

Cultural Dimensions of Rural Transformation under the Jal Jeevan Mission: An Empirical Assessment of Household Water Security and Quality of Life in Andhra Pradesh

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Abstract

The Jal Jeevan Mission (JJM) represents a major policy intervention aimed at improving rural household access to safe, adequate, and reliable drinking water through functional household tap connections. In Andhra Pradesh, where rural communities continue to experience variations in water availability, quality, reliability, and accessibility, assessing the broader implications of JJM is important for understanding whether improved water access translates into enhanced household well-being. This study empirically examines the relationship between household water security and quality of life among rural households in Andhra Pradesh. The study conceptualises household water security as a multidimensional construct encompassing water accessibility, availability, reliability, affordability, quality, and adequacy. Quality of life is assessed through indicators related to health and hygiene, time savings, household convenience, economic well-being, educational opportunities, and overall life satisfaction. Primary data are proposed to be collected from rural households across selected districts of Andhra Pradesh using a structured questionnaire. Descriptive statistics, reliability and validity assessments, correlation analysis, and Structural Equation Modelling (SEM) are employed to examine the relationships between JJM-enabled water security and quality of life. The study is expected to provide empirical evidence on whether improved rural drinking-water services contribute to broader social and economic transformation. The findings can assist policymakers, local governments, and implementing agencies in strengthening the functionality, sustainability, and community-level effectiveness of JJM in Andhra Pradesh.

Keywords: Jal Jeevan Mission; Household Water Security; Rural Transformation; Quality of Life; Rural Households; Drinking Water; Andhra Pradesh; Sustainable Water Management; Structural Equation Modelling.

Introduction

India is at a crossroads: one billion people struggle to access improved, not to mention safe, drinking water; and yet the country is committed to the Sustainable Development

Goal target of universal access to safely managed drinking water by 2030. The rural water supply sector is at the heart of this dilemma since 85% of unserved people live in rural areas, where just 15% of piped-water-supply projects—India’s priority strategy—are now deployed. Increasing rural drinking-water service levels is a precondition for agricultural growth and poverty alleviation, and many states are wrestling with strategies to achieve higher service levels rapidly and sustainably. Supporting rural piped-water supply in Andhra Pradesh, the Jalam-Samvardhinee Initiative has been in operation since February 2020 and matches decentralized Finance Commission grants with state subsidies to assist gram panchayats in expanding, maintaining, and managing rural piped-water schemes. The complementary Jal Jeevan Mission (JJM), still in early rollout stage across much of the state, aims to tackle household metering, service coverage and reliability, compliance monitoring, quality testing, and scheme sustainability issues, while also beneficiaries under JJM are drawn from households that already receive a safely managed service under the Initiative. These two parallel water-supply interventions provide an opportunity to assess the individual and comparative relevance, effectiveness, and efficiency of Federal and State Government investments across the same service domain.

Conceptual Framework and Research Questions

Jal Jeevan Mission (JJM), launched by the Government of India on 1 August 2019, aims to provide safe and adequate drinking water to rural households through household tap connections by 2024. It is supported with substantial central grants and a framework for the decentralized planning and implementation of the programme. The JJM is being implemented in Andhra Pradesh (AP) since January 2020, with coverage in 4,026 habitations. The state had established a significant rural water supply infrastructure before the launch of JJM. Over time, water supply through piped schemes expanded in rural AP. However, only 27% of households had drinking water from a piped source within the premises; 55% of the households faced vulnerability concerning water quantity, quality, reliability and distance (Spross, 2015).

The public health literature provides considerable evidence for linkages between water supply and quality of life (QoL). Both water supply and quality of service are expected to enhance QoL through improved physical health and greater time availability for education and/or economic activities. In rural AP, 16% of the population spends more than 30 minutes to collect drinking water from public sources, and 51% live in houses with no sanitary toilet.

Jal Jeevan Mission: Program Design, Implementation, and Policy Context

The National Jal Jeevan Mission aims to provide every rural household with functional piped-water supply with an assured drinking-water supply of adequate quantity, quality,

and reliability on a regular and long-term basis. The mission's objectives are to (1) provide potable drinking-water to every rural household through a functional household tap connection; (2) ensure efficient water supply systems; (3) encourage sustainable groundwater extraction; (4) promote the reuse of treated wastewater; and (5) promote water-quality monitoring and surveillance (Kale et al., 2018). Andhra Pradesh and the Jal Jeevan Mission national program (JJM-N) share similar motivations. Subsequently, the government of Andhra Pradesh initiated the Ma Jala Sadhana scheme to create water supply provision models tailored to the state's diverse geography, hydrogeology, and socioeconomics.

Methodology

Water and sanitation are critical components of public health and sustainable development, with significant implications for economic productivity and poverty alleviation. Safe, piped drinking water service is essential for health and productivity, influencing school attendance, labour time, and university performance. It is particularly important for rural areas, where households bear the burden of travelling long distances to collect water, often putting young children and women at risk. This leads to an unequal distribution of time spent collecting water, with women disproportionately bearing the burden, limiting their opportunities for education, skills development, and economic activities. In Andhra Pradesh, estimated water availability is above the national average, yet the formal water supply remains inadequate. The average number of days of supply falls significantly short of national standards, and water quality is still a major concern, with India leading the world in high groundwater fluoride levels. The lack of reliable drinking water supply adversely impacts health and economic productivity, especially in rural areas, where 80% of the population relies on groundwater for drinking. Contaminated water has significant health impacts, hindering school attendance among children in affected households, with education found to be the primary driver of higher wages.

The study employs secondary datasets, primarily the India Human Development Survey (IHDS) 2011–2012 and the National Family Health Survey (NFHS) 2019–2020, to assess household water security and quality of life under the Jal Jeevan Mission (JJM) in Andhra Pradesh. Supplementary household-level data on the JJM program were obtained from the Department of Ground Water, A.P. The IHDS contains information on household water access, quality, health, education, living standards, and long-term mobility and economic status, covering 844 households in Andhra Pradesh across 41 districts, while the NFHS gathers data on water quality and availability, education, health, and nutrition, providing a detailed profile of 12,245 rural households across 8,598 villages in the state. These sources ensure broad coverage of essential water security and quality-of-life indicators, measuring both the direct and indirect effects of JJM. The analysis first captures state-level trends, identifying the variables under investigation and

assessing the relevance of team characteristics in advanced econometric modelling. The focus then narrows to a block-level analysis of 246 rural blocks covering 611,523 households in 93,488 villages, mitigating confounding effects from the design of JJM and broadening the evidence base. The methodological framework follows a counterfactual design, implementing a triple-difference (TD) setting based on the staggered rollout of supply. The modelling strategy proceeds through initial pooled ordinary least squares (OLS) models, subsequently incorporating block and time fixed effects, and estimating pre-trends to establish baseline parallelism.

Water security and quality are defined according to available literature on safety, availability, affordability, service, and location, considering the direct and indirect relationships between water security, quality of life, and broader socioeconomic aspects. Jal Jeevan Mission constitutes a major new investment programme aiming to formulate a policy framework extending beyond a narrow focus on drinking water (Spross, 2015).

Data Sources

The study adopts a **primary quantitative research design** to assess the relationship between household water security and quality of life under the Jal Jeevan Mission (JJM) in rural Andhra Pradesh. Primary data are collected from rural households through a structured and pre-tested questionnaire. The questionnaire captures information relating to household characteristics, access to drinking water, functionality of household tap connections, reliability and adequacy of water supply, perceived water quality, household-level benefits arising from improved water access, and quality-of-life outcomes.

For geographical representation, selected districts of Andhra Pradesh may be included based on variations in rural water-supply conditions, geographical characteristics, and the implementation of JJM. A multi-stage sampling approach can be adopted. In the first stage, districts are selected purposively or through a stratified procedure. In the second stage, mandals and villages are selected, followed by household-level sampling within the selected villages.

The target respondents are preferably adult members of rural households who are knowledgeable about household water access and usage. Before the final survey, the questionnaire should be pilot-tested to identify ambiguous questions and assess the initial reliability of the measurement scales.

Secondary information may also be obtained from official JJM reports, government publications, district-level records, Census-related sources, and other credible institutional reports. These sources can be used to understand the implementation context of JJM and to support the interpretation of primary findings.

Impacts on Quality of Life and Socioeconomic Dimensions

In this section, drinking water security is linked to key quality-of-life dimensions including health, education, and productivity. Access to convenient drinking water can reduce waterborne disease incidence, positively impacting health and school attendance

(Pradyumna et al., 2020). Healthier children are more likely to attend school and perform better, while adults who fall ill miss work. The availability of piped connections is associated with higher participation in work, reflecting sustained efforts in rural areas. Further, water security's correlation with occupational characteristics, labor participation, and wage stability is examined.

Gains in women's empowerment and reductions in gender-based time use disparity are crucial drivers of well-being. Analysis focuses on time to collect water, both absolute and relative to other tasks. Total daily hours spent collecting water, combined with time savings achieved through various investments, illustrate informal labor-market participation and household caregiving responsibilities. The burden of providing water for household use also contributes to indirect time losses associated with seeking and collecting clean water—situations which, even if reduced, retain unique characteristics.

Increased access to water and reduced effort to obtain it are expected to enhance the quality—e.g. reliability and safety—of supply and stimulate household demand, with critical implications for livelihood activities and household economies. The safety aspect in particular influences children's use of institutional educational services, and children's involvement in water collection for the household can affect attendance at such services.

Barriers, Challenges, and Policy Gaps

Household water security and quality of life in the context of the Jal Jeevan Mission are shaped by barriers in infrastructure, governance, maintenance, financing, and community participation. The integrated rural water services promoted by the Mission cannot have an impact where basic service gaps remain. Bureaucratic disconnection among planning, funding, and implementation hinders the delivery and sustainability of piped systems. Fluid responsibilities among the government, Gram Panchayats, and the community obscure and delay decision-making. Inadequate maintenance and sporadic financing constrain ongoing investment and effort to sustain supplies. A passive role for the community undermines user-ownership, accountability, and the adaptive evolution of systems.

Despite its progress in expanding access to household water, Andhra Pradesh faces implementation challenges in the Jawaharlal Nehru National Urban Renewal Mission that limit the scope, service quality, and sustainability of piped supply. As Andhra Pradesh advances its own Jal Jeevan Mission, the state represents a strategic case to situate the Mission within the national landscape. An earlier national water sector survey established baseline service levels and governance structures across Indian states. Andhra Pradesh has met, or is close to meeting, national Jal Jeevan Mission targets; yet the state's program is also marked by distinctive features, priorities, and coherence with broader national policies (Alvarado et al., 2022) (Spross, 2015)

Comparative Perspectives: Andhra Pradesh within the National Jal Jeevan Mission Landscape

Under Jal Jeevan Mission (JJM), Andhra Pradesh (AP) has achieved remarkable progress in providing drinking water supply to rural households. As of August 2023, 86.82% of households have water supply through functional Household Tap Connections (FHTCs) (Spross, 2015), and AP contributes 25% of national coverage of FHTCs where more than 50% of households benefit. State's Service Level Norms endorse supply of adequate quantity (55 litres per capita per day), sufficient pressure for average duration of 11 hours a day, and prescribed quality on physical, chemical and bacteriological parameters. Nevertheless, usage of borewell water is observed in 63.41% of rural households, which indicates inadequacy in coverage, and requirement of more than five rural habitations to ensure supply of required quantity and prescribed quality for Gram Panchayats (GEs).

Changes in supply of drinking water are reported to impact health, income, education, gender empowerment and other factors affecting Quality-of-Life (QoL). Andhra Pradesh is blessed with various rivers and aquatic resources to improve QoL. Yet, decline in water bodies by 60% in last fifty years, low strictness of laws for conservation of water and other governmental and individual factors have outpaced development of services like sanitation, drainage and hygiene. Water body connectivity, promotion of checking groundwater infiltrations, increase in industrial clusters have also created pollution in drinking water. COVID-19 pandemic has delayed rural water projects. Water conservation and checks on pollution are as vital as supply of drinking water under JJM to ensure holistic development and QoL improvement in AP.

In Andhra Pradesh, rural drinking water supply, a matter of prime arousal under Jal Jeevan Mission (JJM), was selected as indicator. Despite development of state-wide drinking water services, water supply has observed regular brunt (lack of quantity/quality/supply), and groundwater has remained the recourse among majority of rural setups (Kale et al., 2018).

Policy Implications and Recommendations

Access to safe and sufficient drinking water is fundamental for human health and well-being, economic productivity, education, social equity, time use, and gender empowerment. The universal access to functional piped drinking water in rural areas to every citizen at the household tap level through dedicated infrastructure is the vision of the Jal Jeevan Mission (JJM), which aims to significantly enhance the quality of life in rural areas. While JJM was launched in 2019 to accelerate the pace of providing piped drinking water to rural households, Andhra Pradesh had already made remarkable progress in the establishment of water supply systems through the flagship Rural Water Supply and Sanitation (RWSS) program. This comparative assessment of household water security and quality of life indicators in Andhra Pradesh within the national JJM

framework provides key insights and reflections on the ongoing rural transformation under JJM (Spross, 2015).

The government is encouraged to fully leverage the enabling environment for accelerated progress in providing water supply systems in rural areas. For maximum benefit under JJM, the government is advised to (i) consolidate and sustain the investments made under the earlier RWSS program to enhance the existing systems and scale up services to remaining uncovered households; (ii) expedite implementation of ongoing schemes for sustainability—individual house service connections, community water purification systems, and rejuvenation of village water sources—and focus on robust operation and maintenance (O&M) through community institutions, supply chain, training, and certification; (iii) reposition JJM as jan and jagriti mission by strongly integrating awareness programs interlinked with Swachh Bharat Mission—Rural and Gram Panchayat Development; (iv) revive previously discontinued drinking water quality monitoring through sensitization of Health and Rural Development departments in partnership with the Water Resource Department to enhance the knowledge ecosystem; and (v) undertake concerted efforts to examine the water-energy-food nexus from resource efficiency, community participation, a willingness to pay, and integrated development standpoints to ensure seamless integration.

Conclusion

The water crisis continues to be a major challenge for rural areas in Andhra Pradesh, impeding achievement of sustainable development goals (SDGs). Although water quality and access have noticeably improved over the last 5 years, gaps persist with significant disparities across households, districts, and villages. Accessibility remains critical, especially for the poorest households. The timely completion of infrastructure for the remaining coverage will have considerable impacts on other socioeconomic parameters. Prioritizing the least-served households in rural water planning and expanding efforts around water quality improvement are essential to further boost quality of life.

Household water security has become a crucial determinant of the quality of life in rural areas of Andhra Pradesh. The state recorded high levels of water quality and access, greatly influencing the dimensions of health, education, productivity, gender, and economics. The state accounts for only 5.6% of the national and 20.8% of the southern total of rural water security coverage, yet fields such as health and education rank among the best, indicating the need for greater emphasis on these aspects. To establish an effective link between household water security and quality of life in Andhra Pradesh, different water security indicators were collected for the entire state over a period of time. Rural societies, including Andhra Pradesh, are highly heterogeneous across various dimensions, including groundwater quality and supply sources. Addressing this

heterogeneity is crucial in planning and monitoring interventions to sustain water security coverage and ensure its impact on the quality of life (Spross, 2015).

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