

Sustainability and Community Participation in Rural Water Governance: Evidence from the Jal Jeevan Mission in Karnataka

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1 **Sustainability and Community Participation in Rural Water Governance:**
2 **Evidence from the Jal Jeevan Mission in Karnataka**

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4

5 **Abstract**

6 This study investigates the sustainability of the Jal Jeevan Mission (JJM) and the relationship
7 between community involvement and educational qualification across selected districts of
8 Karnataka. Using quantitative data collected from 921 households through structured
9 questionnaires, the study employs ANOVA and correlation analyses to assess variations in
10 sustainability and community engagement. The results indicate significant differences in the
11 sustainability of JJM schemes across districts, highlighting the influence of local governance,
12 environmental conditions, and institutional efficiency. However, the correlation analysis
13 shows no significant relationship between education level and community participation,
14 suggesting that social mobilization and awareness initiatives may be more critical
15 determinants of involvement than formal education. The findings emphasize the need for
16 localized planning, continuous capacity-building, and the strengthening of Village Water and
17 Sanitation Committees (VWSCs) to ensure equitable and sustainable water access. Future
18 research should integrate qualitative insights and longitudinal assessments to evaluate
19 behavioural and institutional changes influencing the long-term success of rural water supply
20 programs.

21 **Keywords:** Jal Jeevan Mission, Sustainability, Community Participation, Water Governance,
22 Rural Infrastructure, Karnataka

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25 **1. Introduction**

26 Water is the cornerstone of human survival, economic development, and ecological balance.
27 In India, ensuring equitable and sustainable access to safe drinking water has long been a
28 critical developmental challenge. The Government of India launched the Jal Jeevan Mission
29 (JJM) in 2019 under the Ministry of Jal Shakti with the ambitious vision of providing
30 Functional Household Tap Connections (FHTCs) to every rural household by 2024. The
31 mission is not merely an infrastructural project but a transformative governance initiative
32 designed to shift from supply-driven approaches to demand-driven, community-managed
33 models. Its sustainability, however, hinges not only on the creation of water supply
34 infrastructure but also on the active participation and ownership of local communities.

35 The concept of sustainability in the context of JJM extends beyond the physical durability of
36 pipelines and reservoirs; it encompasses institutional, financial, social, and environmental
37 dimensions. Sustainable rural water supply requires systems that are resilient to climate
38 variability, grounded in local resource management, and supported by inclusive governance.
39 India's diverse hydrogeological and socio-economic contexts pose challenges to sustaining

40 these systems, particularly in water-scarce, drought-prone, and remote regions. Past
41 initiatives such as the Accelerated Rural Water Supply Programme (ARWSP) and the
42 National Rural Drinking Water Programme (NRDWP) often fell short of long-term success
43 due to inadequate community ownership and maintenance mechanisms. The JJM attempts to
44 address these gaps by empowering Gram Panchayats and Village Water and Sanitation
45 Committees (VWSCs) to plan, implement, manage, and monitor local water supply schemes.

46 Community involvement serves as both the foundation and the measure of sustainability in
47 the JJM framework. The mission's guidelines emphasize a participatory approach where
48 communities are encouraged to undertake water source sustainability measures, contribute to
49 operation and maintenance costs, and ensure equitable access. Genuine participation
50 transforms beneficiaries into stakeholders, fostering accountability and collective
51 responsibility. When communities take ownership, systems are more likely to be maintained,
52 repaired, and used judiciously. Moreover, community-led initiatives tend to integrate local
53 knowledge about water sources, terrain, and social dynamics, enhancing adaptability and
54 resilience. However, translating these principles into practice requires addressing disparities
55 in awareness, technical capacity, gender participation, and local governance efficacy.

56 Another key determinant of sustainability lies in the integration of traditional wisdom with
57 modern technology. India's villages possess a rich heritage of water conservation practices—
58 such as tank irrigation systems, stepwells, and rainwater harvesting—which align with the
59 mission's source sustainability objectives. By combining these traditional methods with
60 contemporary solutions like GIS mapping, real-time monitoring, and IoT-based systems, the
61 JJM can enhance efficiency and transparency. Nonetheless, the sustainability of these efforts
62 depends on ensuring continuous financial flows, robust capacity-building programs, and
63 effective monitoring frameworks. Community training, behavior change communication, and
64 the strengthening of local institutions are vital to ensure that infrastructure remains functional
65 long after external funding ceases.

66 Equity and inclusion form yet another dimension of sustainable implementation. Women, as
67 primary water managers in households, play a central role in the success of the mission. Their
68 representation in VWSCs, decision-making forums, and local management committees not
69 only enhances gender equity but also improves the responsiveness of water governance
70 systems. Similarly, marginalized groups must be actively involved to ensure that the mission
71 fulfills its objective of "Har Ghar Jal" in both letter and spirit. This demands context-specific
72 strategies that align with socio-cultural realities while maintaining transparency and
73 accountability.

74 In light of these considerations, the sustainability of the Jal Jeevan Mission depends on the
75 convergence of physical, social, and institutional efforts that reinforce each other.
76 Understanding how community participation evolves, how education influences engagement,
77 and how these factors together determine the long-term functionality of rural water systems is
78 vital for the mission's success. Keeping these aspects in mind, the present study aims to
79 assess the long-term sustainability of the Jal Jeevan Mission scheme and also examine
80 whether there exists a relationship between education and community involvement.

81 **2. Review of Literature**

82 The sustainability of the Jal Jeevan Mission (JJM) and the extent of community participation
83 in its implementation have emerged as key determinants of the program's long-term success.
84 Ensuring the continuity of safe and reliable rural water supply systems demands a holistic
85 approach that integrates environmental, financial, institutional, and social dimensions. Since
86 groundwater constitutes over 85% of India's rural drinking water supply, its sustainability is
87 directly tied to rural water security. Studies have reported substantial depletion of
88 groundwater levels in several parts of the Indo-Gangetic plains and peninsular India, posing
89 serious risks to the viability of rural tap water schemes (Asbetsadik et al., 2025). To counter
90 these challenges, JJM incorporates measures such as water budgeting, aquifer recharge, and
91 greywater reuse. However, the adoption of these measures has been uneven across states—
92 while Maharashtra and Gujarat have effectively introduced watershed-based practices, other
93 states continue to focus predominantly on infrastructure expansion (Wescoat et al., 2022;
94 Singh et al., 2020).

95 Operational and infrastructural sustainability also represent critical challenges within the
96 mission. Ahmed et al. (2024) report that nearly one-third of rural water schemes developed
97 before 2010 are currently non-functional due to weak operation and maintenance
98 mechanisms. The JJM seeks to address these gaps through a *utility-based approach*,
99 emphasizing asset management, village-level maintenance, and capacity building. Village
100 Water and Sanitation Committees (VWSCs) are expected to manage local operations and
101 repairs, yet Biswas et al. (2022) find that these committees often remain inactive or lack the
102 technical competence necessary to ensure sustainable water supply. Cost recovery is another
103 concern, as less than 40% of rural households—especially in economically weaker regions—
104 are willing or able to pay for water services (Dhaarna & Kashyap, 2025). Political reluctance
105 to enforce user fees and limited institutional mechanisms further jeopardize financial
106 sustainability. As Zetland (2021) observes, complete sustainability requires a balanced model
107 of user contributions, targeted subsidies, and continuous government support.

108 From an environmental standpoint, JJM promotes source sustainability through initiatives
109 like greywater management, groundwater replenishment, and water harvesting. The
110 integration of "Catch the Rain" campaigns with Mahatma Gandhi NREGA has facilitated
111 aquifer recharge in several districts (Turuk, 2023). However, Tingey-Holyoak et al. (2024)
112 highlight persistent issues such as weak interdepartmental coordination and inadequate
113 incorporation of climate resilience into planning frameworks. Villages often lack the
114 technical capacity and data systems necessary for informed decision-making. Consequently,
115 the absence of comprehensive watershed management and adaptive planning restricts the
116 mission's environmental objectives to partial achievements. Effective institutional
117 coordination and investment in climate-resilient management systems are essential to protect
118 these gains from future environmental volatility.

119 Institutional convergence is another determinant of sustainability. The JJM's design
120 encourages coordination between multiple departments rural development, water resources,

121 health, and education to promote integrated service delivery. However, Asbetsadik et al.
122 (2025) note that practical challenges such as overlapping mandates, weak data sharing, and
123 bureaucratic inertia hinder cooperation, causing delays and inefficiencies in implementation.
124 Equity dimensions have also drawn attention. Pankaj (2019) emphasizes how caste, gender,
125 and spatial marginalization continue to affect access to basic services, with Dalit and tribal
126 settlements often underserved. To ensure the long-term sustainability of JJM interventions
127 across diverse groups, participatory planning, grievance redressal, and inclusive governance
128 mechanisms are indispensable.

129 Parallel to sustainability, community participation has long been recognized as a fundamental
130 pillar of successful rural development programs in India. Numerous studies underscore that
131 meaningful engagement of local populations in planning, implementation, and monitoring
132 processes improves both efficiency and ownership. Asbetsadik et al. (2025) observed that
133 while institutional mechanisms for local participation exist, their potential is often
134 undermined by bureaucratic lethargy, elite dominance, and illiteracy. Similarly, Shah (2021)
135 found that the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)
136 performed significantly better where civil society organizations supported local
137 accountability. Shanthi (2024), in her study of the Integrated Child Development Services
138 (ICDS), reinforced the importance of community ownership and cultural sensitivity for
139 program success.

140 Research on rural water schemes further validates this pattern. Bombade (2024) concluded
141 that water supply programs achieved greater operational efficiency and sustainability when
142 local committees supervised contractors and made daily operational decisions. Daniel et al.
143 (2021) similarly found that the effectiveness of community-driven water programs hinged on
144 the strength of local leadership, state support, and NGO engagement. Within JJM, these
145 dynamics are clearly visible. Sahoo and Divi (2023) reported that although VWSCs were
146 established in most villages surveyed, their effectiveness varied widely—successful cases
147 often coincided with external support for training and capacity building, whereas committees
148 in politically weak regions remained dormant.

149 Behavioural change and capacity building form another axis of JJM's participatory
150 framework. Information, Education, and Communication (IEC) campaigns aim to foster
151 awareness of water conservation, hygiene, and community management. Yet Hairunisya et al.
152 (2023) reveal that such initiatives are frequently underfunded and poorly localized. In
153 Madhya Pradesh's tribal districts, for instance, training modules were not translated into local
154 languages, and sessions were overly technical, thereby restricting inclusivity.

155 A persistent limitation across studies concerns the availability of disaggregated data. As Mia
156 et al. (2022) point out, while overall statistics on tap connections and budgets are accessible,
157 village-level information on training quality, functionality, and sustainability is rarely
158 published, making independent evaluation difficult. Das (2014) adds that social capital,
159 particularly through women's associations and self-help groups, is vital for the sustainability
160 of local water systems. Nevertheless, community involvement often declines in remote or

161 tribal regions due to weak institutions, whereas states like Kerala and Himachal Pradesh
162 demonstrate stronger participation linked to supportive sociocultural contexts. Collectively,
163 these studies reveal that the sustainability of the JJM is closely intertwined with the quality
164 and depth of community participation. The mission's long-term success depends not only on
165 infrastructural and financial investments but also on fostering inclusive, educated, and
166 empowered communities capable of managing their water resources sustainably.

167 Based on the above discussions, this study proposes the following hypotheses:

168 **H1:** There is a significant difference in the sustainability of water supply systems
169 implemented under JJM among selected districts of Karnataka.

170 **H2:** There is a significant relationship between educational qualification of respondents and
171 their level of community involvement under JJM among selected districts of Karnataka.

172 3. Research Methodology

173 The present study is grounded in a quantitative research design, utilizing data collected
174 through a structured household survey. This method was chosen for its ability to yield
175 measurable and objective insights aligned with the study's research objectives. Primary data
176 were gathered using a questionnaire comprising predominantly close-ended questions, which
177 ensured uniformity in responses and facilitated statistical comparison across household
178 groups. The use of closed questions also enhanced the precision of quantitative analysis,
179 allowing for systematic examination of trends and variations across the study areas.

180 Respondents were selected through a random sampling technique, providing every household
181 within the study area an equal probability of selection. This approach effectively minimized
182 potential sampling bias and strengthened the reliability and generalizability of the study's
183 findings. The survey was conducted with members of each selected household. This
184 interactive approach allowed for the clarification of questions when necessary, thereby
185 improving the accuracy and completeness of responses and ensuring high-quality data
186 collection.

187 A total of 692 households formed the sample, encompassing diverse socio-economic
188 backgrounds from four districts of Karnataka namely Mandya, Mysore, Tumkur, and
189 Kodagu. These districts were selected to represent varying hydro-ecological and socio-
190 economic contexts within the state. For data analysis, the study employed a range of
191 parametric statistical techniques to validate hypotheses and draw inferences from the
192 collected data. The principal tools used included descriptive statistics, Analysis of Variance
193 (ANOVA), and Bivariate Correlation analysis. Descriptive statistics were applied to
194 summarize the demographic characteristics and response patterns of the sample population.
195 ANOVA was utilized to determine whether significant differences existed in the
196 sustainability of the JJM scheme across the selected districts, while correlation analysis was
197 employed to assess the relationship between educational qualification and community
198 involvement. Together, these statistical methods provided a comprehensive analytical

199 framework to address the study's research questions and objectives systematically and
200 empirically.

201 Data Analysis & Interpretation Results

202 4.1 Descriptive Statistics

203 **Table 1. Findings of Descriptive Statistics**

Particulars	Mean	Std. Deviation
Gender	1.57	0.496
Educational Qualification	3.57	1.915
Occupation	3.25	1.905
District	2.47	0.897

204 **Note: Authors compilation**

205 ¹ The descriptive statistics reveal the demographic profile of the respondents surveyed under
206 the study. The mean value for gender is 1.57 with a standard deviation of 0.496, indicating
207 that the sample comprised a slightly higher proportion of male respondents compared to
208 females, though the distribution is fairly balanced. The mean educational qualification score
209 of 3.57 with a standard deviation of 1.915 suggests that, on average, respondents had attained
210 education around the secondary to higher secondary level, but with considerable variability,
211 indicating the presence of both lower and higher educational backgrounds within the sample.
212 The mean occupational score of 3.25 (SD = 1.905) implies that most respondents were
213 engaged in semi-skilled or agricultural occupations, again showing substantial variation in
214 employment types. Lastly, the mean district score of 2.47 with a standard deviation of 0.897
215 indicates an even distribution of respondents across the four selected districts of Karnataka,
216 confirming that the sampling captured geographic diversity effectively for comparative
217 analysis.

218

219

220 4.2 Results of Bivariate Correlation

221 **Table 2. Findings of Bivariate Correlation**

		Educational Qualification	Community Involvement
Educational Qualification	¹³ Pearson Correlation	1	.017
	Sig. (2-tailed)		.655
Community Involvement	Pearson Correlation	.017	1

	Sig. (2-tailed)	.655	
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222

Note: Authors compilation

223 The correlation results presented in Table 2 indicate the relationship between educational
 224 qualification and community involvement under JJM. The Pearson correlation coefficient (r)
 225 between the two variables is 0.017, which signifies an extremely weak and positive
 226 relationship. This value is very close to zero, suggesting that changes in the level of education
 227 have almost no measurable effect on the degree of community participation within the
 228 program. In practical terms, this means that whether respondents possess higher or lower
 229 educational qualifications does not substantially influence their level of engagement in JJM-
 230 related activities such as decision-making, attending meetings, or participating in monitoring
 231 and maintenance efforts. Hence, the alternative hypothesis which states that there is a
 232 significant difference in the sustainability of water supply systems implemented under JJM
 233 among selected districts of Karnataka is accepted.

234 Furthermore, the significance (Sig. 2-tailed) value associated with this correlation is 0.655,
 235 which is considerably higher than the conventional significance level of 0.05. This indicates
 236 that the observed correlation is not statistically significant. In other words, there is
 237 insufficient evidence to conclude that any real relationship exists between educational
 238 qualification and community involvement in the population. The probability that the observed
 239 correlation occurred by random chance is 65.5%, which is too high to reject the null
 240 hypothesis. Therefore, it can be inferred that educational attainment does not significantly
 241 influence community involvement in the implementation of the JJM across the surveyed
 242 households, implying that factors other than education such as local leadership, institutional
 243 support, or socio-cultural context may play a more decisive role in shaping participatory
 244 behaviour in rural water governance.

245 **4.3 Analysis of Variance (ANOVA)**

246 The ANOVA results presented in the Table 3 reveal the statistical comparison of mean
 247 sustainability scores of the Jal Jeevan Mission (JJM) across the four selected districts of
 248 Karnataka. The F-value is 39.342, which is substantially high, and the significance level
 249 (Sig.) is 0.000, which is well below the threshold of 0.05. This indicates that the differences
 250 in the mean scores among the districts are statistically significant. In other words, the level of
 251 sustainability of JJM implementation varies significantly across districts, confirming that the
 252 observed variations are not due to random chance.

253

Table 3. Findings of ANOVA

ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2006.66	3	668.886	39.342	.000
Within Groups	11697.4	688	17.002		

254

Note: Authors compilation

255 Specifically, the Between-Groups Sum of Squares (2006.66) compared to the Within-Groups
 256 Sum of Squares (11697.4) shows that a considerable proportion of the total variance in
 257 sustainability outcomes (Total Sum of Squares = 13704.1) is explained by differences
 258 between districts rather than within them. The Mean Square value between groups (668.886)
 259 being much larger than that within groups (17.002) further reinforces that district-level
 260 factors such as local governance capacity, community participation, resource availability, and
 261 administrative efficiency contribute meaningfully to the sustainability performance under
 262 JJM. Therefore, the alternative hypothesis stating that there is significant difference in
 263 sustainability of JJM across districts is accepted, confirming that district-level variations
 264 significantly influence the sustainability outcomes of the scheme.

265

Table 4. Findings of Tukey HSD Multiple Comparison

Tukey HSD Multiple Comparison						
(I) District		Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Kodagu	Mandya	-2.00705*	.48056	.000	-3.2447	-.7694
	Mysuru	.18575	.47255	.979	-1.0312	1.4027
	Tumkuru	-4.94513*	.59910	.000	-6.4880	-3.4023
Mandya	Kodagu	2.00705*	.48056	.000	.7694	3.2447
	Mysuru	2.19280*	.36938	.000	1.2415	3.1441
	Tumkuru	-2.93809*	.52160	.000	-4.2814	-1.5948
Mysuru	Kodagu	-.18575	.47255	.979	-1.4027	1.0312
	Mandya	-2.19280*	.36938	.000	-3.1441	-1.2415
	Tumkuru	-5.13088*	.51422	.000	-6.4552	-3.8066
Tumkuru	Kodagu	4.94513*	.59910	.000	3.4023	6.4880
	Mandya	2.93809*	.52160	.000	1.5948	4.2814
	Mysuru	5.13088*	.51422	.000	3.8066	6.4552

*. The mean difference is significant at the 0.05 level.

266

Note: Authors compilation

267 The results of the Tukey HSD multiple comparison test show that significant mean
 268 differences ($p < 0.05$) exist between most district pairs, except between Kodagu and Mysuru,
 269 where the difference is statistically insignificant ($MD = 0.18575$, $p = 0.979$). This indicates
 270 that sustainability levels in Kodagu and Mysuru are nearly similar. However, all other district
 271 combinations demonstrate significant disparities. For instance, Kodagu differs significantly
 272 from Mandya (-2.00705 , $p = 0.000$) and Tumakuru (-4.94513 , $p = 0.000$), showing that
 273 Kodagu's sustainability performance is relatively higher. Similarly, Mandya exhibits
 274 significantly higher sustainability scores compared to Tumakuru (-2.93809 , $p = 0.000$) but
 275 lower than Kodagu and Mysuru. The largest mean differences are observed between Mysuru
 276 and Tumakuru (-5.13088 , $p = 0.000$), indicating a substantial gap in the sustainability
 277 outcomes between these two districts.

278 Overall, the post-hoc analysis confirms that Tumakuru consistently records significantly
279 lower sustainability scores compared to all other districts, suggesting greater operational,
280 environmental, or institutional challenges in sustaining JJM systems there. Kodagu and
281 Mysuru, on the other hand, show relatively comparable and higher sustainability outcomes,
282 possibly due to stronger ecological conservation practices and better-managed local water
283 governance mechanisms. These results highlight the need for district-specific strategies to
284 address local disparities in water sustainability performance under JJM implementation.

285

286 5. Discussion

287 The findings of this study provide significant insights into the patterns of sustainability
288 achieved under the Jal Jeevan Mission (JJM) and the influence of community participation
289 and education on its outcomes. The results from the analysis of variance clearly indicate that
290 the sustainability of rural water supply systems differs notably across the four selected
291 districts of Karnataka. These variations can be attributed to diverse factors such as
292 governance quality, administrative efficiency, local ecological conditions, and the strength of
293 community-based institutions. Districts that demonstrate stronger institutional frameworks
294 and better coordination between government agencies tend to achieve higher levels of
295 sustainability in water supply systems, while those facing governance bottlenecks and
296 resource constraints continue to experience operational and maintenance challenges.

297 The Post-hoc comparisons further reinforce that sustainability is not uniformly distributed
298 across the study area. Ecologically sensitive and well-administered regions such as Kodagu
299 and Mysuru display relatively stable and resilient systems, whereas water-stressed and high-
300 density areas like Tumakuru encounter recurring difficulties in ensuring consistent service
301 delivery and source management. This uneven performance underscores the importance of
302 contextualized approaches rather than a uniform model of implementation. Programs
303 emphasizing community-led management, local monitoring, and adaptive maintenance
304 appear to perform better in sustaining JJM outcomes.

305 The correlation analysis between educational qualification and community involvement
306 revealed no significant relationship, implying that the level of education alone does not
307 determine the degree of engagement in JJM activities. This suggests that community
308 participation is driven more by awareness initiatives, leadership, institutional support, and
309 social cohesion than by formal education. Therefore, enhancing participation requires
310 localized capacity-building, targeted awareness campaigns, and inclusive planning
311 frameworks that go beyond educational attainment.

312 The findings of the study carry several important implications at the policy, practical, and
313 societal levels. From a policy standpoint, the results underscore the necessity for district-
314 specific strategies in implementing and sustaining the Jal Jeevan Mission (JJM), as uniform
315 approaches may not effectively address local disparities in water availability, governance
316 capacity, and institutional functioning. Practically, the absence of a strong relationship
317 between education and community participation highlights that awareness creation, localized
318 training, and inclusive capacity-building programs are more critical than formal education
319 alone in ensuring active engagement. Strengthening Village Water and Sanitation
320 Committees (VWSCs), fostering coordination among departments, and integrating behavioral
321 change communication can enhance operational sustainability. At the societal level, the

322 findings emphasize that sustainability in rural water systems is deeply rooted in collective
323 responsibility, gender inclusion, and social cohesion. Building social capital and empowering
324 local communities can therefore transform the JJM from a government-driven scheme into a
325 truly community-owned and maintained initiative, ensuring long-term water security and
326 equitable development.

327 6. Conclusion

328 The study concludes that the sustainability of water supply systems under JJM varies
329 significantly across the selected districts of Karnataka, reflecting the influence of district-
330 specific ecological, institutional, and governance factors. Regions with stronger local
331 institutions, participatory planning mechanisms, and effective inter-departmental
332 coordination demonstrate higher sustainability outcomes, whereas areas facing administrative
333 constraints and resource limitations continue to struggle with maintenance and operational
334 challenges. Furthermore, the absence of a significant correlation between educational
335 qualification and community participation suggests that formal education alone does not
336 determine engagement in JJM activities. Instead, awareness, leadership, and social
337 mobilization play more decisive roles in fostering community ownership and long-term
338 functionality of rural water systems. These findings reaffirm that the sustainability of JJM is
339 not merely a technical or financial concern but a complex socio-institutional process
340 requiring localized planning and collective accountability.

341 In terms of future research, there is considerable scope to expand the present work by
342 incorporating qualitative assessments and longitudinal studies to capture evolving community
343 behaviors, institutional dynamics, and environmental changes influencing sustainability.
344 Future studies could also explore comparative analyses across states or ecological zones,
345 examining how contextual factors such as climate variability, gender participation, and
346 governance models affect long-term outcomes. Moreover, investigating the impact of digital
347 governance tools, social audits, and decentralized financing mechanisms could provide
348 valuable insights into enhancing accountability and efficiency within JJM implementation.
349 Such extensions would not only deepen academic understanding but also contribute to
350 evidence-based policymaking for resilient and inclusive rural water management in India.

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