GEOGRAPHICAL ANALYSIS

ORIGINAL ARTICLE

A Geographical Study on Assessment of Functional Household Tap Connection (FHTC) Implementation in Karnataka State using OLS method

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Abstract

Access to clean and safe water is essential for human well-being and socio-economic progress. The Jal Jeevan Mission (JJM), initiated by the Government of India in 2019, aims to ensure Functional Household Tap Connections (FHTCs) for all rural households by 2024. In Karnataka, a state with a substantial rural populace, JJM plays a pivotal role in alleviating water scarcity and enhancing water accessibility. This study assesses the implementation of JJM in Karnataka, with a focus on the distribution of tap water connections across districts. By scrutinizing data on tap water coverage, the research identifies disparities in access and investigates factors contributing to varying levels of implementation success. The Ordinary Least Squares (OLS) method is employed to discern the divergence between estimated and actual tap water connections. Initial findings indicate that districts like Gadag, Dharwad, and Chamarajanagara demonstrate higher proportions of tap water connections, likely attributed to prioritized resource allocation, early implementation, infrastructure development, community involvement, and strategic planning. However, further inquiry is necessary to comprehensively understand the nuanced factors shaping implementation outcomes. The analysis using the OLS method reveals that in Northern Karnataka, the actual number of tap water connections surpasses the estimated value, suggesting effective implementation efforts. Conversely, in southern and coastal districts, while the estimated tap water connections are high, the actual performance falls short of the estimation, posing a significant challenge for the JJM slated for completion by December 2024. Hence, policymakers and scholars must address this disparity to achieve the target of 100% tap water connections in Karnataka.

1 Introduction

Access to clean water is a fundamental right crucial for public health and development, especially in rural India. The Jal Jeevan Mission (JJM) launched by the Government of India in 2019 aims to provide piped water to all rural households by 2024, with Functional Household Tap Connections (FHTCs) being a key component.

In Karnataka, significant progress has been made in providing tap water connections to rural homes. As of August 15, 2019, 24.23% (Map.1) of households had tap water connections, which has since increased to 74.60% in February 2024.

While challenges remain, efforts have resulted in providing tap water connections to 66.48% of rural households since the mission's launch.

FHTC implementation in Karnataka is crucial for addressing water scarcity and improving rural life. District-wise data analysis helps assess progress and challenges, informing strategies for better implementation.

The aim of the study is to identify the differences between estimated and actual tap water connections in different districts of Karnataka State. The data has been collected from the official JJM website. For data analysis, simple statistical techniques like percentage, average, ordinary least square regression methods have been used. Graphs, maps are also used for data analysis.

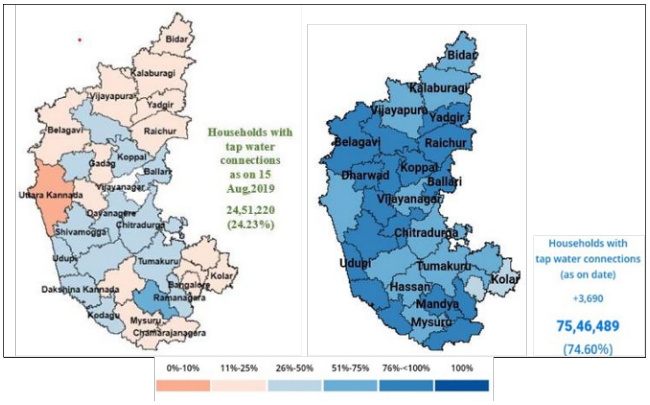

Fig. 1. Jal Jeevan Mission: Progress in Karnataka (JJM report) in 2019 and 2024
Source map: JJM website

Based on the current status of the Jal Jeevan Mission report, the map shows that Gadag (99.99%), Dharwadh (99.12%) and Chamarajanagara (91.63%) districts emerge as the top three with tap water connections exceeding 90%. Contrary, districts like Kolar (40.47%), Bengaluru urban (40.62%) exhibit tap water connections below 50%. Notably, a trend emerges where most northern karnataka districts demonestarte medium tap water connections compared to theor southern counterparts.

2 Phase-wise Implementation of JJM in Karnataka

The implementation of the Jal Jeevan Mission scheme in Karnataka has followed a phased approach to ensure systematic coverage and efficient utilization of resources.

- **Preparatory Phase:** Before the formal launch of the JJM scheme, Karnataka conducted detailed planning and assessment exercises to identify priority areas, assess existing infrastructure, and estimate resource requirements. This phase involved coordination between various government departments, local authorities, and stakeholders to lay the groundwork for implementation.
- **Launch and Initial Rollout:** The JJM scheme was officially launched in Karnataka, marking the beginning of the implementation process. During this phase, pilot projects may have been initiated in select districts or regions to test implementation strategies, refine processes, and identify potential challenges.
- **Identification of Beneficiary Households:** A crucial step in the implementation process was the identification of beneficiary households in rural areas lacking access to piped water supply. This involved surveys, data collection, and verification exercises to ensure that the scheme reaches the intended beneficiaries effectively.
- **Infrastructure Development:** With beneficiary households identified, the focus shifted to infrastructure development, including the construction of water supply systems, installation of pipelines, and establishment of water treatment facilities. This phase required coordination between government agencies, contractors, and local communities to ensure timely completion of projects.

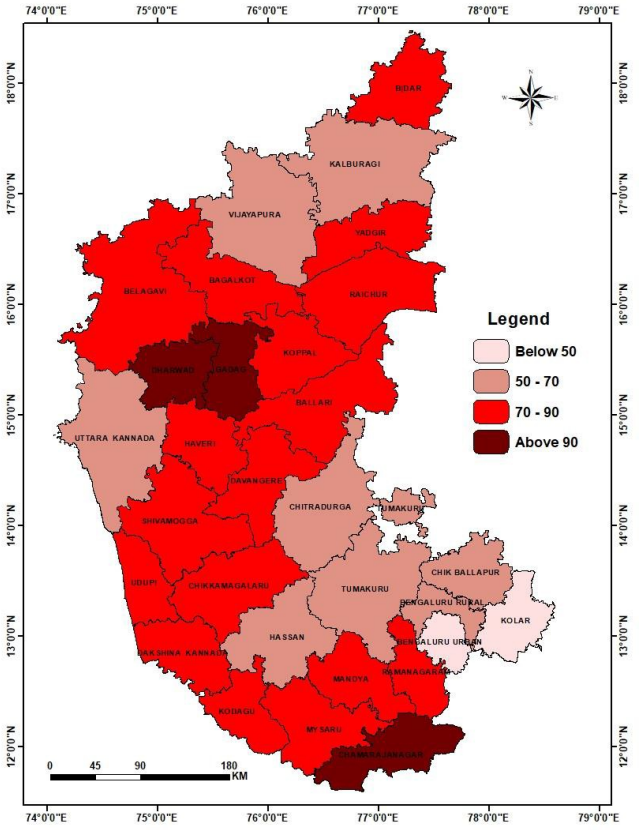

Fig. 2. Percentage of Rural household tap connection under JJM in Feb 2024

- **Capacity Building and Training:** Alongside infrastructure development, efforts were made to build the capacity of local institutions, water supply agencies, and community members to manage and maintain water supply systems effectively. Training programs may have been conducted to impart technical skills, promote community participation, and raise awareness about water conservation and hygiene practices.
- **Expansion and Scaling Up:** As initial projects were completed and operationalized, the JJM scheme expanded its coverage to reach more rural households across Karnataka. This involved prioritizing underserved areas, targeting marginalized communities, and leveraging additional funding and resources to accelerate implementation.
- **Monitoring and Evaluation:** Throughout the implementation process, robust monitoring and evaluation mechanisms were put in place to track progress, assess performance, and address any issues or bottlenecks that arose. Regular reviews, audits, and feedback mechanisms helped ensure transparency, accountability, and continuous improvement.
- **Sustainability and Long-term Planning:** As the JJM scheme progresses, efforts are being made to ensure the sustainability of water supply systems and the long-term viability of investments.

This includes promoting community ownership, leveraging technology for efficient water management, and integrating water supply planning with broader rural development initiatives.

3 Assessment of Functional Tap Water connections using Ordinary Least Square method

In examining the Jal Jeevan Mission (JJM), it's crucial to highlight the prioritized areas for providing potable tap water. The mission targets communities dealing with water quality issues, Japanese Encephalitis/Acute Encephalitis Syndrome (JE/AES) affected regions, aspirational districts, drought-prone and desert areas, SC/ST majority villages, and Saansad Adarsh Gram Yojana (SAGY) villages, emphasizing its commitment to serving vulnerable and marginalized populations.

The present study, evaluate functional tap water connections based on groundwater pH value and annual rainfall. The ordinary least square method has been used to estimate the share of tap water connections for Karnataka State. Inaddition to this, the study also identify the regions where there is a disparity between low current tap water connections and higher estimated shares of water connections. This analysis sheds light on districts lacking adequate tap water connections.

According to Ground water report of Karnataka 2020, in Bidar and Gulbarga, where the pH values are below 8, the groundwater may be slightly acidic or neutral, potentially indicating natural geological processes or localized contamination sources. On the other hand, in Udupi, Daksinakannada and Chamarajanagar, where the pH values are above 8.6, the groundwater may be alkaline, possibly influenced by geological formations or human activities such as agriculture, urbanization or industrial operations. Finally the result indicates that nearly all districts, with the exception of a few, exhibit normal ground water ph values.

The average annual rainfall from 2015 to 2021 in Karnataka State shows that North and Hyderabad Karnataka, including districts such as Belgaum, Bagalkote, Raichur, Gadag, Koppal, and Bellary, along with some South districts like Tumkur and Mandya, have an average annual rainfall of less than 700 mm. Most of the southern districts, including Bangalore Rural and Urban, Kolar, Ramanagara, Mysore, Chamarajanagar, and Hassan, experience annual rainfall ranging from 700 to 1400 mm. On the other hand, coastal districts like Uttara Kannada, Dakshina Kannada, and Udupi receive very high rainfall, exceeding 2800 mm.

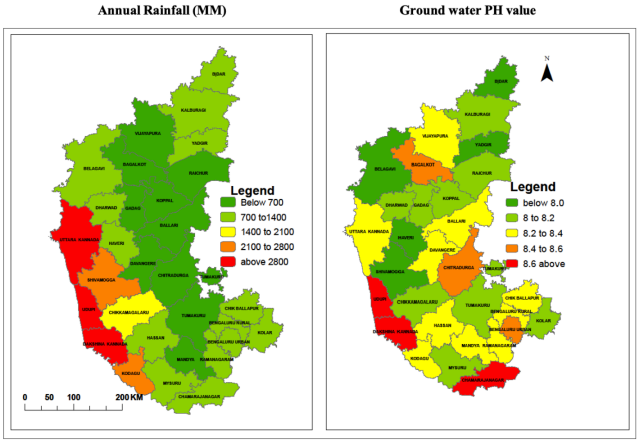

Fig. 3. District wise Annual Rainfall and Ground water PH value of Karnataka State (2019-20)

Based on this analysis, the study estimates the probability of the share of tap water connections and then compares that estimated result with the actual share of ground water connections using the ordinary least square method.

In the Ordinary Least Squares (OLS) method, the standard residual represents the difference between the observed value and the predicted value of the dependent variable, divided by the standard deviation of the residuals. It indicates how many standard deviations away from the predicted value the observed value is. Essentially, it measures the extent to which each data point deviates from the regression line.

A high standard residual typically indicates that the observed value is higher than the predicted value, suggesting

Table 1. istrict wise Share of Tap water connection, Ground water PH value & Annual RF in Karnataka state (2019-20)

District	GroundWater ph value	% of Tap water Connection	Aver age Annual RF (MM)
Bidar	7.9	73.89	838
Gulbarga	8.2	64.61	770
Yadgir	8	79.14	719
Raichur	8.16	88.3	654
Bijapura	8.3	67.18	591
Bagalkote	8.5	86.15	582
Belgaum	8	86.03	826
Uttara Kannada	8.35	53.48	2936
Dhar-wadh	8.1	99.08	787
Gadag	8.1	99.98	624
Koppala	8.2	88.47	614
Bellary	8.3	86.46	599
Haveri	8	88.24	800
Shimoga	7.99	85.46	2325
Udupi	9	80.94	4535
Chikkam-agalur	8.1	71.5	1833
Davan-gere	8.3	86.19	659
Chi-tradurga	8.5	65.87	540
Hassan	8.47	56.2	1142
Dakshina Kannada	8.8	87.86	4006
Tumkur	8.15	54.92	669
B.Urban	8.6	40.62	846
Bangalore rural	8.3	68.46	798
C.ballapur	8.4	58.22	736
Kolar	8.2	40.47	735
Mandya	8.19	87.46	699
Ramna-gar	8.4	89.21	840
Mysore	8.28	70.68	837
C,nagara	8.9	91.63	787
Kodagu	8.4	85.44	2729

Source: Ground water year book of Karnataka (2020) JJM report

that the model overestimated the outcome for that particular data point. A negative standard residual in the context of Ordinary Least Squares (OLS) regression indicates that the observed value is lower than the predicted value.

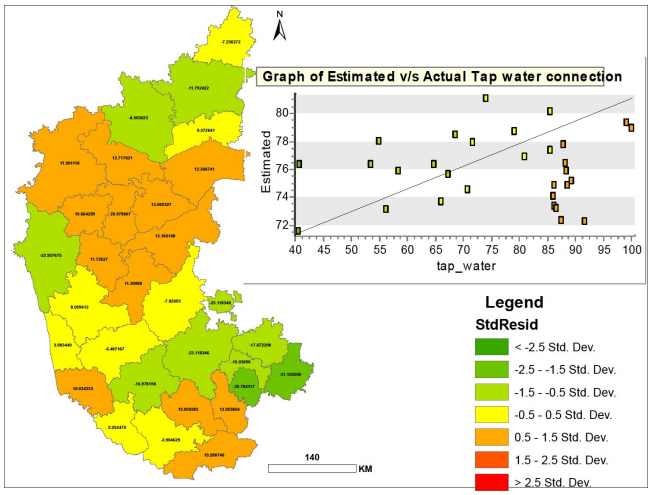

Fig. 4. Estimated share of tap water connection in Karnataka state using OLS Method

The above map and table of the OLS regression show that only a few districts exhibit similarities between estimated and actual tap water connections. Another significant point is that most of the negative values, indicating where the predicted value is much higher than the actual value, are

observed in several southern districts, namely Kolar, Bangalore Rural and Urban, Tumkur, Chikkaballapura, and Hassan. On the other hand, maximum northern districts have higher standard residuals, indicating less predicted value than actual value.

4 Conclusion

The present study emphasizes the significance of the Jal Jeevan Mission (JJM) in Karnataka, which aims to provide Functional Household Tap Connections (FHTCs) to rural households. By analyzing district-wise tap water distribution and employing the Ordinary Least Squares (OLS) method, several noteworthy findings have been uncovered.

The study identifies certain districts like Gadag, Dharwad, and Chamarajanagara, which have made commendable progress in tap water connection implementation. This success is attributed to factors such as efficient resource allocation, early project initiation, infrastructure development, community engagement, and strategic planning. However, further investigation is necessary to comprehensively understand the diverse factors influencing implementation outcomes.

Furthermore, the research sheds light on disparities in tap water connection access across regions. While Northern

Karnataka demonstrates successful implementation efforts, with actual tap water connections exceeding estimations, Southern and Coastal districts face challenges, with actual performance falling short of estimations.

These findings underscore the urgent need for policymakers and scholars to address implementation disparities and enhance program efficacy. As the JJM aims for 100% tap water connections by December 2024, bridging these gaps is crucial to achieving this ambitious target and ensuring equitable access to clean water for all rural households in Karnataka.

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