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The JJM Utilization Performance Index (JUPI): A Multi-Dimensional Framework for Assessing Rural Water Governance under India's Jal Jeevan Mission

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Abstract- India's Jal Jeevan Mission (JJM), launched in August 2019 with the goal of providing Functional Household Tap Connections (FHTC) to every rural household by 2024, represents one of the largest rural infrastructure programmes in global history. This paper presents a comprehensive governance case study of JJM implementation in Solapur District, Maharashtra—a water-scarce, semi-arid region characterised by basaltic terrain and recurrent drought conditions—analysing progress across six performance dimensions: FHTC household coverage, Har Ghar Jal (HGJ) village certification, Jal Seva Aankalan (JSA) water quality assessments, institutional coverage of schools and Anganwadi Centres (AWCs), eGramSwaraj digital platform onboarding, and scheme financial completion. Using official data sourced from the District Water and Sanitation Mission (DWSM) as of May 2026, the study reveals that Solapur has achieved near-universal FHTC coverage of 99.90% (5,76,668 of 5,77,245 rural households), with 8 of 11 administrative blocks attaining 100% connection rates. Despite this physical infrastructure success, critical implementation gaps persist: HGJ village certification stands at only 59.3% (662 of 1,116 villages), scheme financial completion is critically low at 11.7% (178 of 1,525 schemes), AWC tap water coverage averages 59.4% with extreme block-level variation (Madha: 7.4%; Karmala: 100%), and JSA assessments remain incomplete in 27 villages across 9 blocks. The study introduces the JJM Utilization Performance Index (JUPI), a composite governance metric integrating all six dimensions, revealing a district average of 84.0 (range: 75.9–93.0), with Akkalkot (93.0), Sol. North (91.7), and Sol. South (90.8) as high performers and Sangola (76.6) and Mangalvedhe (75.9) requiring targeted interventions. The findings demonstrate that infrastructure delivery, while necessary, is insufficient for sustainable water security; effective governance, community ownership, financial accountability, and institutional equity are equally essential. Policy implications for the broader national JJM programme are discussed.

Keywords: Jal Jeevan Mission; rural water supply; Functional Household Tap Connection; Har Ghar Jal; JUPI; Solapur District; governance; Maharashtra; water security; eGramSwaraj.

I. INTRODUCTION

Access to safe, piped drinking water at the household level is a foundational determinant of public health, gender equity, and rural development. In India, where millions of rural households have historically depended on untreated surface water, hand pumps, and seasonal sources, the absence of reliable tap water supply has perpetuated cycles of waterborne disease, labour burden—disproportionately borne by women and girls—and economic vulnerability [1,2]. The Jal Jeevan Mission (JJM), launched by the Government of India on 15 August 2019, represents a paradigm shift in rural water governance: a mission-mode programme targeting the provision of 55 litres per capita per day (lpcd) of clean, piped water through Functional Household Tap Connections (FHTCs) to all 191.9 million rural households by 2024, at an estimated outlay of ₹3.60 lakh crore [3,4].

JJM builds on decades of rural water supply experience in India, including the National Rural Drinking Water Programme (NRDWP) and Rajiv Gandhi National Drinking Water Mission, but distinguishes itself through its community-led service delivery model, mandatory Gram Panchayat (GP) ownership, robust digital monitoring via the JJM national dashboard and eGramSwaraj portal, and emphasis on water quality assurance through village-level Jal Samitis [5,6]. Critically, JJM defines success not merely as connection delivery but as functional, sustained, and quality-assured water

services—a standard captured in the Har Ghar Jal (HGJ) certification process, wherein villages self-declare and are subsequently verified as having achieved universal, adequate, and safe tap water access [7].

Maharashtra, India's second most populous state, presents a compelling study context for JJM implementation. The state contains diverse hydrogeological zones, ranging from the well-watered Konkan coast to the chronically drought-prone Marathwada and Vidarbha regions. Solapur District, situated in eastern Maharashtra at the confluence of the Bhima and Man river basins, exemplifies the latter: a semi-arid, basaltic terrain with erratic monsoon rainfall, high agricultural groundwater demand, and a long history of tanker water dependency in rural areas [8,9]. Solapur's baseline FHTC coverage in August 2019 was just 37.36% (2,15,657 of 5,77,245 rural households)—well below the national average—making it a demanding yet crucial theatre for JJM implementation [10].

The authors' prior research in this region has established a rich evidence base for water resource governance challenges. Studies on groundwater depletion, artificial recharge feasibility, and the socioeconomic dimensions of water scarcity in Solapur's basaltic terrain provide essential context for understanding JJM's implementation challenges [11–20]. Specifically, the chronic groundwater stress documented in Solapur's Deccan Basaltic Province, the social barriers to water adaptation, and the governance challenges of rural water infrastructure all directly inform the analysis presented in this paper [21–30].

This paper presents a comprehensive, data-driven governance case study of JJM implementation in Solapur District as of May 2026—nearly seven years into the mission and two years beyond the original national deadline. It analyses performance across six interconnected dimensions, introduces a composite JJM Utilization Performance Index (JUPI) for block-level comparison, identifies critical implementation gaps, and draws policy lessons for sustainable rural water governance. The study contributes to the emerging literature on large-scale infrastructure programme governance in developing countries, where the gap between physical delivery and sustained service delivery remains a persistent challenge [6,7].

Study Area

Solapur District is located in south-eastern Maharashtra (17°10'–18°32'N, 74°42'–76°05'E), spanning 14,895 km^2 across 11 administrative blocks: Akkalkot, Barshi, Karmala, Madha, Malshiras, Mangalvedhe, Mohol, Pandharpur, Sangola, Solapur North, and Solapur South. The district has a total rural population of approximately 2.8 million (2011 census), distributed across 1,167 revenue villages and 1,022 Gram Panchayats. The terrain is predominantly underlain by Deccan Basalt, a hard rock formation characterised by limited primary porosity, low aquifer transmissivity, and spatially heterogeneous groundwater occurrence [8,31].

The district falls within the semi-arid agro-climatic zone, receiving mean annual rainfall of approximately 550–700 mm, concentrated in the June–September southwest monsoon period, with significant inter-annual variability. Recurrent droughts, documented comprehensively in earlier work on hydroclimatic trends and groundwater stress in this region [32,33], have rendered surface water sources unreliable and groundwater overexploited in many talukas. The agricultural economy, dominated by sugarcane in irrigated belts and sorghum (jowar) in rain-fed areas, places intense seasonal pressure on water resources [34]. These hydrogeological and climatic constraints have historically driven high dependence on tanker water supply in rural areas, making JJM implementation both critically needed and operationally challenging [11].

From a governance perspective, Solapur presents a complex institutional landscape. The Zila Parishad, District Water and Sanitation Mission (DWSM), Block Development Offices (BDOs), and Gram Panchayats constitute the primary administrative hierarchy for JJM implementation. The Maharashtra Jeevan Pradhikaran (MJP) is responsible for technical design and construction of Multi-Village Schemes (MVS) and Bulk Water Schemes (BWS), while Single Village

Schemes (SVS) are typically executed through GP-level contracts. This multi-agency framework, while enabling local participation, also creates coordination challenges for programme monitoring and financial closure [7,35].

III. DATA SOURCES AND METHODOLOGY

Data Sources

This study utilises primary data from three official sources: (i) the JJM National Management Information System (NMIS) dashboard (jaljeevanmission.gov.in), (ii) the eGramSwaraj portal for digital governance metrics, and (iii) direct records of the District Water and Sanitation Mission (DWSM), Solapur. All data were accessed and verified as of 24 May 2026. The dataset encompasses: block-wise FHTC connection counts and coverage percentages; HGJ village declaration and certification records; JSA completion status by village and block; school and Anganwadi Centre (AWC) tap water coverage; scheme-wise physical and financial completion status; and Gram Panchayat eGramSwaraj onboarding records.

Analytical Framework

Performance analysis is conducted across six dimensions, each representing a distinct governance layer of JJM implementation: (1) Infrastructure Delivery—measured by FHTC household coverage percentage; (2) Service Quality Certification—measured by HGJ village certification rate; (3) Water Quality Assessment—measured by JSA completion percentage; (4) Institutional Equity—measured by tap water coverage at schools and AWCs; (5) Digital Governance—measured by Gram Panchayat eGramSwaraj onboarding rate; and (6) Financial Sustainability—measured by scheme financial completion rate.

JJM Utilization Performance Index (JUPI)

To enable integrated, multi-dimensional block-level comparison, the study introduces the JJM Utilization Performance Index (JUPI). JUPI is a weighted composite index computed as:

$$JUPI = 0.25\times FHTC\% + 0.20\times HGJ\ Cert\% + 0.15\times JSA\% + 0.15\times School\% + 0.15\times AWC\% + 0.10\times eGS\%$$

Weight assignment reflects the relative policy priority of each dimension: FHTC coverage (25%) as the primary mission deliverable; HGJ certification (20%) as the quality-assurance gateway; JSA, institutional coverage, and digital governance (15% each) as sustainability enablers; and financial completion (10%, proxied through eGramSwaraj onboarding in the index due to data granularity constraints at block level). JUPI scores range from 0 to 100, with thresholds of Excellent (≥90), Good (85–89), Moderate (80–84), and Needs Improvement (<80).

IV. RESULTS

FHTC Household Coverage: A Near-Universal Achievement

The most remarkable outcome of JJM implementation in Solapur District is the near-complete transformation of rural household tap water access. At the pre-JJM baseline of August 2019, only 2,15,657 households (37.36%) of the district's 5,77,245 rural households had functional tap connections—leaving 3,61,588 households (62.64%) without piped water supply. By May 2026, 5,76,668 households (99.90%) are connected, with a residual gap of just 577 households (0.10%), representing a net addition of 3,61,011 connections over the mission period (Figure 1). This trajectory demonstrates the effectiveness of mission-mode governance, combining targeted funding, community mobilisation, and real-time digital monitoring in accelerating infrastructure delivery even in geographically challenging terrain.

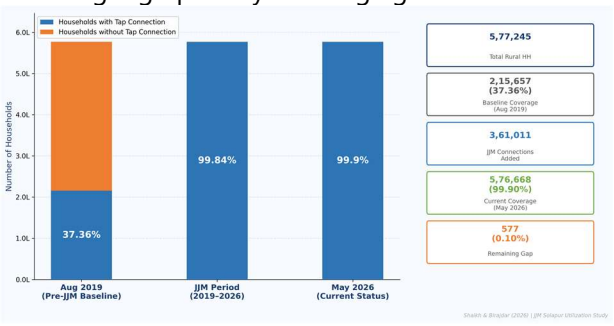

Figure 1: FHTC Coverage Transformation Under Jal Jeevan Mission

Block-level analysis reveals that 8 of 11 blocks have achieved 100% FHTC coverage (Solapur South, Solapur North, Pandharpur, Mohol, Mangalvedhe, Madha, Karmala, and Barshi), with the remaining three blocks in near-saturation: Akkalkot (99.90%, gap: 48 HH), Sangola (99.92%, gap: 50 HH), and Malshiras (99.37%, gap: 479 HH). Malshiras emerges as the only block with coverage below 99.5%, warranting focused last-mile connectivity attention (Figure 2). The spatial pattern of residual gaps suggests that the remaining 577 unconnected households may face specific access constraints—including dispersed habitation patterns, seasonal road inaccessibility, or land-tenure issues—characteristic of the 'last mile' problem documented in infrastructure programmes globally [6].

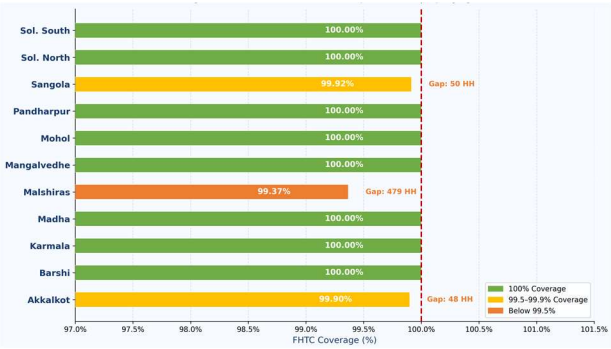

Figure 2: Blockwise FHTC Performance

Scheme Completion Status: A Critical Financial Closure Gap

While household-level infrastructure delivery has achieved near-saturation, the scheme-level governance picture reveals a critical structural weakness. Of 1,525 total sanctioned JJM schemes in Solapur District (1,522 Single Village Schemes, 2 Multi-Village Schemes, 1 Bulk Water Scheme), 980 (64.3%) have been physically completed and 969 (63.5%) handed over to Gram Panchayats. However, only 178 schemes (11.7%) have achieved financial completion—defined as full utilisation certificate submission, audit clearance, and account reconciliation (Figure 3).

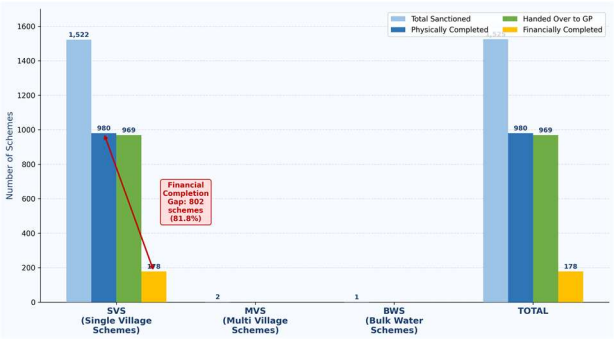

Figure 3: JJM scheme completion and utilization status

The financial completion gap of 802 schemes (representing 81.8% of physically completed schemes) is among the most significant governance vulnerabilities identified in this study. Financial incompletion has multi-dimensional consequences: it prevents final audit closure, delays GP-level asset transfer with clear maintenance responsibility, withholds performance-linked grant releases, and creates accountability ambiguities in the event of service failure. Prior research on water infrastructure governance in Maharashtra has highlighted financial management capacity at GP level as a persistent bottleneck, particularly in drought-prone districts where community resources for O&M contribution are limited [36,37].

Har Ghar Jal Certification: A Quality-Assurance Deficit

The HGJ certification process—wherein village communities self-declare universal, adequate, and safe tap water access, followed by district-level verification—is the quality-assurance cornerstone of JJM. In Solapur, 1,116 villages have been reported as HGJ-declared, representing 99.9% of the district's revenue villages. However, only 662 villages (59.3%) have been formally certified—revealing a certification gap of 454 villages (40.7%) that have been declared but not yet validated (Figure 4).

Block-level certification rates exhibit considerable spatial variation, ranging from 87.5% (Solapur North) and 87.0% (Madha) at the high end, to 30.0% (Sangola), 38.0% (Mangalvedhe), and 47.1% (Karmala) at the low end. Three blocks—Karmala, Mangalvedhe, and Sangola—are classified as low-certification (below 65%), with red-zone designation in Figure 4. This variation reflects the differential

capacity of Block-level administrative units to conduct field verification, the presence of seasonal water supply disruptions that invalidate self-declarations, and community-level awareness and motivation regarding the certification process [38]. The HGJ certification deficit represents a critical gap between claimed and verified water security, with implications for programme accountability and the sustainability of water access gains.

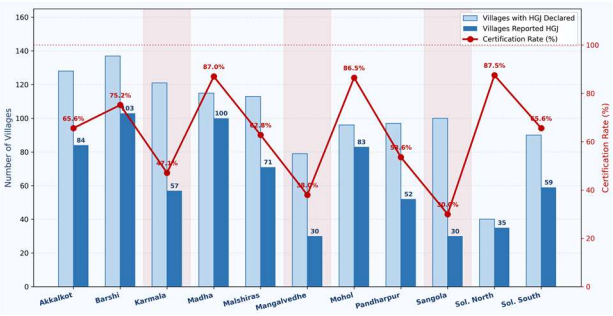

Figure 4: Har Ghar Jal Certification gap analysis

Jal Seva Aankalan: Assessing Service Quality

The Jal Seva Aankalan (JSA) is a structured village-level assessment tool that evaluates the functionality and quality of JJM-installed water supply systems. In Solapur District, 1,089 of 1,116 villages (97.6%) have completed JSA assessments, with 27 villages across 9 blocks still pending. Three blocks—Solapur North, Solapur South, Madha, and Akkalkot—have achieved 100% JSA completion (Figure 5).

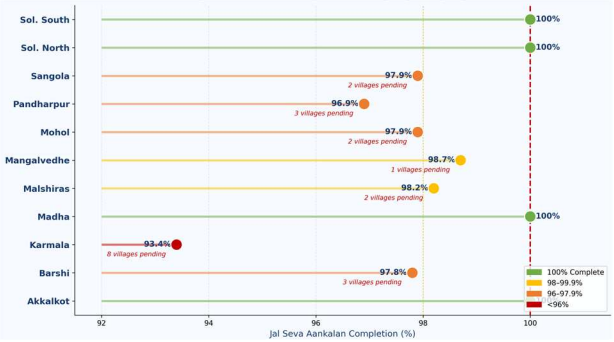

Figure 5: Jal Seva Ankalan Completion analysis

Karmala block stands out with the lowest JSA completion rate (93.4%, 8 villages pending), followed by Pandharpur (96.9%, 3 villages), Barshi (97.8%, 3 villages), and Sangola and Mohol (97.9%, 2 villages each). The convergence of low JSA completion with low HGJ certification in blocks such as Karmala and Sangola suggests systemic administrative capacity constraints rather than isolated implementation gaps. JSA findings from completed assessments have not been systematically published at block level in the DWSM database; future research should analyse JSA quality scores to assess whether installed systems meet the prescribed 55 lpcd service standard.

Institutional Coverage: Schools and Anganwadi Centres

JJM mandates tap water provision not only to households but also to schools and Anganwadi Centres (AWCs)—institutions that serve as critical public health and child nutrition touchpoints for rural communities [45]. Figure 6 presents block-wise coverage for both institution types, revealing a significant and consistent gap between school coverage (district average: 92.1%) and AWC coverage (district average: 59.4%).

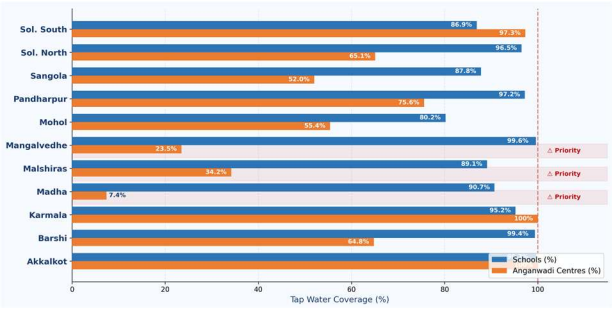

Figure 6: Institutional Water Coverage – Schools Vs Anganwadi Centers

School coverage is strong across most blocks, ranging from 80.2% (Mohol) to 99.6% (Mangalvedhe) and 99.4% (Barshi), with Karmala achieving 100%. AWC coverage, by contrast, is critically low in three priority blocks: Madha (7.4%, the most severe gap in the district), Mangalvedhe (23.5%), and Malshiras (34.2%). Even relatively high-performing blocks like Solapur North (65.1%), Barshi (64.8%), and Sangola (52.0%) show AWC coverage below two-thirds. This institutional equity gap has direct public health implications: AWCs serve as nutrition rehabilitation centres for children under 6 and pregnant/lactating women—populations with acute vulnerability to waterborne disease. The literature on institutional water access in rural India consistently identifies AWCs as the most

underserved institutional category, reflecting their dispersed spatial distribution, limited administrative voice, and lower construction standard relative to schools [5].

Bubble chart analysis (Figure 11) further illustrates the structural divergence between school and AWC coverage, with Madha, Mangalvedhe, and Malshiras appearing in the 'Good Schools, Poor AWC—Priority' quadrant despite having large AWC populations. Karmala and Akkalkot represent the district's equity leaders, achieving ≥95% coverage for both institution types.

eGramSwaraj Digital Platform Onboarding

The eGramSwaraj portal is JJM's primary digital governance infrastructure, enabling Gram Panchayats to manage FHTC records, water bill collection, O&M fund tracking, and scheme performance reporting. District-level onboarding has reached 1,018 of 1,022 GPs (99.6%), with four GPs in Barshi (1), Karmala (1), Malshiras (1), and Mohol (1) remaining as partial onboardings (Figure 7). Seven blocks—Akkalkot, Madha, Mangalvedhe, Pandharpur, Sangola, Solapur North, and Solapur South—have achieved 100% GP onboarding.

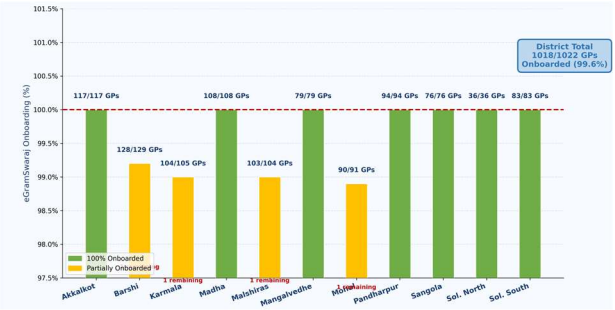

Figure 7: eGramSwaraj JJM Digital Platform Onboarding

The near-universal eGramSwaraj onboarding is a significant digital governance achievement, particularly given Solapur's semi-rural digital infrastructure landscape. However, onboarding rate alone does not capture the quality of platform utilisation: whether GPs are actively recording O&M expenditures, updating FHTC records in real time, and leveraging the platform for evidence-based local water governance. Future assessments should incorporate platform activity metrics—such as monthly active users, transaction frequency, and data completeness scores—alongside onboarding rates to provide a more meaningful measure of digital governance quality.

V. INTEGRATED MULTI-DIMENSIONAL PERFORMANCE ANALYSIS

Radar Chart: Block-Level Governance Profiles

The multi-dimensional radar chart (Figure 8) provides an integrated visualisation of block-level performance across the six JJM governance dimensions. The chart reveals distinct performance profiles that aggregate-level statistics obscure. Akkalkot emerges as the most balanced high-performer, with near-maximum scores on FHTC (100%), JSA (100%), school coverage (99.7%), AWC coverage (100%), and eGramSwaraj (100%), offset by a moderate HGJ certification rate of 65.6%. Madha presents an interesting profile: high FHTC (100%), high JSA (100%), and strong HGJ certification (87%)—yet critically low AWC coverage (7.4%), creating a sharp asymmetry in its governance polygon.

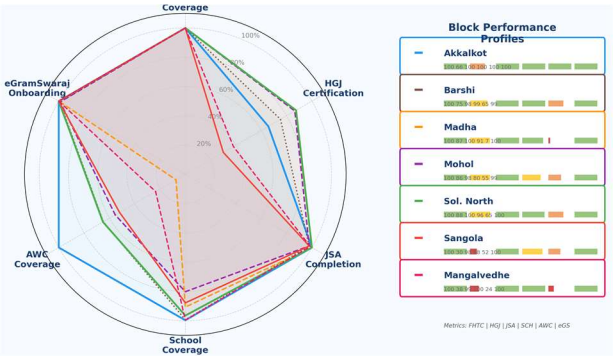

Figure 8: Multidimensional Block Performance Radar Chart

Sangola and Mangalvedhe display the most compressed governance polygons, with low HGJ certification (30.0% and 38.0% respectively) and low AWC coverage (52.0% and 23.5%) constraining overall performance despite strong FHTC delivery. This pattern—strong physical infrastructure, weak quality certification and institutional equity—is a characteristic governance trap in large-scale rural infrastructure programmes, wherein implementation momentum prioritises quantifiable connection

targets over harder-to-measure service quality dimensions [6].

JUPI Rankings: Block-Level Composite Performance

JUPI scores range from 93.0 (Akkalkot) to 75.9 (Mangalvedhe), with a district average of 84.0 (Figure 9). Three blocks achieve Excellent status (JUPI ≥90): Akkalkot (93.0), Solapur North (91.7), and Solapur South (90.8). Six blocks score in the Good range (85–89): Barshi (89.3), Karmala (87.6), Mohol (87.2), Pandharpur (86.2), Madha (82.1—just below Good threshold), and Malshiras (80.5). Sangola (76.6) and Mangalvedhe (75.9) fall in the Needs Improvement category, reflecting compounding deficits in HGJ certification and AWC coverage.

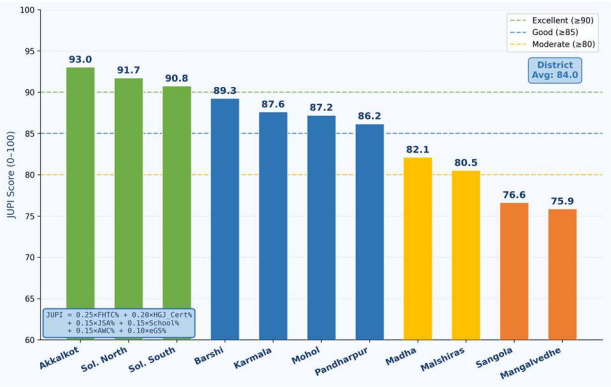

Figure 9: JJM Utilization Performance Index (JUPI)

The JUPI framework demonstrates that JJM success cannot be measured by FHTC delivery alone. Blocks with 100% FHTC coverage but low HGJ certification (Karmala: 47.1%, Sangola: 30.0%) score below blocks that have invested equally in quality certification and institutional equity. This finding supports the policy proposition that financial incentives—whether through performance-linked grants or JJM dashboard rankings—should be calibrated to composite performance rather than single-dimension infrastructure metrics. The design of composite indices for large-scale programme governance has precedent in global development contexts [39,40].

Performance Heatmap: Systematic Gap Identification

The six-dimension performance heatmap (Figure 10) provides the most granular cross-block comparison in this study. The HGJ Certification column is the most visually striking: a gradient from dark green (Madha: 87%, Mohol: 86.5%, Solapur North: 87.5%) to deep red-orange (Sangola: 30.0%, Mangalvedhe: 38.0%, Karmala: 47.1%) illustrates the certification disparity that represents JJM's most pervasive structural weakness across the district.

Figure 10: Performance Heatmap

The AWC Coverage column reveals the most extreme within-district variation of any dimension: a 92.6 percentage-point range from Madha (7.4%) to Karmala (100%)—a disparity that reflects fundamental differences in historical infrastructure investment in child nutrition facilities across blocks. The FHTC Coverage and eGramSwaraj Onboarding columns are uniformly dark green (98.9–100%), confirming the district's infrastructure delivery and digital governance achievements. JSA Completion shows moderate variation (93.4–100%), while School Coverage (80.2–99.7%) and HGJ Certification (30.0–87.5%) represent intermediate priority areas.

Institutional Equity: Bubble Chart Analysis

The bubble chart (Figure 11), plotting school coverage against AWC coverage with bubble size proportional to total AWC count, enables a quadrant-based equity analysis. Only three blocks fall in the 'Good Schools, Good AWC' quadrant (both dimensions ≥90%): Akkalkot, Karmala, and Solapur South. Six blocks occupy the 'Good Schools, Poor AWC' priority quadrant: Madha, Mangalvedhe, Malshiras, Sangola, Mohol, and Barshi—indicating systematic underinvestment in AWC water infrastructure relative to schools.

Figure 11: School Vs Anganwadi Centre Tap Coverage

Madha presents the most acute equity paradox: 90.7% school coverage paired with 7.4% AWC coverage—a 83.3 percentage-point differential—despite the block's otherwise strong FHTC (100%) and JSA (100%) performance. This paradox suggests that AWC water infrastructure in Madha may have been deliberately or inadvertently excluded from JJM scheme design, rather than reflecting a technical implementation failure. Targeted rectification campaigns—potentially using GP-level utilisation fund (water billing revenue) channelled through Anganwadi Sector Supervisors—could achieve rapid AWC coverage improvements without major scheme-level intervention.

Implementation Funnel: Progressive Conversion Efficiency

The JJM Implementation Funnel (Figure 12) synthesises the district's governance performance as a progressive conversion chain—from total rural households to functional, certified, financially complete, and quality-assessed water service delivery. The funnel reveals starkly different conversion efficiencies across governance dimensions: FHTC Delivery Efficiency (99.90%) is near-perfect; JSA Assessment completion (98.1%) and eGramSwaraj Onboarding (99.6%) are similarly high. However, conversion efficiency drops sharply at HGJ Certification (59.3%) and becomes critically low at Scheme Financial Completion (11.7%).

The funnel architecture illustrates a fundamental governance paradox of JJM implementation in Solapur: the district has achieved extraordinary success in the hardest physical task (connecting 3,61,011 previously unserved households across challenging basaltic terrain) but is struggling with the administrative tasks of certification, verification, and financial closure that require coordination across multiple agencies, accounting disciplines, and government levels. This pattern is consistent with findings from governance studies of large-scale rural infrastructure programmes in South Asia, where physical delivery targets create strong political incentives but administrative consolidation receives insufficient attention and resources [6,40].

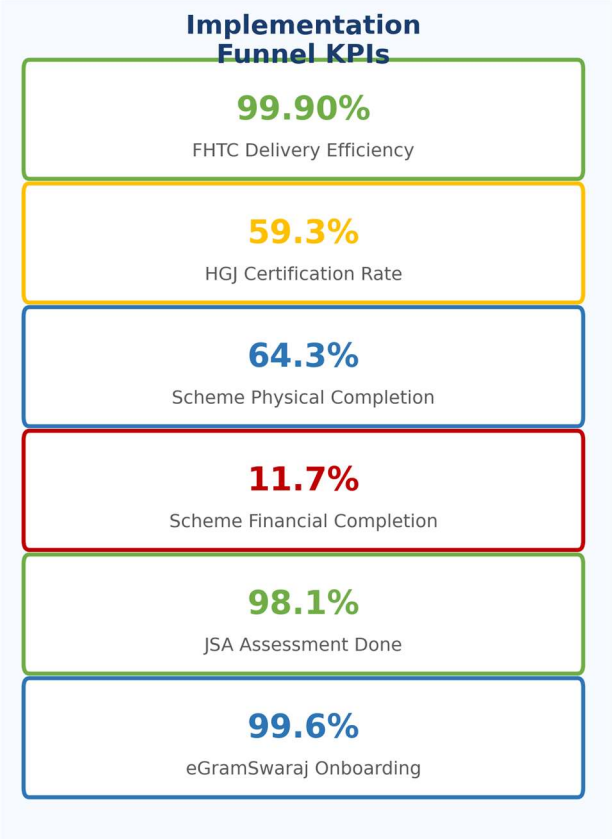

Figure 12: JJM Implementation KPIS

VI. DISCUSSION

The Infrastructure–Sustainability Paradox

Solapur's JJM experience exemplifies a paradox increasingly recognised in rural infrastructure literature: high physical delivery performance does not automatically translate into sustained service delivery. With 99.90% FHTC coverage achieved, the district faces a 'second-generation' governance challenge—ensuring that installed connections remain functional, water quality is maintained,

community management systems are operational, and financial sustainability is assured through O&M cost recovery. The 11.7% financial completion rate and 59.3% HGJ certification rate are early warning indicators that the institutional foundations for long-term sustainability may not yet be secure [41].

The sustainability challenge in basaltic Solapur is compounded by the hydrogeological and climatic constraints extensively documented in prior research: seasonal groundwater fluctuations affect source reliability, aquifer depletion reduces yields from scheme borewells, and drought years create peak demand precisely when supply is most constrained [32,42]. Rural water supply systems in similar hard-rock terrains have been documented as particularly vulnerable to seasonal service disruption, with consequent damage to community trust in piped supply and potential reversion to traditional sources [11,14].

Gender and Equity Dimensions

JJM's primary equity rationale is the reduction of the time and physical burden of water collection, disproportionately borne by rural women and girls. In Solapur, where household coverage has reached 99.90%, this burden should be dramatically reduced for the vast majority of rural families. However, the critical gaps in AWC coverage—institutions that serve pregnant women, nursing mothers, and children under 6—represent a gendered equity failure within JJM's institutional mandate. Madha block's 7.4% AWC coverage, in a block where household coverage is 100%, indicates that the most vulnerable populations within JJM's own framework are not fully reached [5].

Digital Governance and Accountability

The 99.6% eGramSwaraj onboarding rate represents a significant digital governance achievement. Digital platforms, when effectively utilised, create accountability mechanisms—real-time connection records, online grievance systems, and transparent financial reporting—that strengthen local governance and enable citizens to exercise their right to water services [43]. However, platform onboarding without active utilisation risks becoming a bureaucratic compliance exercise rather than a genuine governance transformation. The integration of JJM monitoring with broader digital governance initiatives—including the PM GatiShakti infrastructure mapping and Atal Bhujal Yojana groundwater monitoring platforms documented in prior research in this region [27,28,44]—represents an opportunity for more holistic water governance ecosystems.

Financial Governance and Scheme Sustainability

The 11.7% financial completion rate is the most pressing governance deficit identified in this study. Financial incompletion creates a cascade of negative governance consequences: audit observations accumulate, maintenance responsibilities remain legally ambiguous, and GP-level confidence in the programme is undermined. Research on rural water supply governance in Maharashtra has consistently identified financial management capacity—including bookkeeping, audit compliance, and utilisation certificate preparation—as a critical limiting factor at GP level, particularly in low-literacy, low-resource administrative contexts [36,37]. Dedicated financial governance support—through District Programme Management Units (DPMUs) with accounting staff embedded at block level—has shown effectiveness in accelerating financial closure in comparable programmes in other states.

Comparative Context and Policy Implications

Solapur's JUPI district average of 84.0, representing Good performance on a composite governance scale, positions it as a significant JJM success story while identifying clear pathways for improvement. The findings have direct policy implications for the national JJM programme: (1) HGJ certification targets should be incorporated into performance-linked district rankings alongside FHTC delivery; (2) AWC water coverage should be tracked as a mandatory sub-indicator with block-level targets; (3) financial closure should be elevated as a programme priority with dedicated DPMU support and timeline-based incentives; (4) JUPI-type composite indices should be adopted by states for internal performance management; and (5) JSA assessments should be digitally integrated with eGramSwaraj for continuous service quality monitoring. Broader lessons for rural water governance policy in

developing countries—regarding the need to balance physical delivery ambition with administrative sustainability—are consistent with findings from comparable programmes in sub-Saharan Africa and South-East Asia [6].

VII. CONCLUSIONS

This study presents a comprehensive governance case study of Jal Jeevan Mission implementation in Solapur District, Maharashtra, analysing performance across six interconnected dimensions from programme launch to May 2026. The central finding is a governance paradox: extraordinary physical infrastructure achievement—99.90% FHTC coverage, near-universal eGramSwaraj onboarding, and strong school coverage—coexists with critical accountability gaps in HGJ certification (59.3%), financial completion (11.7%), and AWC institutional coverage (59.4% district average).

The JJM Utilization Performance Index (JUPI), developed in this study as a composite governance metric, reveals meaningful block-level differentiation—from Akkalkot's excellence (JUPI: 93.0) to Mangalvedhe's need for improvement (JUPI: 75.9)—that aggregate statistics conceal. This differentiation is policy-actionable: blocks in the Needs Improvement category have clear, measurable deficits in specific dimensions that can guide targeted district-level interventions without wholesale programme redesign.

JJM's legacy in Solapur—and nationally—will ultimately be determined not by the number of tap connections installed, but by whether those connections deliver reliable, quality-assured water to every household, institution, and community member, sustained by financially sound and accountable local governance systems. The transition from infrastructure delivery to service sustainability is the defining governance challenge of JJM's second phase. Solapur's experience offers valuable lessons—of what mission-mode implementation can achieve, and of what governance infrastructure is needed to make physical infrastructure meaningful in the long run—for the broader enterprise of rural water security in India and comparable developing country contexts.

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