Tank Irrigation in Kanyakumari District: Patterns, Challenges, and Farmer Perceptions from Two Taluks

Vaisakh Petchinath M[1], C A Sham Shankar[2]

[1]*Research Scholar, Reg. No. 21113151031005, P.G. Department of Economics & Research Centre, S.T. Hindu College, Nagercoil – Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli -627012, Tamil Nadu, India.*
[2]*Associate Professor, P.G. Department of Economics & Research Centre, S.T. Hindu College, Nagercoil – Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli -627012, Tamil Nadu, India.*

Abstract

Sustainable agriculture and food production are crucial for achieving India's target of 30% sustainable food production by 2030. The National Mission for Sustainable Agriculture (NMSA) aims to enhance agricultural productivity, sustainability, profitability, and climate resilience through various initiatives. To meet these ambitious targets, improving resource efficiency, particularly in land and water use, is essential in agriculture. Secondary data from the Season and Crop Report of Tamil Nadu and Kanyakumari Statistical Handbook (various years) reveals a consistent decline in gross and net irrigated areas across canal, tank, and groundwater sources between 2014-15 and 2022-23. Tank irrigation, once the backbone of regional agriculture, has suffered a negative compound growth rate of -1.08% (gross) and -1.56% (net). Semi-structured interviews with 30 farmers from Agastheeswaram and Thovalai taluks further highlight the multifaceted challenges: invasive weed growth, high labour costs, exclusion of tenant farmers from Water User Associations (WUAs), and limited government funding. Community participation in tank maintenance remains sporadic, despite farmers recognising tanks' ecological and livelihood benefits. The study underscores the urgent need for inclusive governance reforms, streamlined MGNREGA convergence, and ecosystem-based management to revitalise tank irrigation systems. Future research should focus on institutional performance, ecosystem services valuation, and climate-resilient irrigation strategies to ensure sustainable water management and agricultural resilience in the district.

Key Words: tank irrigation, sustainable agriculture, community-participation, institutional performance

1. Introduction

1.1. Evolution of Participatory Irrigation Management (PIM) in India

India faces a severe water crisis, with nearly 600 million people experiencing high to extreme water stress. This situation arises from a combination of factors, including limited freshwater resources, rising demand due to population growth and urbanisation, and unsustainable water management practices (Vaidya Mahadevan, 2024). Agriculture, which consumes about 90% of India's freshwater, is particularly vulnerable to water scarcity. Consequently, this leads to reduced crop yields, increased food prices, and potential conflicts over water resources (Saccoccia, n.d.). Farmers are compelled to abandon agricultural activities due to a lack of irrigation water or stable income, resulting in the conversion of agricultural lands into commercial properties. This will impact the nation's food security and economic stability. Intense competition for water utilisation may result in changes to cropping patterns, irrigation systems, and increased efficiency pressures. This situation is likely to worsen due to the effects of climate change. The centralised management of irrigation has not yielded the desired outcomes, and the ongoing poor performance of large-scale irrigation projects has shifted attention to alternative strategies that cater to the water use and needs of local communities. Numerous studies have demonstrated that common property resources are better managed and utilised efficiently when entrusted to users, as they possess a greater incentive to maintain and preserve the resource (Gandhi & Namboodiri, 2002). This concept has led to participatory irrigation management (PIM), which empowers local communities to oversee the management and maintenance of water bodies, ensuring equitable water access for all users. PIM has seen widespread adoption in several countries, and the concept of PIM in India emerged at various points in time. Both the Sixth and Seventh Five-Year Plans emphasised the need for farmer participation. This change was continued in the National Water Policy in 1987 and again in 2005, which stressed farmer participation and led to guidelines being issued in 2005. The Report of the Committee on the Pricing of Irrigation Water in 1992, also known as the Vaidyanathan Committee, specifically focused on management through user groups. The need for introducing PIM was realised in India during the early 1990s, with the belief that it would help address deficiencies in the government-regulated irrigation system (Raju et al., 2008). PIM has gained support in many states in India and is seen as an important step towards the reforms in the irrigation sector, with the expectation that local farmer groups and Water User Associations (WUAs) would take responsibility for local irrigation and drainage management. WUA consist of farmers from the same region who elect a governing body and work together to maintain and oversee irrigation activities in a tank or canal system. They either complement or substitute the role of the state in irrigation management. PIM has issued guidelines based on which states such as Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Orissa, Rajasthan, Sikkim, Tamil Nadu and Uttar Pradesh have enacted exclusive legislations for involving farmers in irrigation management and the formation of WUAs. As a result of this there are around 85,000 WUAs have been formed covering an irrigated area of 17.84 million hectares (Ministry of Water Resources, 2002). This gives legal backing to WUAs and recognition of the rights of the water users.

The effectiveness of PIM has received a mixed response; however, it has ensured equitable access to water for all farmers, whether they are small or large farmers. increased efficiency of water use, an increase in irrigation intensity and agricultural productivity in many states after the implementation of PIM (Ghosh et al., 2019). Similarly, certain challenges hamper the full realisation of the benefits of PIM. PIM is often seen merely as transferring responsibilities to lower levels rather than a holistic shift in management. The Water Resources Department (WRD) must improve institutional arrangements for capacity building and incentives for effective management. Farmer participation in planning and prioritising is almost absent, and tenant farmers are often not involved despite provisions for inclusive membership. There is a significant gap between the proposed guidelines and the actual functioning of the WUAs. WUAs may function more as water distributors than managers. Meetings and general body meetings may be held primarily for formality. There is a need to examine the policies and practices implemented by states and WUAs that have yielded desired results and transfer those learnings to other WUAs.

1.2 Tank Irrigation in Tamil Nadu: Present condition, Policy reforms and its relevance

There has been extensive research on the decline of tank irrigation in Tamil Nadu and the factors contributing to this trend include encroachment, institutional challenges, declining community participation, rise in groundwater irrigation and lack of maintenance of tanks (Gandhiraj, 2006; Balasubramanian, 2006; Sathiyamoorthy et al., 2023). This change has not only led to the decline of traditional tank irrigation systems but also worsened the groundwater depletion, posing challenges to sustainable water management in the region.

Scholars such as Palanisami (2006, 2022) have demonstrated that the restoration of existing tanks is a more economically and environmentally viable alternative to developing new irrigation infrastructure or schemes. This ensures sustainable water management and better utilisation of public funds (Jain et al., 2024). Cost-benefit analyses indicate that rehabilitating tanks yields higher returns on investment by enhancing water storage capacity, improving groundwater recharge, and supporting agricultural productivity. For instance, a study by Palanisami (2022) demonstrated that the benefits of tank rehabilitation outweigh the costs, regardless of tank size, making it a cost-effective strategy for managing water resources.

Tamil Nadu was one of the states to implement PIM in a phased manner, and as a result, the government enacted The Tamil Nadu Farmers Management of Irrigation Systems Act, 2000, and it came into force in October 2002. The purpose of this Act is "to promote and secure distribution of water among its users, adequate maintenance of the irrigation systems, efficient and economical utilization of water to optimize agricultural production by involving the fanners and inculcating a sense of ownership of the irrigation systems in these in accordance with the water budget and the operational plan" (TAMIL NADU GOVERNMENT GAZETTE, 2001; Rajagopal et al., 2002). The Water Resource Department (WRD) is responsible for the formation of WUAs, and in Tamil Nadu, at present, there are nearly 5702 WUAs. The WRD is close to bringing amendments to this almost 25-year-old act by considering various stakeholders and addressing the shortcomings in the existing act. (Lakshmi, 2025).

Community participation, facilitated through WUAs, plays a vital role in the success of tank restoration projects. Studies have shown that active involvement of stakeholders in planning, organising and executing rehabilitation activities leads to improved maintenance, equitable water distribution, and better agricultural yields (Palanisami, 2006). Community-managed tanks exhibit higher performance levels compared to those managed by governmental agencies alone (Palanisami, 2022). Many studies have focused on and highlighted the importance of community-based organisations, especially WUAs from an institutional and governance perspective in sustaining tank irrigation systems. Mosse (2003) and Sakthivadivel et al. (2004) argue that the effectiveness of tank management is strongly based on participatory governance and collective action, with WUA acting as a link between the state and local farmers.

In Tamil Nadu, there existed the Kudimaramathu system, an age-old practice of community participation in tank repair and management. Customs and traditions guided this system passed down through generations until the arrival of British rule. Practices such as Kudimaramathu in Tamil Nadu and other traditional irrigation systems across India illustrate the rights available to village societies over water and natural resources. The community maintained full control over and access to water resources within their villages or field boundaries. The system functioned effectively and was characterized by well-defined rules and regulations governing all essential functions of water management, including system maintenance, water sharing, conflict resolution, collection of penalties for non-participation in maintenance work, and other measures to meet community needs (Sivasubramaniyan, 2006). The colonial rule led to the decline of the Kudimaramathu system, even though the British realised its importance and later supported the system (Rajendran, 2018). The green revolution is another reason for the decline of the Kudimaramathu system as high-yielding varieties (HYVs) of crops need proper water many high-income farmers started adopting tube and bore wells. When the influential farmers became less active in the tank management, the small farmers were not able to gather enough resources to maintain the tank systems (Venkatachalam & Balooni, 2018).

Recognising the importance of tank restoration, the Government of Tamil Nadu launched the Kudimaramathu scheme in 2017, aiming to revive the traditional practice of community-led maintenance of water bodies (Rajendran, 2018). Local communities, especially farmers, are encouraged to take part in desilting, repairing bunds and clearing encroachments in tanks and lakes under this scheme. This scheme has improved water availability for irrigation in many places, but once the government stops funding for this program, we have to wait and see whether community participation will still continue managing the tank sustainably. (Venkatachalam & Balooni, 2018). Despite policy shifts aimed at reviving traditional participatory practices, studies bring light on the challenges, such as the dominance of elite groups in the WUA, limited capacity of farmers and weaker participation restrict the full benefits of community-managed irrigation systems (Janakarajan, 1993; Ranganathan et al., 2018). These challenges show that even though institutional reforms have created opportunities for decentralised water governance, genuine inclusion of all users, including tenant farmers and accountability within WUAs remain critical for achieving equitable and efficient outcomes.

From a socio-economic perspective, tanks are deeply interwoven with rural livelihoods, particularly for small and marginal farmers who depend on tank irrigation for cultivating paddy and other crops. Several scholars (e.g., Palanisami et al., 2009; Janakarajan, 1993) emphasize that tanks provide not only a lifeline for agricultural production but also a safety net during dry spells, thereby reducing farmers' vulnerability to rainfall variability. However, the benefits of tank irrigation are not evenly distributed—access to water often reflects broader social and economic inequalities shaped by caste, class, and landholding size. Studies highlight the need for targeted interventions to ensure that the most marginalized groups can fully benefit from tank irrigation, emphasizing the importance of inclusive decision-making and equitable water allocation within WUAs.

The environmental and ecosystem services perspective broadens the understanding of tanks beyond their agricultural function, framing them as multi-functional landscapes that offer critical ecological benefits. Recent research by Karthikeyan et al. (2020) and Jayanthi et al. (2012) underscores the role of tanks in groundwater recharge, flood moderation, and biodiversity conservation. Tanks also serve as habitats for a variety of aquatic and terrestrial species, contributing to the maintenance of regional ecological balance. Nevertheless, rapid urbanization and encroachment have significantly threatened these ecosystem functions, with studies calling for integrated tank restoration approaches that balance agricultural needs with environmental sustainability (Sundaravadivel et al., 1999).

Finally, the climate resilience perspective is emerging as a critical dimension of tank irrigation research in Tamil Nadu. Scholars such as Kumar et al. (2022) argue that tanks are invaluable buffers against climate variability, acting as decentralized water storage systems that mitigate the impacts of erratic monsoon patterns and prolonged droughts. By retaining runoff and facilitating groundwater recharge, tanks can play a pivotal role in enhancing the adaptive capacity of rural communities. Recent studies advocate for integrating climate-smart strategies—such as catchment treatment, contour bunding, and vegetation buffers—into tank rehabilitation efforts (Jayanthi et al., 2021). This aligns with broader calls for linking traditional tank systems with modern climate resilience frameworks, recognizing the vital role of tanks in securing rural livelihoods and sustaining agro-ecological systems in a changing climate.

Despite these positive developments, challenges remain in sustaining community engagement and ensuring the long-term success of tank rehabilitation efforts. Issues such as inadequate institutional support, lack of capacity building, and limited financial incentives can hinder the effectiveness of WUAs. Therefore, it is imperative to strengthen institutional frameworks, provide technical assistance, and foster a sense of ownership among community members to achieve sustainable outcomes in tank irrigation management.

1.3 Relevance of the Study

While the existing literature on tank irrigation in Tamil Nadu has explored the institutional, socio-economic, environmental, and climate resilience dimensions, there remains a notable gap in studies focusing on farmers' perspectives on tank irrigation and the functioning of WUAs in Tamil Nadu. There is also a gap in studies focusing on the unique challenges and opportunities of tank irrigation in the Kanyakumari district. Despite the district having more than 2000 tanks, which play a vital role in the development of agriculture has received limited attention. The present study aims to fill this gap by systematically assessing the performance of tank irrigation systems and the functioning of Water User Associations (WUAs) in Kanyakumari district. By providing a comprehensive understanding of the ground realities, such as governance structures, social capital, and ecological sustainability, this research offers valuable insights that can inform targeted policy interventions and strengthen community-based water resource management in the district. Ultimately, it contributes to the broader discourse on the revitalisation of tank irrigation systems in Tamil Nadu, offering context-specific recommendations for ensuring sustainable and equitable water governance.

2. Materials and Methods

2.1 Data Sources and Initial Analysis

This study examines the patterns, challenges, and farmer perceptions of tank irrigation in the Kanyakumari district of Tamil Nadu. Using secondary data extracted from the Season and Crop Reports of Tamil Nadu over various years, a study was conducted to understand the agricultural and irrigation patterns in Tamil Nadu. Similarly, analysis was performed on data compiled from the Statistical Handbook of Kanyakumari District for various years to study the changes in the gross irrigated area and net irrigated area.

2.2 Farmer Perception Survey

It is necessary to understand the challenges faced by farmers from their perspective. To strengthen secondary data analysis, primary data were collected through semi-structured interviews. Fifteen farmers from Periyakulam, Veeramathandapuram WUA in Thovalai Taluk and fifteen farmers from Eraviputhoor, Kadankulam WUA in Agastheeswaram taluk were chosen for this purpouse. The farmers were purposively selected to ensure the representation of varied farm sizes and socioeconomic backgrounds. This approach enabled the study to capture a range of perspectives on tank irrigation practices, benefits, and challenges in the district.

The semi-structured interview schedule included questions on:

- Farmers' dependency on tank irrigation.
- Perceptions of tank condition and maintenance.
- Challenges faced in accessing water.
- Participation in community-level water management activities.

Interviews were conducted in the local language (Tamil) to ensure clarity and encourage open responses. Responses were transcribed and thematically analysed to identify common and divergent views across the two taluks.

2.3 Data Analysis

Secondary data on irrigation trends were tabulated and visualised using descriptive statistics to highlight the key trends and patterns. Qualitative data from the farmer interviews were analysed thematically to understand the nuanced perceptions and challenges associated with tank irrigation.

By integrating both quantitative secondary data and qualitative primary data, the methodology ensures a comprehensive understanding of tank irrigation in the district, capturing both macro-level trends and micro-level farmer experience.

3. AGRICULTURE AND IRRIGATION PATTERN IN TAMILNADU: AN ANALYSIS

TRENDS IN THE SOURCES OF IRRIGATION IN TAMILNADU: 2000-01 2021-22

As provided in Table 1, at the state level, the irrigation through canal forms 831744 hectares in 2000-01, and this has declined to reach 756096 hectares in 2009-10. It is also seen that irrigation through tanks constituted 589152 hectares in 2000-01, and this has declined to 504064 hectares in 2009-10. In the case of wells as the source of irrigation, it stood at 1305376 hectares in 2000-01, and this has increased slightly to reach 1595248 hectares in 2009-10.

TABLE 1

TRENDS IN THE SOURCES OF IRRIGATION IN TAMILNADU: 2000-01 2021-22

(in Ha)

Year	Canals	Tanks	Wells	Others	TOTAL
2000-01	831744	589152	1305376	161728	2888000
2001-02	809489	619021	1229639	142851	2801000
2002-03	614460	422730	1168860	106260	2312310
2003-04	448932	384492	1168512	146064	2148000

2004-05	754182	464112	1242027	176679	2637000
2005-06	800080	575240	1465840	78840	2920000
2006-07	780030	531576	1484946	92448	2889000
2007-08	753232	506928	1492144	114560	2866864
2008-09	764991	539304	1614981	11724	2931000
2009-10	756096	504064	1595248	8592	2864000
2010-11	748384	532896	1621984	8736	2912000
2011-12	746928	527592	1683552	5928	2964000
2012-13	589389	420237	1628088	5286	2643000
2013-14	653676	324159	1642227	58938	2679000
2014-15	667870	332572	1684668	40890	2726000
2015-16	671351	348316	1750007	39326	2809000
2016-17	675881	349452	1764577	65934	2855844
2017-18	675485	351032	1785732	5762	2818011
2018-19	844740	347838	1985484	5105	3183167
2019-20	647983	351484	1669322	3614	2672403
2020-21	687818	372316	1719506	4254	2783894
2021-22	683806	410214	1830779	4703	2929502
AVERAGE	709388.5	445669.4	1569705	58555.54	2783318
CV	12.81	21.38	14.38	101.62	7.87
LGR	-0.31	-2.33	2.00	-12.46	0.41
CGR	-0.22	-2.28	2.10	-15.77	0.45

Source: Season and Crop Report of Tamil Nadu, various years.

The other sources formed 161728 hectares in 2000-01, and this has declined to reach 8592 hectares in 2009-10. From all sources, the total net area irrigated forms 2888000 hectares in 2000-01, and this has declined to reach 2864000 hectares in 2009-10. As provided in the table, at the state level, the irrigation through canal forms 748384 hectares in 2010-11, and this has declined to reach 683806 hectares in 2021-22. It is also seen that irrigation through tanks constituted 532896 hectares in 2010-11, and this has declined to 410214 hectares in 2021-22. In the case of wells as the source of irrigation, it stood at 1621984 hectares in 2010-11 and this has increased slightly to reach to reach 1830779 hectares in 2021-22. The other sources form just 8736 hectares in 2010-11, and this has declined to reach 4703 hectares in 2021-22. From all sources, the total net area irrigated forms 8736 hectares in 2010-11 and this has declined to reach to reach 4703 hectares in 2021-22. The irrigation pattern by all sources for the overall period indicates that the average level of irrigation through the canal formed 709388.5 hectares. Irrigation through Tanks formed 445669.4 hectares. Irrigation through wells formed 1569705 hectares. Irrigation through other sources formed 58555.54 hectares. Irrigation from all sources formed 2783318 hectares. In terms of growth rates, while the growth in irrigation through canals stood at -0.31 per cent, the growth in irrigation through Tanks stood at -2.33 per cent, Tube wells 2 per cent, other wells -12.46 per cent, and overall, the irrigation from all sources increased at the rate of 0.41 per cent. The coefficient of variation, as a measure of dispersion indicated that canal irrigation has registered a coefficient of variation of 12.81 per cent, Tanks irrigation has registered a coefficient of variation of 21.38 per cent, well irrigation has registered a coefficient of variation of 14.38 per cent, irrigation from other sources has registered a coefficient of variation of 101.62 per cent and the overall dispersion stood at 7.87 per cent.

3.1 TRENDS IN AREA IRRIGATED IN KANYAKUMARI DISTRICT

Gross Area Irrigated

As provided in Table 2, in the case of gross irrigated area by source, in the district of Kanyakumari, irrigation through canal sources stood at 10457 hectares in 2014-15 and has declined to 9460 hectares in 2022-23. The average level of area irrigated through this source stood at 9209.89

hectares for the entire study period, with a coefficient of variation of 13.73 per cent. During the study period, the area under canal irrigation has grown at a negative linear growth rate of -0.23 per cent and a positive compound growth rate of 0.10 per cent. In the case of tank irrigation, the area irrigated by this source stood at 14899 hectares in 2014-15, and this has declined to 13696 hectares in 2022-23. The average level of area irrigated through this source stood at 14261.00 hectares for the entire study period, with a coefficient of variation of 5.06 per cent. During the study period, the area under tank irrigation has grown at a negative linear growth rate of -1.11 per cent and a negative compound growth rate of -1.08 per cent. In the case of Ground Water irrigation, the area irrigated by this source stood at 6380 hectares in 2014-15, and this has declined to 3211 hectares in 2022-23. The average level of area irrigated through this source stood at 4000.56 hectares for the entire study period, with a coefficient of variation of 25.76 per cent. During the study period, the area under Ground Water irrigation has grown at a negative linear growth rate of -7.98 per cent and a negative compound growth rate of -7.14 per cent. In the case of Dug wells irrigation, the area irrigated by this source stood at 2696 hectares in 2014-15, and this has increased to 3277 hectares in 2022-23. The average level of area irrigated through this source stood at 3288.78 hectares for the entire study period, with a coefficient of variation of 10.67 per cent. During the study period, the area under Dug wells irrigation has grown at a linear growth rate of 0.20 per cent and at a positive compound growth rate of 0.42 per cent. In the case of all sources of irrigation, the area irrigated by this source stood at 34432 hectares in 2014-15, and this has declined to 29644 hectares in 2022-23. The average level of area irrigated through this source stood at 30760.22 hectares for the entire study period, with a coefficient of variation of 7.29 per cent. During the study period, the area under all sources of irrigation has grown at a negative linear growth rate of -1.60 per cent and a negative compound growth rate of -1.50 per cent.

NET AREA IRRIGATED

As provided in Table 2, in the case of the district of Kanyakumari, among the various sources of irrigation, the net irrigated area through canals stood at 8683 hectares in 2014-15, and this has declined to 7952 hectares in 2022-23. The average level of area irrigated through this source stood at 7735.33 hectares for the entire study period, with a coefficient of variation of 14.61 per cent. During the study period, the area under canal irrigation has grown at a negative linear growth rate of -0.03 per cent and a positive compound growth rate of 0.35 per cent. In the case of tank irrigation, the area irrigated by this source stood at 11221 hectares in 2014-15, and this has declined to 10348 hectares in 2022-23. The average level of area irrigated through this source stood at 10637.22 hectares for the entire study period, with a coefficient of variation of 5.36 per cent. During the study period, the area under tank irrigation has grown at a negative linear growth rate of -1.60 per cent and at a negative compound growth rate of -1.56 per cent. In the case of Ground Water irrigation, the area irrigated by this source stood at 5392 hectares in 2014-15, and this has declined to 3011 hectares in 2022-23. The average level of area irrigated through this source stood at 3647.22 hectares for the entire study period, with a coefficient of variation of 20.68 per cent.

TABLE:2

	Gross area irrigated																					
Source	2014-15		2015-16		2016-17		2017-18		2018-19		2018-19		2020-21		2021-22		2022-23		AVERAGE	CV	LGR	CGR
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area				
canals	53	10457	53	10616	53	6207	53	9019	53	9337	53	8983	53	9409	53	9401	53	9460	9209.89	13.73	-0.23	0.10
tanks	2623	14899	2623	15411	2623	14908	2623	13037	2623	14249	2623	13909	2623	14239	2623	14001	2623	13696	14261.00	5.06	-1.11	-1.08
Ground Water	1590	6380	1598	4736	1786	4000	1749	3721	1833	4055	1859	3572	1880	3100	1896	3230	1982	3211	4000.56	25.76	-7.98	-7.14
Dug wells	2113	2696	2145	3865	2166	3659	2103	2958	2103	3306	2073	3090	1951	3387	2038	3361	2043	3277	3288.78	10.67	0.20	0.42
total	6379	34432	6419	34628	6628	28774	6528	28735	6612	30947	6608	29554	6507	30135	6610	29993	4025	29644	30760.22	7.29	-1.60	-1.50
	Net area irrigated																					
Source	2014-15		2015-16		2016-17		2017-18		2018-19		2018-19		2020-21		2021-22		2022-23		AVERAGE	CV	LGR	CGR
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area				
canals	53	8683	53	8742	53	4906	53	8154	53	7841	53	7587	53	7866	53	7887	53	7952	7735.33	14.61	-0.03	0.35
tanks	2623	11221	2623	11646	2623	11249	2623	10429	2623	10264	2623	10165	2623	10258	2623	10155	2623	10348	10637.22	5.36	-1.60	-1.56

Ground Water	1590	5392	1598	4091	1786	3700	1749	3377	1833	3746	1859	3466	1880	2975	1896	3067	1982	3011	3647.22	20.68	-6.38	-5.83
Dug wells	2113	2682	2145	3789	2166	3422	2103	2858	2103	3236	2073	3067	1951	3350	2038	3301	2043	3161	3207.33	10.07	0.27	0.45
total	6379	27978	6419	28268	6628	23277	6528	24818	6612	25087	6608	24285	6507	24449	6610	24410	4025	24472	25227.11	6.80	-1.57	-1.49

TRENDS IN THE SOURCE WISE GROSS AND NET AREA IRRIGATED IN KANYAKUMARI DISTRICT

Source: Table computed from Kanyakumari Statistical Handbook of various years

4. Semi-Structured Interview Analysis

The semi-structured interviews with farmers and Water User Association (WUA) presidents in Agastheeswaram and Thovalai taluks revealed critical insights into the current state of tank irrigation in Kanyakumari district. Thematic analysis of these interviews yielded three overarching themes: (1) tank condition and maintenance challenges, (2) issues related to community participation and institutional coordination, and (3) broader perceptions of tank irrigation's role in rural livelihoods and sustainability.

4. 1. Tank Condition and Maintenance Challenges

A recurring concern among farmers was the proliferation of invasive species, particularly *Prosopis Juliflora* and other weeds, in and around the tanks. These species not only obstruct the supply channels but also contribute to the pollution of tank water, adversely affecting both irrigation and the health of the aquatic ecosystem (Sharma & Raghubanshi, 2010). Farmers reported that routine maintenance, such as de-weeding and channel clearance, typically occurs once a year or when the overgrowth becomes unmanageable. Due to limited financial resources, these tasks often rely heavily on the pooled labour of local farmers.

Another significant barrier to tank maintenance identified by respondents is the high cost of labour. The implementation of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) in the region has inadvertently diverted agricultural labour to better-paying wage labour opportunities, making it difficult for farmers to hire workers for tank upkeep. Although MGNREGA provisions theoretically support labour-intensive public works like tank maintenance (Ramakrishnan, 2014), the interviews underscored a lack of coordination between Panchayat bodies and WUAs in utilising MGNREGA funds for these activities.

Farmers also pointed to the cumbersome process of desilting, noting that it currently requires permission and oversight from the Public Works Department (PWD). This administrative hurdle not only delays essential maintenance but also limits the autonomy of farmers and WUAs in managing tank resources—an outcome that runs counter to the intended spirit of participatory irrigation management (Shah, 2009).

4.2. Community Participation and Institutional Challenges

While most farmers expressed an awareness of the importance of collective action for tank maintenance, several factors hinder sustained community participation. Many of the respondents were tenant farmers who are not eligible for WUA membership. This exclusion reduces their incentives to actively engage in WUA decision-making or maintenance activities, echoing broader concerns in the literature about the challenges tenant farmers face in participatory irrigation systems (Meinzen-Dick et al., 2002).

Land ownership dynamics further exacerbate these challenges. Many landowners have migrated to urban areas or settled abroad, resulting in absentee membership within the WUAs. Consequently, while these landowners may remain members on paper, their physical absence and lack of direct agricultural involvement diminish the effectiveness of collective governance structures.

Financial constraints also emerged as a critical issue. WUA presidents reported chronic underfunding, both in terms of accessing government funds and raising internal resources through membership fees. Irregular payment of WUA fees by farmers further compounds this problem, leaving the associations with insufficient funds to carry out necessary maintenance and development works.

4.3. Broader Perceptions of Tank Irrigation and Sustainability

Despite the challenges highlighted above, both farmers and WUA leaders articulated a strong recognition of the multifaceted value of tanks in their agricultural and ecological landscapes. All farmers interviewed, except for a few wealthier individuals with supplementary tube well irrigation, are heavily dependent on tank irrigation for their agricultural activities. They noted that tanks act as critical buffers during periods of heavy rainfall, helping to mitigate the risk of floods and maintain ecological balance—a view that aligns with recent studies on the ecosystem services provided by traditional irrigation tanks (Reddy & Behera, 2009).

Interestingly, several respondents also highlighted the potential for tanks to provide supplementary livelihoods through activities like fish rearing, duck tending, and lotus cultivation. However, they expressed frustration with regulatory barriers, noting that such activities require explicit permission from the PWD, limiting their ability to leverage these opportunities for both household income and tank maintenance funding.

Encroachment of tanks and conversion of agricultural lands to commercial properties was identified as another serious concern. Farmers reported that such encroachments reduce the area available for tank irrigation and threaten the overall sustainability of agriculture in the district—a phenomenon widely observed across India (Vaidyanathan, 2001).

Finally, while farmers acknowledged that community participation is robust during large-scale maintenance activities or when major issues arise, day-to-day engagement in WUA meetings and routine tank governance is limited. This suggests a need for institutional reforms to broaden the membership base (including tenant farmers) and incentivise more consistent participation.

Conclusion and Policy Implications

The analysis of irrigation trends in Kanyakumari district over the period 2014-15 to 2022-23 reveals a concerning pattern of declining irrigated areas across most sources. Tank irrigation, once a lifeline for the region, has witnessed a steady reduction in both gross and net irrigated areas, with negative linear and compound growth rates. Similarly, groundwater irrigation shows a sharp decline, reflecting possible depletion or reduced accessibility of groundwater resources. In contrast, dug well irrigation exhibits modest growth, hinting at localised efforts to tap into smaller aquifers or more sustainable irrigation practices.

The overall decline in gross irrigated area—from 34,432 hectares in 2014-15 to 29,644 hectares in 2022-23—highlights the urgent need for interventions to rejuvenate and sustain the district's irrigation potential. Particularly, the consistent decrease in tank irrigation, despite the district’s favourable rainfall, underscores the gaps in tank management and maintenance.

These quantitative trends resonate with qualitative insights from farmer interviews in Agastheeswaram and Thovalai taluks. Factors such as invasive weed growth, high labor costs, lack of coordination between Panchayats and WUAs, exclusion of tenant farmers from WUA membership, and bureaucratic hurdles in tank maintenance collectively erode the vitality of these irrigation systems. The ecological and livelihood benefits of tanks—beyond irrigation—remain underutilised due to regulatory restrictions, further limiting their sustainability.

References:

1. Vaidya Mahadevan, A. (2024, May 18). *A Parched Nation: Analyzing India’s Water Scarcity Challenges*. Economic and Political Weekly. Retrieved May 18, 2024, from http://epw.in/engage/article/parched-nation-analyzing-indias-water-scarcity#:~:text=According%20to%20NITI%20Aayog's%20%E2%80%9CComposite%20Water%20Management,the%20water%20quality%20index%20(NITI%20Aayog%202019).
2. Saccoccia, L. (n.d.). *One-Quarter of world’s crops threatened by water risks*. World Resources Institute. https://www.wri.org/insights/growing-water-risks-food-

crops#:~:text=Some%20countries%20are%20already%20grappling,in%20India%20continue%20to%20warm.

3. Sivasubramaniyan, K. (2006). Sustainable Development of Small Water Bodies in Tamil Nadu. *Economic and Political Weekly*, *41*, 2854–2863. https://doi.org/10.2307/4418409
4. Manoharan, S., & Francis, C. (2020). Regenerating Kudimaramathu-the Water Governance by People: an Emergent Solution to Protect Water Bodies in Tamil Nadu. In *Copyright@ EM International* (Vol. 26, Issue 1).
5. Gandhi, Vasant P. and Namboodiri, N.V., "Investment and Institutions for Water Management in India's Agriculture: Profile and Behavior" in Donna Brennan (ed), Water Policy Reform: Lessons from Asia and Australia, Canberra, Australian Centre for International Agricultural Research, 2002
6. Raju, K. V., Dayal, P., Chatterji, J., & Asian Development Bank. (2008). Irrigation Management transfer. In *Irrigation Management Transfer*. Asian Development Bank. http://ndl.ethernet.edu.et/bitstream/123456789/31084/2/173.Asian%20Development%20Bank.pdf#page=33.07
7. Ministry of Water Resources. (2002). *STATUS OF PARTICIPATORY IRRIGATION MANAGEMENT (PIM) IN INDIA- POLICY INITIATIVES TAKEN AND EMERGING ISSUES*. https://bisses-valais.ch/app/uploads/medias/status-of-participatory-irrigation-management-pim-in-india-policy-initiatives-taken-and-emerging-issues/cadwm_status_of_pim_0.pdf#page=3.88
8. Janakarajan, S. (1993). In search of tanks: Some hidden facts. Economic and Political Weekly, 28(26), A53–A60.
9. Jayanthi, M., Chandrasekar, N., & Elangovan, R. (2012). Assessment of tanks in Tamil Nadu using remote sensing and GIS. Indian Journal of Soil Conservation, 40(3), 206–210.
10. Jayanthi, M., Raj, R., & Chandrasekar, N. (2021). Climate-resilient management practices for tanks. Journal of Environmental Management, 289, 112494. https://doi.org/10.1016/j.jenvman.2021.112494
11. Karthikeyan, C., Somasundaram, E., & Chandrasekar, N. (2020). Tank systems: Multifunctional landscapes in Tamil Nadu. Environmental Sustainability, 3(2), 103–112. https://doi.org/10.1007/s42398-020-00107-4
12. Kumar, M., Selvaraj, K. N., & Subramanian, S. (2022). Role of tanks in climate change adaptation in South India. Water Policy, 24(3), 420–433. https://doi.org/10.2166/wp.2022.122
13. Mosse, D. (2003). The rule of water: Statecraft, ecology and collective action in South India. Oxford University Press.
14. Palanisami, K., Meinzen-Dick, R., & Giordano, M. (2009). Tank irrigation in the 21st century: What next? Agricultural Economics Research Review, 22(Conference Issue), 151–158. https://doi.org/10.22004/ag.econ.57393
15. Ghosh, S., Kolady, D. E., Das, U., Gorain, S., Srivastava, S. K., & Mondal, B. (2019). Spatio-temporal variations in effects of participatory irrigation management (PIM) reform in India: A panel data analysis. *Agricultural Water Management*, *222*, 48–61. https://doi.org/https://doi.org/10.1016/j.agwat.2019.05.042
16. Rajendran, S. (2018). Tamil Nadu Revives Kudimaramathu Ancient Wisdom of Water Management. In *COMMENTARY FEBRUARY* (Vol. 10). https://www.epw.in/journal/2018/6/commentary/tamil-nadu-revives-kudimaramathu.html
17. Gandhiraj, V. (2006). DECLINE OF TANK IRRIGATION INSTITUTIONS IN SOUTH INDIA - A CASE OF TAMIL NADU. In *National Seminar on Water & Culture, Hampi, Bellary Dist* [Journal-article]. https://prod-qt-images.s3.amazonaws.com/indiawaterportal/import/sites/default/files/iwp2/Decline_of_tank_irrigation_institutions_in_South_India___A_case_of_Tamil_Nadu____Paper_presented_at_a_national_seminar_on_water_and_culture__2007_.pdf
18. Balasubramanian, R. (2006). *Institutional landscapes in common pool resource Management: A case study of irrigation tanks in South India*. https://hdl.handle.net/10535/1742
19. Sathiyamoorthy, S., Kajisa, K., & Sakurai, T. (2023). Performance of community-based tank irrigation system and its determinants: Evidence from Tamil Nadu, India. *Developing Economies*, *61*(3), 232–252. https://doi.org/10.1111/deve.12347

20. Palanisami, K. & NABARD Research and Policy Series. (2022). Tank irrigation in India: future management strategies and investment options. In *NABARD Research and Policy Series* (Report No. 10/2022). National Bank for Agriculture and Rural Development. https://www.nabard.org/hindi/auth/writereaddata/tender/2911220533paper-10-tank-irrigation-in-india-by-dr-palanisami.pdf
21. Jain, S., Srivastava, A., Vishwakarma, D., Rajput, J., Rane, N., Salem, A., & Elbeltagi, A. (2024). Protecting ancient water harvesting technologies in India: strategies for climate adaptation and sustainable development with global lessons. *Frontiers in Water, 6*. https://doi.org/10.3389/frwa.2024.1441365
22. Palanisami, K. (2006). Sustainable Management of Tank Irrigation Systems in India. *Journal of Developments in Sustainable Agriculture*. https://doi.org/10.11178/jdsa.1.34
23. Venkatachalam, L., & Balooni, K. (2018). Payment for Ecosystem Services to Sustain Kudimaramathu in Tamil Nadu. *Economic & Political Weekly EPW FEBRUARY, 10*(6). https://doi.org/10.1080/07900627
24. TAMIL NADU GOVERNMENT GAZETTE. (2001). The Tamil Nadu Farmer's Management of Irrigation Systems Act, 2000. In *TAMIL NADU GOVERNMENT GAZETTE* [Report]. https://lawsofindia.blinkvisa.com/pdf/tamil_nadu/2001/2001TN7.pdf
25. Rajagopal, A., Janakarajan, S., Madras Institute of Development Studies, & SACI Waters. (2002). State in perplexity: The politics of water rights and system turnover in Tamil Nadu. In *Working Paper* (Issue No. 171). Madras Institute of Development Studies. https://www.mids.ac.in/assets/doc/WP_171.pdf
26. Lakshmi, K. (2025, January 31). *WRD to finalise draft amendment to Tamil Nadu Farmers Management of Irrigation Systems Act, 2000 by March*. The Hindu. https://www.thehindu.com/news/cities/chennai/wrd-to-finalise-draft-amendment-to-tamil-nadu-farmers-management-of-irrigation-systems-act-2000-by-march/article69164258.ece
27. Meinzen-Dick, R., Raju, K. V., & Gulati, A. (2002). What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. *World Development*, 30(4), 649-666.
28. Ramakrishnan, R. (2014). MGNREGA and participatory irrigation management in India. *International Journal of Rural Management*, 10(1), 57–73.
29. Reddy, V. R., & Behera, B. (2009). Impact of water pollution on rural communities: An economic analysis. *Ecological Economics*, 68(11), 2800–2805.
30. Shah, T. (2009). Taming the anarchy: Groundwater governance in South Asia. *Resources for the Future Press*.
31. Sharma, G. P., & Raghubanshi, A. S. (2010). How Lantana invades dry deciduous forest: A case study from Vindhyan highlands, India. *Tropical Ecology*, 51(2), 305–316.
32. Vaidyanathan, A. (2001). *Water resource management: Institutions and irrigation development in India*. Oxford University Press