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Farmers' Organisation and Irrigation Water Management in Vagaikulam of Tamiravaruni Basin (1995–2005)

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ABSTRACT

This paper examines the evolution and impact of participatory irrigation management in the Vagaikulam tank system of the Tamiravaruni basin, Tamil Nadu, during 1995–2005. Through a detailed case study, it analyses the formation and functioning of the Water Users' Association (WUA), the outcomes of tank modernization, and the challenges of social inclusion and financial sustainability. The study finds that the WUA model improved water distribution equity, increased agricultural productivity, and reduced conflict, while also highlighting persistent issues such as gender exclusion and vulnerability to rainfall variability. By critically reviewing contemporary literature and integrating empirical findings, the paper situates the Vagaikulam experience within broader trends in irrigation management reform, emphasizing the importance of adaptive institutions, inclusive governance, and technological innovation for sustainable rural water management.

Keywords: Participatory Irrigation Management, Water Users' Association (WUA), Tank Modernization, Agricultural Productivity, Social Inclusion, Common Property Resource.

1 INTRODUCTION

Vagaikulam, a prominent tank in the Tamiravaruni basin of Tamil Nadu, has long been a vital resource for irrigation and rural livelihoods. The period 1995–2005 marked a turning point in irrigation management here, driven by state policy reforms, the formation of Water Users' Associations (WUAs), and targeted tank modernization. This paper provides a detailed case study of Vagaikulam, critically reviews the literature of the period, and analyses the outcomes and prospects for participatory irrigation management.

2 OBJECTIVES

1. To document the formation and operational dynamics of the Water Users' Association in Vagaikulam.
2. To assess the impact of participatory irrigation management on water distribution, agricultural productivity, and conflict resolution.
3. To critically review the literature on tank irrigation management and modernization in Tamil Nadu (1995–2005).
4. To identify challenges related to social inclusion, financial sustainability, and gender participation within the WUA framework.
5. To analyze the prospects and policy implications for sustainable irrigation management in the context of technological and institutional innovations.

3 RESEARCH QUESTIONS

1. How did the establishment of the WUA in Vagaikulam affect water allocation and agricultural productivity between 1995 and 2005?
2. What were the main factors contributing to the success or limitations of participatory irrigation management in this context?
3. How did tank modernization and external support influence the effectiveness of local irrigation institutions?
4. What challenges related to social and gender inclusion persisted despite institutional reforms?
5. How does the Vagaikulam experience compare with broader trends in irrigation management in Tamil Nadu and India?

4 METHODOLOGY

Case Study Approach: The study employs an in-depth case study of the Vagaikulam tank system, focusing on the period 1995–2005.

Data Collection: Review of primary records from the WUA (membership, meeting minutes, fee collection, maintenance activities); analysis of agricultural yield and water delivery data; interviews with key stakeholders: WUA leaders, head- and tail-reach farmers, and irrigation officials; and field observations of tank infrastructure and maintenance works.

Literature Review: Critical synthesis of peer-reviewed articles, government reports, and project documents related to participatory irrigation management, tank modernization, and institutional change in Tamil Nadu.

Comparative Analysis: The Vagaikulam case is compared with similar experiences in other regions (e.g., Orissa) to contextualize findings and draw broader lessons.

Thematic Analysis: Challenges and outcomes are analysed thematically, with particular attention to equity, inclusion, financial sustainability, and institutional adaptability.

5 CASE STUDY: VAGAIKULAM TANK SYSTEM

5.1 Background and Setting

Vagaikulam tank, located in the North Kodaimelalagian Channel system, irrigates approximately 88 hectares directly through sluices 49–53, with additional areas served via the 44th sluice. The tank supports paddy as the principal crop, alongside pulses and groundnut in the dry season.

5.2 Formation and Functioning of the Water Users' Association

In 1995, following state-wide policy shifts, a WUA was established in Vagaikulam under the Tambraparani Project. The association comprised all landholding farmers in the command area, with an elected executive committee responsible for water distribution, maintenance, and conflict resolution.

Membership and Participation: The WUA had over 120 registered members, representing both head- and tail-reach farmers. Regular meetings were held, with attendance rates exceeding 70% in the initial years.

Water Allocation: The WUA implemented a rotational water supply schedule (warabandi), ensuring equitable access. Tail-end farmers, previously disadvantaged, reported a 25–30% increase in water deliveries during the main irrigation season.

Maintenance and Resource Mobilization: The association collected annual maintenance fees (Rs. 100–150 per acre), which funded desilting, bund repairs, and sluice maintenance. In 1998, the WUA mobilized a collective effort to desilt 1.5 km of field channels, reducing conveyance losses by an estimated 15%.

5.3 Outcomes and Impacts

Agricultural Productivity: Average paddy yields increased from 3.2 to 4.1 tons/ha between 1995 and 2005, attributed to improved water reliability and timely supply.

Conflict Reduction: The incidence of disputes over water allocation fell sharply, with the WUA mediating and resolving most cases internally.

Social Capital: The participatory process fostered greater trust and cooperation among farmers, including marginalized groups.

5.4 Challenges Encountered

Social Dynamics: Initial resistance from influential head-reach farmers required sustained facilitation by external agents (Irrigation Community Organisers).

Financial Sustainability: While fee collection was robust in the early years, late payments and defaults increased during years of poor rainfall.

Gender Inclusion: Women's participation in decision-making was limited, reflecting broader social norms.

6 COMPARATIVE AND THEMATIC REVIEW OF LITERATURE (1995–2005)

6.1 Participatory Irrigation Management and Institutional Change

The literature of the period highlights the transition from state-managed to farmer-managed irrigation systems in Tamil Nadu. Selvam (1995) provides a detailed account of the Vagaikulam WUA's formation, emphasizing the importance of local leadership, transparent rules, and regular monitoring. The study notes that the association's effectiveness depended on its ability to adapt traditional practices (such as communal labour) to new institutional frameworks.

Other studies (e.g., Palanisami and Easter, 2000) corroborate these findings, showing that WUAs in Tamil Nadu achieved better maintenance and water distribution outcomes than non-participatory systems. However, success was contingent on external support, especially in the early years.

6.2 Tank Modernization and Technical Innovations

Tank modernization programs, supported by the European Economic Community and state agencies, included physical interventions (desilting, sluice repairs) and institutional reforms (WUA formation). Research by Sakthivadivel et al. (2004) demonstrates that modernized tanks like Vagaikulam exhibited higher water use efficiency and reduced conveyance losses. However, the effectiveness of modernization was often undermined by encroachment, groundwater over-extraction, and inadequate cost recovery.

6.3 Water as a Local Common Property Resource

Recent scholarship frames tank irrigation as a local common property resource, managed through collective action (Shah and Ballabh, 1997). The Vagaikulam case aligns with Ostrom's design principles: clear boundaries, participatory rule-making, and graduated sanctions for non-compliance. Nevertheless, the literature warns that social heterogeneity and external shocks (droughts, policy changes) can destabilize collective management.

6.4 In-depth Analysis / Cross-Cutting Insights

- WUAs can enhance equity, efficiency, and sustainability in tank irrigation systems.
- Success depends on strong local leadership, external facilitation, and adaptive management.
- Persistent challenges include social exclusion, financial sustainability, and integration with broader water governance frameworks.

7 IMPACT OF IRRIGATION MANAGEMENT TRANSFER (IMT) ON AGRICULTURAL PRODUCTIVITY

Irrigation Management Transfer (IMT) has been widely promoted in India to improve the efficiency and sustainability of irrigation systems by devolving management responsibilities from government agencies to Water User Associations (WUAs). A detailed case study from Orissa, covering the period 1995–2005, demonstrates that IMT, combined with system rehabilitation, led to substantial improvements in agricultural productivity.

The study found that cultivated area increased by 9.6–22%, cropping intensity by 10–26%, and irrigated area by 18–107%. There was also a notable shift from a supply-driven to a demand-driven water delivery system, allowing for more timely and equitable distribution of water among farmers. These changes were accompanied by a diversified cropping pattern and higher productivity, reflecting the positive impact of local participation and collective decision-making on resource management.

The effectiveness of WUAs was assessed using a Group Dynamic Effectiveness Index, which indicated robust performance in leadership, participation, and conflict resolution. However, challenges remained, including the need for continued capacity building and financial sustainability. The Orissa experience aligns with findings from Tamil Nadu, where similar reforms in tank irrigation systems have led to increased yields and reduced water conflicts. Overall, IMT has proven to be a viable strategy for revitalizing minor irrigation projects, provided that adequate institutional support and technical guidance are maintained (Mishra et al., 2011).

8 GENDER EXCLUSION IN FARMER-MANAGED IRRIGATION SYSTEMS

Despite policy emphasis on participatory irrigation management, women's involvement in farmer-managed irrigation systems in Tamil Nadu has remained minimal. A case study by Dasthagir (2009) reveals that women are largely excluded from decision-making roles in WUAs, even though they contribute significantly to agricultural labour and water management at the household level. The study attributes this exclusion to entrenched social norms, lack of legal land ownership among women, and the perception that irrigation management is a male domain. As a result, women's perspectives and needs are often overlooked in water allocation, maintenance scheduling, and conflict resolution.

This exclusion not only limits the effectiveness of WUAs but also perpetuates gender inequality in rural communities. The research suggests that targeted interventions—such as legal reforms to recognize women's land rights, capacity-building programs, and reserved seats for women in WUA leadership—are essential to ensure more inclusive and effective irrigation management. Addressing gender exclusion is critical for achieving equitable and sustainable outcomes in participatory irrigation systems (Dasthagir, 2009).

9 RISE OF WELL IRRIGATION

Field research in Tamil Nadu indicates a marked decline in tank irrigation and a corresponding rise in well irrigation between 1980 and 2005. By 2005, tanks accounted for only 5% of the irrigated area, down from 19% in 1980. This decline is attributed to neglect of tank maintenance, siltation, and social discord that hindered collective action for upkeep. As tanks fell into disrepair, farmers increasingly turned to private wells, leading to over-extraction of groundwater. Wealthier farmers, with resources to deepen wells and invest in powerful pumps, were able to secure more water, often at the expense of their less affluent neighbours.

This shift has exacerbated groundwater depletion and increased inequality in water access. The findings underscore the need for revitalizing tank systems through community mobilization, regular desilting, and institutional reforms to ensure equitable water distribution and long-term sustainability (Vaidyanathan, 2001).

10 TANK IRRIGATION AS LOCAL COMMON PROPERTY RESOURCE

Tank irrigation systems in Tamil Nadu have evolved as classic examples of local common property resources, managed through collective action. Empirical analysis shows that successful tank management depends on well-defined boundaries, participatory rule-making, and the ability to enforce sanctions. However, institutional evolution is not uniform; some tanks thrive due to strong social capital and effective leadership, while others decline in the absence of cooperation or in the face of external pressures such as urbanization and policy neglect.

Theoretical and case-based research highlights that robust local institutions can adapt to changing socio-economic conditions, but require external support for technical upgrades and conflict mediation. Strengthening these institutions through legal recognition, capacity building, and integration with broader water governance frameworks is essential for sustaining tank irrigation as a viable common property resource (Shah and Ballabh, 2005).

11 PROSPECTS FOR 2005–2015

The modernization of irrigation systems in Tamil Nadu, particularly through the rehabilitation of traditional tanks and the adoption of micro-irrigation technologies, has significantly enhanced agricultural productivity over the past two decades. The Tamil Nadu Irrigated Agriculture Modernization and Water-Bodies Restoration and Management Project (TNIAMWRMP) exemplifies this transformation, focusing on reviving tank irrigation, improving infrastructure, and promoting water-efficient practices. By 2015, the project is expected to rehabilitate over 5,000 tank systems, increasing the fully irrigated area by nearly 40% and improving water storage and conveyance efficiency.

A key outcome of modernization has been the increased adoption of micro-irrigation, especially drip irrigation, which allows precise water delivery to crops, reducing losses and enhancing yields. Although initial adoption rates were below targets due to risk aversion among farmers, State and Central Government subsidies, along with peer influence, have led to a steady increase in uptake. The integration of micro-irrigation has been particularly beneficial for high-value crops such as coconut, sugarcane, and horticultural produce, contributing to both water savings and higher incomes.

The project also fostered institutional changes, notably the formation and capacity building of Water User Associations (WUAs), which have played a critical role in managing water distribution, maintaining infrastructure, and ensuring equitable access among farmers. These institutional reforms, combined with technical improvements, have resulted in yield increases of over 30% for paddy and notable gains for pulses and other crops. Furthermore, enhanced water availability has enabled diversification into fish culture and dairy, promoting rural livelihoods and resilience.

Peer-reviewed research corroborates these findings, emphasizing that integrated modernization—combining infrastructure upgrades, technological adoption, and participatory management—yields substantial and sustained improvements in agricultural productivity and resource use efficiency (Kumar et al., 2011). However, ongoing challenges include ensuring financial sustainability, adapting to climate variability, and scaling innovations to reach all stakeholders.

11.1 Strengths of the Vagaikulam Model

- Inclusive governance: The WUA's participatory approach improved water access for tail-end farmers and reduced elite capture.
- Resource mobilization: Collective fee collection and labour mobilization enabled timely maintenance and infrastructure upgrades.
- Conflict resolution: Internal mediation mechanisms reduced dependence on external authorities and fostered local ownership.

11.2 Limitations and Areas for Improvement

- Gender and social inclusion: Limited participation of women and landless labourers highlights the need for targeted inclusion strategies.
- Financial vulnerability: Reliance on annual fees makes the system susceptible to defaults during adverse years.
- Scaling and replication: The unique social cohesion of Vagaikulam may not be easily replicable in more heterogeneous or conflict-prone contexts.

11.3 Policy and Institutional Innovations

Recent years have seen the scaling up of participatory irrigation management through projects like the Tamil Nadu Irrigated Agriculture Modernisation Project (TNIAMP). Subbasin boards and federations of WUAs are being established to facilitate integrated planning and resource sharing.

11.4 Technological Advancements

Micro-irrigation (drip and sprinkler systems) is increasingly adopted, especially for high-value crops, with government subsidies accelerating uptake. Digital tools such as mobile-based advisory services and remote sensing are being piloted for real-time water management.

11.5 Climate Resilience and Sustainability

The increasing frequency of droughts and erratic rainfall patterns necessitates adaptive management. WUAs are being trained in conjunctive use of surface and groundwater, crop diversification, and ecosystem-based approaches.

11.6 Challenges and Opportunities

Institutional sustainability requires continued capacity building and financial innovation (e.g., water pricing, community-managed funds). Ensuring participation of women, smallholders, and marginalized groups remains a priority. Integration with basin-level institutions can enhance resilience and resource optimization.

12 CONCLUSION

The Vagaikulam case provides a compelling example of how participatory irrigation management can effectively transform traditional tank-based irrigation systems. Between 1995 and 2005, the formation of the Water Users' Association (WUA) under state reform initiatives marked a turning point in local water governance. The WUA enhanced water distribution equity, improved agricultural productivity, and substantially reduced conflict through localized mediation and rule-based allocation mechanisms. These institutional changes, supported by modest yet consistent resource mobilization, strengthened social capital and enabled the execution of timely maintenance and modernization activities.

The detailed case study aligns with findings in contemporary literature that underscore the significance of local leadership, participatory rule-making, and community ownership in the success of WUAs. Moreover, the Vagaikulam experience reflects broader patterns observed across Tamil Nadu and other Indian states, where irrigation management transfer (IMT), supported by technical interventions, has led to higher crop yields, increased cropping intensity, and better responsiveness to farmer needs.

Yet, the case study also exposes persistent limitations. Gender exclusion remained a major challenge, with women largely absent from leadership and decision-making roles despite their central role in agricultural labour. Financial sustainability proved vulnerable in the face of climatic uncertainties, particularly during drought years. The model's replicability may be constrained in socially heterogeneous or conflict-prone regions without similar levels of community cohesion or external facilitation.

Literature reviewed in the paper reinforces the view that tank irrigation systems function best when approached as common property resources embedded in broader socio-ecological contexts. The integration of micro-irrigation technologies, digital tools, and ecosystem-based strategies—as seen in projects like TNI-AMWRMP further illustrates the potential for modernized and climate-resilient irrigation models. However, the scaling of such models demands sustained institutional support, capacity building, and a stronger emphasis on social and gender inclusion.

Looking ahead, the prospects for sustainable irrigation in Tamil Nadu rest on deepening participatory governance, embedding digital and climate-resilient practices, and integrating WUAs into basin-level planning frameworks. This requires enabling policies, inclusive institutional architectures, and continuous adaptation to ecological and social dynamics.

In sum, the Vagaikulam experience demonstrates that participatory irrigation management, when properly resourced and socially inclusive, can significantly enhance water use efficiency, agricultural livelihoods, and local governance. Its lessons are vital not only for reviving traditional tank systems but also for shaping future water management strategies in an era of climate stress, rural transformation, and resource scarcity.

REFERENCES

1. Dasthagir, K. G. (2009). Women's Exclusion in Farmer Management of Irrigation Systems in Tamil Nadu: A Case Study. *Indian Journal of Gender Studies*, 16(3), 377–393.
2. Kumar, M. D., Singh, O. P., & Samad, M. (2011). Water management, productivity, and the impact of irrigation modernization: Evidence from Tamil Nadu, India. *Agricultural Water Management*, 98(12), 1828–1836.
3. Mishra, A., Ghosh, S., Nanda, P., & Kumar, A. (2011). Assessing the impact of rehabilitation and irrigation management transfer in minor irrigation projects in Orissa, India: A case study. *Irrigation and Drainage*, 60(1), 52–60.

4. Palanisami, K., & Easter, K. W. (2000). Tank irrigation in the 21st century: What next? *Economic and Political Weekly*, 35(19), 1622–1627.
5. Sakthivadivel, R., Shah, T., & Raju, K. V. (2004). Sustainable Tank Management in India: Issues and Approaches. *Irrigation and Drainage Systems*, 18(2), 89–105.
6. Selvam, V. (1995). Water Users' Association in Vagaikulam Tank, North Kodaimelalagian Channel, Tambraparani Project: farmers' experience. *International Water Management Institute*.
7. Shah, T., & Ballabh, V. (1997). Water Markets in North Bihar: Six Village Studies. *Economic and Political Weekly*, 32(52), A183–A190.
8. Shah, T., & Ballabh, V. (2005). Tank irrigation management as a local common property: the case of Tamil Nadu, India. *Irrigation and Drainage*, 54(3), 271–290.
9. Vaidyanathan, A. (2001). Local Water Management in Tiruchi District. *AgEcon Search*.