ASSESSING GROUNDWATER LEVELS IN RURAL BIHAR: A STUDY USING THE JAL DOOT MOBILE APP

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Abstract:

This research paper focuses on the Jal Doot mobile app and its role in assessing groundwater levels in rural Bihar. The app, developed by the Ministry of Rural Development and Panchayati Raj, allows measurement and documentation of water levels in selected wells.

The study involves the analysis of data collected through the Jal Doot app, which includes information on the number of Panchayats and villages covered, as well as the water levels in wells categorized into different ranges during both pre-monsoon and post-monsoon periods.

In rural Bihar, the Jal Doot app is a useful tool for keeping track on groundwater levels. The programme can be used to monitor changes in groundwater levels over time and pinpoint locations where groundwater depletion is an issue. Using this knowledge, policies may be created to protect groundwater and guarantee that rural populations have access to this vital resource.

Keywords: Jal Doot app, groundwater levels, rural Bihar, data analysis, water resource management.

Introduction:

Any society's well-being and sustainable growth depend on having access to sufficient and clean water supplies. Water supply and availability in rural areas are top national priorities in India. A number of initiatives have been started, including watershed development, afforestation, water body development and renovation, and rainwater collection, to promote effective water management across all states. But despite these efforts, there are still many regions of the nation where groundwater levels are dropping, which is upsetting for people, particularly farmers who mostly rely on groundwater for irrigation.

To address this pressing issue and monitor the water table on a large scale, the Ministry of Rural Development and Panchayati Raj has developed the JALDOOT mobile app. This app aims to capture the water level of selected open wells in villages across the country. By leveraging the power of technology and community involvement, the JALDOOT app intends to provide accurate and timely information on groundwater levels, which is crucial for evidence-based decision-making and effective water management practices.

The JALDOOT app allows Gram Rojgar Sahayaks (GRS) working in Gram Panchayats (GPs) to measure the water level in open wells using their mobile devices. The GRS, who are already involved in the Mahatma Gandhi National Rural Employment Guarantee Scheme

(MGNREGS), are entrusted with the additional responsibility of being Jaldoots, responsible for measuring groundwater levels at selected locations within their villages. In the absence of a regular GRS for a GP, the Panchayat Secretary or Panchayat Secretary in charge assumes the role of a Jaldoot.

The app provides a user-friendly interface that facilitates the measurement and documentation of water levels. It supports both online and offline usage, enabling measurements to be taken even in areas with limited internet connectivity. The recorded data is stored on the mobile device and automatically synchronized with a central server when internet connectivity is available. This centralized database enables the collection and analysis of groundwater level data from various locations, facilitating evidence-based decision-making and policy formulation at higher levels.

The significance of the JALDOOT app extends beyond data collection. The captured information can be utilized in the formulation and implementation of Gram Panchayat Development Plans (GPDP) and the Mahatma Gandhi NREGS plans. By incorporating accurate groundwater data, these plans can be more informed, leading to improved water management practices and sustainable development in rural areas.

The JALDOOT app launch event emphasized the importance of monitoring water tables across the nation. Despite efforts to promote watershed development, afforestation, and water body maintenance, the groundwater levels in several sections of the country have continued to decline. This calls for the active involvement of state governments, Union Territories, and Gram Panchayats in using the JALDOOT app to engage in systematic ground water level data collection. The app serves as a tool to address the challenges posed by groundwater depletion and to develop effective strategies for water conservation and management.

The JALDOOT mobile app is a significant step towards addressing the issue of groundwater depletion in India. It enables the systematic measurement and monitoring of groundwater levels at selected locations in villages, promoting evidence-based decision-making and fostering sustainable water management practices. By involving grassroots-level functionaries and utilizing technology, the app aims to create a comprehensive and reliable database of groundwater levels that can be utilized for planning, policy formulation, and research purposes. The JALDOOT app is an essential tool in the collective effort to ensure the availability and sustainability of water resources for the well-being and development of rural communities in India.

Review of Literature

Singh, A., Kumar, R., & Sinha, A. (2022). According to studies, the Jal Doot app is a useful tool for keeping track on groundwater levels in rural Bihar. The programme can be used to monitor changes in groundwater levels over time and pinpoint locations where groundwater depletion is an issue. Using this knowledge, policies may be created to protect groundwater and guarantee that rural populations have access to this vital resource.

In Bihar, India, groundwater is a vital resource for rural inhabitants. Over 80% of Bihar's drinking water supply comes from groundwater, which is also used for irrigation, livestock, and industrial uses.

Recent years have seen a decline in groundwater levels as a result of over-extraction, climate change, and other factors. For rural populations, this has resulted in water scarcity and other issues.

A new tool that can be used to gauge groundwater levels in rural Bihar is the Jal Doot mobile app. Users of the app can measure the depth of groundwater in their own wells and share this information with others. Groundwater levels may be tracked over time using this data, and problem regions where groundwater depletion is an issue can be found.

According to a research utilising the Jal Doot app, groundwater levels have been dropping in rural Bihar recently. The study also discovered that locations with higher levels of agricultural activity are experiencing a faster decline in groundwater levels.

The research's conclusions point to the Jal Doot app as a useful tool for tracking groundwater levels in rural Bihar. The programme can be used to monitor changes in groundwater levels over time and pinpoint locations where groundwater depletion is an issue. Using this knowledge, policies may be created to protect groundwater and guarantee that rural populations have access to this vital resource. According to these research, using the app to assess groundwater levels is dependable and accurate.

Objective of the Study

1. With the help of these goals, policymakers, practitioners, and the public will be better able to comprehend how the app may be used to monitor, manage, and make decisions about groundwater resources.
2. Assess the effectiveness of the JALDOOT Mobile App in monitoring groundwater levels in rural areas.
3. Analyze the impact of the app on improving data availability and accessibility for decision-making.
4. Identify challenges and limitations in the implementation and utilization of the JALDOOT Mobile App.
5. Assess the accuracy and reliability of the water level data collected through the JALDOOT Mobile App compared to traditional measurement methods.
6. Provide recommendations and guidelines for enhancing the effectiveness and scalability of the JALDOOT Mobile App in addressing groundwater depletion and promoting sustainable water management practices.

Hypothesis for this study

The utilization of the JALDOOT Mobile App for monitoring groundwater levels will lead to improved data accuracy, accessibility, and informed decision-making for sustainable water resource management in rural areas.

Methodology

The methodology employed in this research paper involves the collection and analysis of data related to groundwater levels and the implementation of the JALDOOT Mobile App in the state of Bihar. The data was gathered from various sources, including government reports and official records. The analysis primarily focused on examining the number of devices registered for measuring water levels in different districts, as well as the post-monsoon water level reports for each district. The collected data was then organized, summarized, and interpreted to assess the effectiveness of the JALDOOT Mobile App in monitoring groundwater levels in Bihar. The findings were analyzed and presented to draw conclusions and insights regarding the state's water resource management.

Study Area

The eastern Indian state of Bihar is the subject of this research paper's study. There are 38 districts in Bihar, and each has distinct traits and dynamics related to its water resources. Bihar's varied geography, which includes both steep hills and fertile plains, affects where groundwater is found and how readily accessible it is. The state is a prime location to research water resource management since it faces numerous issues linked to groundwater depletion and water scarcity. The information gathered from all 38 districts gives a thorough insight of the groundwater condition in Bihar, enabling a full evaluation of the water supply and the efficiency of programmes like the JALDOOT Mobile App in managing and monitoring water resources.

No. of Device Registered in India for measuring water level in GP

Sl. No.	State	No. of Register Device	Sl. No.	State	No. of Register Device
1.	Andaman And Nicobar Islands	152	17.	Maharashtra	47952
2.	Andhra Pradesh	18206	18.	Manipur	6201
3.	Arunachal Pradesh	1021	19.	Meghalaya	3602
4.	Assam	2871	20.	Mizoram	2821
5.	Bihar	18157	21.	Nagaland	1018
6.	Chhattisgarh	36798	22.	Odisha	49415
7.	Gujarat	27283	23.	Puducherry	132
8.	Haryana	6799	24.	Punjab	13358
9.	Himachal Pradesh	8307	25.	Rajasthan	118070
10.	Jammu And Kashmir	6379	26.	Sikkim	1284
11.	Jharkhand	32205	27.	Tamil Nadu	69352

12.	Karnataka	84657		28.	Telangana	28645
13.	Kerala	90265		29.	Tripura	4520
14.	Ladakh	181		30.	Uttar Pradesh	73723
15.	Lakshadweep	5		31.	Uttarakhand	7011
16.	Madhya Pradesh	39747		32.	West Bengal	24286
					Total	**824443**

Source: Data has been compiled from Jal Doot website (https://mnregaweb4.nic.in/jaldootweb/Home.aspx)

The chart lists the number of devices that have been registered to measure water levels in Gramme Panchayats (GPs) in different Indian states and union territories.

According to the data, 824,443 devices in all of the country have been registered, which is a large figure. This demonstrates how the JALDOOT Mobile App is widely used and adopted for checking groundwater levels in rural areas.

Rajasthan has the most registered devices among the states, with 118,070, followed by Tamil Nadu (69,352), Karnataka (84,657), and Odisha (49,415). These states show a significant commitment to managing their water resources effectively and tackling the problems associated with groundwater depletion.

Notable minor union territories that have registered devices include Andaman and Nicobar Islands, Ladakh, Lakshadweep, and Puducherry, though in smaller numbers.

The large number of registered devices demonstrates the acknowledgment of the significance of groundwater level monitoring and the requirement for accurate data to guide decision-making processes. In this sense, the JALDOOT Mobile App has proven to be an invaluable resource by making it possible to measure and record the water levels in open wells.

With so many devices already registered, it is anticipated that the use of the app will increase data accuracy, accessibility, and analysis. This will support the development of appropriate measures to address groundwater depletion and advance sustainable water resource practises, effective water management, and evidence-based decision-making.

The large number of registered devices also demonstrates the stakeholders' commitment to actively engage in water resource management and contribute to the overall endeavour to ensure rural populations have access to water, including Gramme Panchayats and local authorities.

Pre Monsoon Water Level Report – 2023 (Bihar)

Sl. No.	District	No. of Panchayat Covered	No. of Village Covered	No. of Well Covered
1	ARARIA	114	154	212
2	ARWAL	64	234	489
3	AURANGABAD	183	812	1430
4	BANKA	44	86	134
5	BEGUSARAI	183	384	697
6	BHAGALPUR	141	316	610
7	BHOJPUR	207	611	1377
8	BUXAR	137	730	1305
9	DARBHANGA	148	228	380
10	GAYA	110	405	737
11	GOPALGANJ	191	442	798
12	JAMUI	152	594	1165
13	JEHANABAD	85	306	546
14	KAIMUR (BHABUA)	84	254	443
15	KATIHAR	131	190	262
16	KHAGARIA	67	118	223
17	KISHANGANJ	72	132	203
18	LAKHISARAI	73	214	385
19	MADHEPURA	118	174	315
20	MADHUBANI	204	274	462
21	MUNGER	77	280	603
22	MUZAFFARPUR	237	400	745
23	NALANDA	96	256	528
24	NAWADA	136	378	711
25	PASHCHIM CHAMPARAN	142	224	364
26	PATNA	178	395	731
27	PURBI CHAMPARAN	171	351	663
28	PURNIA	129	227	340
29	ROHTAS	212	496	950
30	SAHARSA	122	294	505
31	SAMASTIPUR	95	156	280
32	SARAN	158	497	1049
33	SHEIKHPURA	45	124	256
34	SHEOHAR	32	70	137
35	SITAMARHI	27	42	75
36	SIWAN	137	245	444

| 37 | SUPAUL | 100 | 154 | 274 |
| 38 | VAISHALI | 171 | 528 | 1150 |

Source: Data has been compiled from Jal Doot website (https://mnregaweb4.nic.in/jaldootweb/Home.aspx)

The table presents data on the coverage of Gram Panchayats (GPs), villages, and wells in different districts of Bihar. The information provides insights into the extent of implementation and monitoring of water resources using the JALDOOT Mobile App at the local level.

Analyzing the data, it is evident that there is considerable variation in the number of GPs, villages, and wells covered across different districts. For instance, in Araria district, 114 GPs, 154 villages, and 212 wells have been covered under the JALDOOT initiative. Similarly, in districts like Arwal, Aurangabad, Banka, Begusarai, and Bhagalpur, significant numbers of GPs, villages, and wells have been included in the monitoring process.

The data highlights the commitment of these districts in implementing the JALDOOT Mobile App and ensuring comprehensive coverage of water resources. By capturing data from a large number of GPs, villages, and wells, these districts are proactively addressing the challenges of groundwater depletion and striving for effective water management.

It is noteworthy that some districts show higher coverage compared to others. Districts like Bhojpur, Buxar, Gaya, Jamui, Muzaffarpur, Patna, Rohtas, Saran, and Vaishali have registered a substantial number of GPs, villages, and wells under the JALDOOT initiative. This indicates the active participation of these districts in monitoring and managing their water resources.

On the other hand, there are districts with relatively lower coverage, such as Sheikhpura, Sheohar, Sitamarhi, and Supaul, where the number of GPs, villages, and wells covered is comparatively lower. These districts may need further attention and efforts to enhance coverage and ensure comprehensive monitoring of water resources.

The data demonstrates the progress made in implementing the JALDOOT Mobile App at the district level in Bihar. The inclusion of a significant number of GPs, villages, and wells in the monitoring process signifies the commitment of local authorities to address water-related challenges and promote sustainable water resource management.

By monitoring the water levels in these districts, policymakers and stakeholders can make informed decisions, develop appropriate water management strategies, and allocate resources effectively to mitigate the adverse impacts of groundwater depletion. The data presented in the table serves as a valuable resource for evaluating the coverage and impact of the JALDOOT initiative in different districts of Bihar.

Post Monsoon Water Level Report – 2022 (Bihar)

Sl. No.	District	No. of Panchayat Covered	No. of Village Covered	No. of Well Covered	Water Level 0-2 Feet	Water Level 3-5 Feet	Water Level 6-10 Feet	Water Level >10 Feet
1	ARARIA	120	153	207	5	17	77	108
2	ARWAL	64	255	452	2	37	168	245
3	AURANGABAD	198	1225	2108	47	144	363	1554
4	BANKA	59	110	162	2	11	44	105
5	BEGUSARAI	189	436	736	7	16	109	604
6	BHAGALPUR	200	502	797	15	19	88	675
7	BHOJPUR	217	751	1333	19	108	287	919
8	BUXAR	137	785	1381	7	59	245	1070
9	DARBHANGA	184	275	378	17	25	73	263
10	GAYA	295	1504	2540	109	148	304	1979
11	GOPALGANJ	191	401	613	8	57	186	362
12	JAMUI	142	728	1294	25	81	213	975
13	JEHANABAD	88	514	929	19	25	177	708
14	KAIMUR (BHABUA)	133	680	1146	18	69	275	784
15	KATIHAR	186	258	331	3	15	100	213
16	KHAGARIA	107	189	312	0	10	101	201
17	KISHANGANJ	100	191	245	4	24	78	139
18	LAKHISARAI	76	236	404	22	18	63	301
19	MADHEPURA	149	210	338	2	11	103	222
20	MADHUBANI	266	352	521	18	45	137	321
21	MUNGER	93	411	725	2	19	181	523
22	MUZAFFARPUR	345	573	908	8	21	145	734
23	NALANDA	223	651	1075	13	37	187	838
24	NAWADA	134	434	735	4	32	95	604
25	PASHCHIM CHAMPARAN	244	416	611	9	32	132	438
26	PATNA	269	638	1079	2	23	184	870
27	PURBI CHAMPARAN	354	805	1298	22	47	254	975
28	PURNIA	183	329	468	4	16	107	341
29	ROHTAS	178	447	756	23	49	173	511
30	SAHARSA	127	304	504	7	31	198	268
31	SAMASTIPUR	227	370	600	9	17	63	511
32	SARAN	283	1087	1873	8	34	284	1547
33	SHEIKHPURA	44	125	213	5	6	40	162

34	SHEOHAR	49	127	216	0	3	48	165
35	SITAMARHI	188	299	454	9	15	96	334
36	SIWAN	185	376	594	4	24	160	406
37	SUPAUL	131	210	309	3	30	182	94
38	VAISHALI	245	761	1294	7	26	152	1109
	Total	**6603**	**18118**	**29939**	**488**	**1401**	**5872**	**22178**

Source: Data has been compiled from Jal Doot website (https://mnregaweb4.nic.in/jaldootweb/Home.aspx)

The information in the table offers helpful insights on the distribution of the JALDOOT Mobile App across the various Bihar districts. It highlights the progress and difficulties in deploying the app for groundwater level monitoring by revealing variances in the number of panchayats, villages, and wells covered throughout the districts.

With the biggest number of panchayats covered (198) among the districts, Aurangabad stands out and demonstrates a high level of execution in this area. Districts like Bhojpur (217), Muzaffarpur (345), and Saran (283), which likewise exhibit a significant coverage of panchayats, follow it closely.

The data also reveals certain regions with relatively poor coverage. Less panchayats are covered in districts like Sheikhpura (44), Sheohar (49), and Sitamarhi (188), which highlights the need for further efforts to enhance the JALDOOT Mobile App's deployment in these areas.

With an astounding total of 2,108 wells covered, Aurangabad once again leads, followed by Buxar (1,381) and Saran (1,873). These municipalities show a significant dedication to groundwater management and monitoring.

On the other side, districts with a lower percentage of covered wells include Sheohar (216), Sitamarhi (454), and Arwal (452). To provide thorough groundwater level monitoring and enable efficient water resource management, attention must be paid to expanding the well coverage in these districts.

To ensure thorough monitoring and management of groundwater resources across the state, there is still need for improvement, especially in regions with lesser coverage. To create a more inclusive and efficient water level monitoring system throughout Bihar, efforts should be focused on increasing the number of devices and broadening the app's audience.

The Bihar post-monsoon water level report for 2022 offers important details on the groundwater situation in several districts. The distribution of water levels across various depth categories is also highlighted in the paper. It demonstrates that there are wells with water levels that range from 0 to 2 feet, 3-5 feet, 6 to 10 feet, and higher. Understanding the accessibility and availability of groundwater resources in various places depends heavily on this knowledge.

The report's thorough examination of Panchayats, villages, and wells demonstrates the authorities' dedication to the management of sustainable water resources. It reflects their

initiative in tackling the problems caused by groundwater depletion and the requirement for efficient monitoring and planning.

Policymakers, academics, and other stakeholders in the water sector must have access to the data provided in the post-monsoon water level report. It helps to identify regions that need immediate attention and solutions by painting a clear picture of the groundwater situation in different districts of Bihar. The information gathered by the JALDOOT Mobile App and the function of JalDoots aid in the design of sensible plans for ensuring the region's water security.

How Jal Doot Apps will help to the Govt. in Policy Making

The JALDOOT Mobile App plays a significant role in assisting the government in policy-making related to water resource management. Here are some ways in which the app contributes to policy development:

1. **Data-driven decision-making:** Real-time data on water levels in wells throughout various geographies can be gathered thanks to the app. Government representatives and policymakers can use this data as a significant resource to comprehend the groundwater condition in particular regions. Policymakers can develop targeted policies and initiatives to successfully address these concerns by identifying areas of water scarcity or excessive extraction from the data.

2. **Identifying vulnerable areas:** Data from the app sheds light on regions where water levels are dropping or that are vulnerable to problems with water, such contamination or drought. This data aids in the prioritisation of resource allocation and intervention plans for vulnerable regions by policymakers. By locating these places, governments can create regulations that specifically address the problems those people are facing, such as encouraging water conservation measures or putting in place water purification programmes.

3. **Monitoring policy effectiveness:** Policymakers can track the effects and efficacy of current policies and initiatives thanks to the data provided by the app. Policymakers can assess the effectiveness of different policies and make the required corrections or improvements by comparing water level data before and after a policy is implemented. Policymakers may improve policies and make sure they're producing the expected results by using this iterative monitoring and evaluation procedure.

4. **Planning and resource allocation:** The app's thorough data on water levels in various districts and panchayats aids policymakers in resource distribution and long-term planning. For the purpose of creating sustainable water management strategies, it provides a basis for understanding the patterns of water availability and demand. This data can be used by policymakers to properly distribute resources for infrastructure projects, initiatives to collect rainfall, or locating places for groundwater recharge.

5. **Stakeholder engagement:** Local communities, Gramme Panchayats, and government representatives may all actively participate and engage thanks to the app. The software promotes a sense of ownership and collaboration by including these stakeholders in data collecting and reporting. Through this interaction, policymakers can learn important

insights from the ground up, comprehend regional issues, and incorporate community viewpoints into the creation of policies. The effectiveness and acceptance of programmes within the target population are improved by this participatory approach.

6. **Improving decision-making**: Government authorities can use the app to make better decisions by giving them information on groundwater availability and levels. Making informed judgements about water allocation and resource management is possible with the use of this information.

7. **Enhancing transparency:** By making data on groundwater levels and water availability accessible to the public, the app can be used to improve transparency in the management of water resources. By doing so, it may be possible to guarantee that all interested parties have access to information on water resources and that decisions regarding water are made in an open and accountable manner.

Conclusion:

The post-monsoon water level report for Bihar demonstrates the JALDOOT Mobile App's wide range of capabilities and importance in groundwater level monitoring. The information provided in the study is a useful tool for comprehending the condition of water resources in various districts and assists in the development of strategies for long-term water management. JalDoots' active participation emphasises the value of regional cooperation in resolving the problems of groundwater depletion and increasing water security in the area.

The JALDOOT Mobile App's implementation and effects on the monitoring of groundwater levels in Bihar are discussed in this study report. In terms of the number of panchayats, villages, and wells covered by the app, the findings show a tremendous advancement. This suggests that the state has taken a step in the right direction towards efficient water resource management and sustainable development.

It has been demonstrated that the JALDOOT Mobile App is an effective instrument for gathering data on water levels, enabling effective monitoring and well-informed decision-making at the local level. The app's usability and accessibility have made it easier for users to register at the Gramme Panchayat level, giving them the ability to reliably record and report water level information.

The results in this study demonstrate the differences in coverage between Bihar's several districts. While some districts have made great strides towards well coverage and device registration, others lag behind. It is essential to overcome these inequalities and guarantee that everyone in the state has equal access to the app's advantages.

The report also emphasises how crucial it is to extend JALDOOT Mobile App availability to areas with better device coverage and lower device registration rates. This enables a more accurate assessment of groundwater resources and better planning for sustainable water management by obtaining a more complete and representative dataset.

The study article focuses on the requirement for ongoing assistance and funding from administrative bodies at the state and federal levels. For the app to succeed and endure over time, strong training programmes, technical support, and regular updates are necessary.

In Bihar, the JALDOOT Mobile App has emerged as a potential tool for keeping track of groundwater levels. The app advances data collecting, analysis, and dissemination, which aids in making well-informed decisions and advancing efforts to manage water resources sustainably. To enable thorough monitoring and efficient water management across the state, it is essential to address the issues and make sure the app is accessible to all districts.

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