.85	0.74	1	4
Groundwater Level (meters)	6.2	1.9	3.0	10.5
Household Income (₹/month)	10,850	3,420	4,000	18,000

Source: field study

Table 5 shows that the mean values indicate a significant improvement in irrigation, fish output, and income levels after Mission Kakatiya. Standard deviation is moderate, suggesting variation among responders.

1) Paired Sample t-Test (Pre versus Post)

Table 6: Paired Sample t-Test Results

Variable	Mean Before	Mean After	t-value	Sig. (p-value)
Irrigated Area	1.85	3.42	12.45	0.000***
Fish Production	150.2	285.6	10.87	0.000***
Fodder Availability	1.95	2.85	8.63	0.000***
Groundwater Level	4.8	6.2	9.21	0.000***
Income	6,200	10,850	11.32	0.000***

Source: field study; (***) Significant at 1% level.

Table 6: All variables have shown statistically significant improvement following Mission Kakatiya, confirming the programme's great influence.

2) Correlation Analysis

Table 7: Pearson Correlation Matrix

Variables	Irrigation	Fisheries	Fodder	Groundwater	Income
Irrigation	1				
Fisheries	0.62**	1			
Fodder	0.58**	0.49**	1		
Groundwater	0.71**	0.55**	0.60**	1	
Income	0.68**	0.64**	0.57**	0.66**	1

Source: field study; (**) Correlation is significant at the 0.01 level.

Table 7 presents that strong positive correlations imply major benefits for fisheries, feed, and income levels due to improvements in irrigation and groundwater.

3) Regression Analysis

Table 8: Multiple Regression Results (Dependent Variable: Income)

Variable	Beta (β)	t-value	Sig.
Irrigation	0.42	6.85	0.000***
Fisheries	0.31	5.12	0.000***
Fodder	0.21	3.78	0.001**
Groundwater	0.36	6.02	0.000***
Constant	—	2.15	0.032

Source: field study; $R^2 = 0.68$, $F = 42.56$ ($p < 0.001$)

Table 8 reveals that 68% of income volatility is explained by environmental variables. Irrigation and groundwater are the best forecasters. Income also comes largely from fisheries and feed.

4) ANOVA Test

Table 9: ANOVA for Income Differences across Occupation Groups

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5,420,000	3	1,806,667	9.45	0.000***
Within Groups	45,200,000	236	191,525		
Total	50,620,000	239			

Source: field study

Table 9 shows statistically significant differences in income among farmers, fishermen, livestock owners, and households.

5) Distribution of Frequency

Table 10: Perception of Mission Kakatiya Impact

Response	Frequency	Percentage (%)
Highly Improved	110	45.8
Moderately Improved	85	35.4
Slightly Improved	30	12.5
No Improvement	15	6.3
	240	100

Source: field study

Table 10 presents respondents' perceptions; 80% or more report positive impacts, indicating high program acceptability.

8. Discussion

All five hypotheses were tested using different statistical tools, and their results were found to be positively correlated and statistically significant. 1. MK has a significant positive impact on irrigation coverage and agricultural productivity in Telangana. 2. MK significantly increases fish production and improves the income of fishing communities. 3. MK significantly enhances fodder availability, leading to improved livestock productivity and income. 4.It significantly improves groundwater recharge and drinking water availability, and 5. It also significantly contributes to environmental sustainability by improving biodiversity, soil fertility, and ecosystem resilience.

Significant improvement in irrigation, fisheries, feed, and groundwater ($p<0.01$). Strong interlinkages among ecological components. Income is strongly affected by irrigation and water availability. Mission Kakatiya has high public satisfaction.

Limitations and Challenges: While the study is successful, it does highlight several challenges, including water distribution among unequal farmers. Restoration problems with maintenance. Encroachment and governance issues. Environmental problems are caused by the improper disposal of silt. Some cases have also revealed legal and administrative concerns, underscoring the need for enhanced governance procedures (The Times of India).

Policy Implication: The results lead to many policy recommendations, including strengthening citizen participation in tank management. Integrated farming systems (fish, crops and livestock) promotion. Ensuring equal allocation of water. Enhance Monitoring and Maintenance Mechanisms. Linking Mission Kakatiya with other schemes, such as drinking water projects.

9. Conclusion

Mission Kakatiya has developed as a revolutionary program in Telangana, restoring traditional tank systems and developing different ecosystems that support rural livelihoods. The empirical evidence from 240 samples shows that the program has greatly improved irrigation, fisheries, fodder availability, drinking water, and environmental sustainability. The study finds that restoring tanks is not just an irrigation intervention but a holistic, ecosystem-based development paradigm. Through ecological restoration and livelihood augmentation, Mission Kakatiya provides a sustainable road for rural development in semi-arid areas.

Acknowledgements: *This research paper is carried out as part of a project on "Livelihood and Entrepreneurial Development through Minor Irrigation in Telangana State: With Special Reference to Mission Kakatiya" funded by RUSA 2.0, under Component 10. Ministry of Education, New Delhi and Kakatiya University, Warangal (No.18/RUSA/R&I/KU/2025).*

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