

Proceedings of Science–Policy Dialogue on Groundwater Governance

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Date: 30 July 2024

Location: New Delhi



Background

The International Water Management Institute (IWMI) and International Food Policy Research Institute (IFPRI) are actively engaged in groundwater governance research as a part of the CGIAR initiative “NEXUS Gains-Realizing Multiple Benefits Across Water, Energy, Food and Ecosystems”. This initiative tackles the challenges across water, energy, food, livelihoods, and ecosystems, aiming for solutions that benefit all. Additionally, IWMI in another CGIAR initiative on National Policies and Strategies (NPS) is researching policy and institutional landscape of Atal Bhujal Yojana (Atal Jal) to understand in-depth policy processes, evolution of the policy landscape across identified policy systems and policy designs around the institutional building and strengthening behaviour change. One of the objectives of these initiatives was to conduct science-policy dialogue which gathers different stakeholders and collects their diverse perspectives on groundwater governance. The dialogue brought together different stakeholders to have insightful discussion on sustainable water management, effective groundwater governance mechanisms and innovative incentive models. The dialogue specifically focused on Atal Bhujal Yojana Scheme to identify successful strategies, potential opportunities, and the role of science and research in improving groundwater governance through the scheme. The dialogue draw participation from different organizations brought together experts from the Ministry of Jal Shakti, National Project Monitoring Unit (NPMU)- Atal Bhujal Yojana, international research organizations, civil society organizations (CSOs), National Government Organizations (NGOs) and local communities, etc.

Objectives

The Science policy dialogue was organized to meet the following objectives.

- To discuss strategies that worked well in Atal Jal learnings from the field on Atal Jal
- Identifying opportunities and challenges at various levels of the scheme
- Deliberate on the role of science and research in developing better and more inclusive strategies for groundwater governance through the scheme.

Science–Policy Dialogue sessions

Session opening and inaugural ceremony

The session started with welcoming the participants to science-policy dialogue. IWMI and IFPRI are actively engaged in groundwater governance as part of NEXUS Gains Initiative. The dialogue served as a platform for sustainable water management, effective groundwater mechanisms, and innovative incentive models. The focus of the dialogue on central groundwater scheme “Atal Bhujal Yojana” was on sharing strategies that work well in the scheme.

Welcome remarks

Dr. Alok Sikka, Country Representative-India & Bangladesh welcomed participants on behalf of **IWMI, IFPRI, and CGIAR NEXUS Gains Initiative**. He recognized **Dr. Raghav Langer-MOJS, Dr. Ruth Meinzen-Dick-IFPRI, Dr. Ashokan-Central Ground Water Board (CGWB), Mr. Sujit Sinha, NPMU-Atal Jal**, and other dignitaries. He emphasized the importance of **groundwater management** in India, as **64% of agricultural water** comes from groundwater pumps. This highlights the need to address the **water-energy-food security nexus**. **NEXUS Gains and National Policies and Strategies** are initiatives operating in India with overlapping goals. They focus on the interconnectedness of **food, land, and water policies** and the importance of **coherent policy frameworks** for effective **groundwater management**.

Community involvement is crucial for successful natural resource management. **NGOs and CSOs** play a vital role in participatory processes. **Community-based watershed management** and **science-based tools** are essential for effective implementation. The **Atal Bhujal Yojana** government initiative aims to incorporate scientific tools into community-led groundwater management. This meeting aimed to **share learnings from the field** and **strengthen the Atal Bhujal Yojana Scheme** through **science-based participatory groundwater management**. By investigating the **interconnectedness of water, energy, and agriculture**, and using **participatory processes**, it can create **synergies** and improve **groundwater management** in India.

Introductory remarks, Dr Ruth Meinzen-Dick, Senior Research Fellow, IFPRI

When NEXUS Gains initiative was established, one of the main challenges was creating a Groundwater Governance Toolbox. Groundwater management is particularly challenging due to its nature as a common-pool resource, where use by one person reduces availability for others and its largely invisible nature. Despite many available tools, a global review by IWMI revealed few successful cases of groundwater management. Effective governance requires coordination across multiple levels and the right policies. Rather than focusing on individual tools, it is better to start by identifying key actors and assessing their needs for knowledge, motivation, and agency mechanisms. Understanding groundwater involves analysing and interpreting raw data within its context. Motivation for managing groundwater can be extrinsic (e.g., regulations, economic incentives) or intrinsic (e.g., environmental care), with both needing attention. Agency mechanisms focus on enabling actors to achieve outcomes and coordinate their efforts. Tools and approaches such as participatory mapping, water games, and crop water budgeting help support knowledge, motivation, and agency. The systems approach of the Foundation for Ecological Security (FES) maps various actors to appropriate tools, aiming to integrate these strategies effectively to improve groundwater management outcomes.

Opening remarks, Dr Ashokan, Member, CGWB

The Central Water Commission's Groundwater Board (CWGB) is actively researching groundwater, particularly in the Indo-Gangetic Plain, which holds 70% of the country's groundwater resources. The CWGB, under the Ministry of Jal Shakti, is focused on groundwater management and regulation. Their 2021-2026 scheme includes monitoring groundwater levels, mapping aquifers, creating recharge plans, and regulating groundwater use. This involves drilling piezometers, installing digital water level recorders, and conducting high-resolution mapping. The CWGB also advises on groundwater management for programs like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) and Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). The Ministry is expanding groundwater monitoring efforts by creating 20,000 new wells. The Atal Bhujal Yojana, which involves community participation, is a successful model for groundwater management. This workshop aimed to explore scaling up this model to other states to improve nationwide groundwater management.

Keynote speaker, Dr Raghav Langer, Director, Atal Bhujal Yojana

Dr. Langer extended gratitude to IWMI and Dr. Sikka and warmly welcomed all dignitaries and participants. According to him, Atal Bhujal Yojana (ABY) is a sustainable groundwater management scheme, funded centrally with 50% support from the World Bank. It incentivizes states based on five Disbursement Linked Indicators (DLIs). One significant change brought about by ABY is the emphasis on community participation in groundwater management. Previously, this aspect was limited to technical organizations, but ABY has shifted focus to include community involvement and capacity building, making it a core component of the scheme.

ABY has also improved groundwater data accessibility and transparency. Previously, groundwater data was sparse, but now there is public access to water level readings through piezometers and well inventories. This public display helps communities plan their water use effectively. ABY promotes data integration and decision-making tools, with secretaries using data for projections and planning. Water security plans and budgeting are conducted at the Gram Panchayat (GP) level, involving 8,200 GPs across seven states. This budgeting helps identify water deficits or surpluses, raising awareness for conservation and recharge. The scheme also incentivizes states for increasing water-efficient practices, with 540,000 hectares already engaged in such activities. Although the scale of these practices is still growing, they mark a positive shift in behaviour and agricultural practices. The program is set for expansion and aims to build institutional capacity at the state level. There has been notable progress,

including improvements in groundwater levels in several regions, highlighting the scheme's focus on community engagement and efficient water use. This initiative requires a long-term vision, and with continued collaboration, we can achieve positive outcomes in groundwater management.

Remarks from Sujit Sinha, Team Leader, National Technical Support Agency (NTSA), NPMU, Atal Jal

Dr. Sinha congratulated IWMI and IFPRI for initiating this dialogue on Groundwater Governance and noted that it is great to have representatives from NGOs and District Implementation Partner (DIP) of Atal-Jal from Mahoba, as well as participants from various provinces who are dedicated to groundwater governance. When this program was conceived in 2018-19, there was no dedicated groundwater management program in India involving the community. Investments from the government in groundwater have lagged, and institutions dealing with groundwater have often been under-resourced, lacking adequate staff and logistics. This context led to the development of the Atal Bhujal Yojana (ABY).

IWMI introduced the nexus concept of energy and irrigation, highlighting that while regulatory measures exist, they often overlook agricultural needs and do not limit groundwater withdrawal. Although CGWB has conducted studies and created a database, there is a need to make this information more accessible to users. Government initiatives have traditionally been top-driven, focusing on supply-side interventions without a dedicated scheme for groundwater sustainability. According to him, ABY is unique in its community-led approach, emphasizing demand-side management and institutional convergence. It integrates local institutions such as groundwater management committees, village water sanitation committees, and water user associations, and involves civil society, NGOs, and volunteers. The program has two main components: institutional building and incentive-based performance programs, assessed by the Quality Council of India. Key pillars of ABY include community participation, demand-side focus, and institutional convergence. He also emphasized that discussions at the secretary level are addressing groundwater management and water budgeting, with DIPs connecting communities with the District Project Management Unit (DPMU). Despite the large amount of data available, challenges remain in strengthening groundwater monitoring, particularly at the Gram Panchayat level, and addressing issues such as data gaps, cultural barriers, and the need for improved awareness and planning.

Presentation by Mutum Lamganbi, Post-Doctoral Fellow, IWMI on "Harnessing Science for Strengthening Groundwater Governance: Lessons from field and past experiences"

The presentation highlighted the trajectory of community led participatory approach and science-based groundwater management. It mentioned how participatory science-based approaches have evolved for sustainable groundwater management, and the learnings from these experiences were internalized and Atal Bhujal Yojana a central scheme on groundwater management was launched. The team presented field reflections from Atal Bhujal Yojana, noting the scheme has strong policy guidelines, but there are challenges on the ground such as community buy-in and capacity development, science-based tools to strengthen community participation and easier planning by the community. IWMI has been working on developing scientific tools and research study which can address the issue and strengthen the scheme implementation. The tools developed are:- toolkit on leadership and community mobilization, and Score Card for assessing the effectiveness of groundwater governance. There is ongoing research on assessment and scope of Direct Seeded Rice adoption in Haryana. Some of the key recommendations was to encourage adoption of simple to use scientific tools at community level to bridge gap between scientific knowledge and practical application, combine local data with reasonable scientific analysis leading to more effective implementation, develop innovative approaches for community mobilization, the training module developed by IWMI in NPS will create champions for mobilizing community to strengthen groundwater governance. Also to promote multi-stakeholder dialogues among researchers (Scientific level), Policy makers (Normative level) and Practitioners (Operational level) for insightful discussions on sustainable water management, effective groundwater governance mechanisms and innovative incentive models.

Exploring science-based tools and their targeted areas for strengthening participatory groundwater governance - presentations

Following the presentation, a session was held on scientific tools for strengthening Groundwater Governance. The first presentation was on the "Leadership Training Module". The module showcased how community mobilization could be scaled up through targeted leadership development. The second tool was the Watershed Planning tool for Natural Resource Management (WAT-NRM), which is a simple yet robust tool for planning watershed development interventions that local partners can easily apply in the field. The third tool discussed was on the Groundwater Games, which creates structured environments where participants learn through hands-on experience, simulating long-term decisions to understand system complexities, foster collaboration and refine mental models of system dynamics. The fourth tool was the Composite Landscape Assessment and Restoration Tool, a user-friendly decision support tool providing location-specific data to help panchayats and local communities plan and estimate soil and water conservation interventions. Lastly, the MGNREGA Impact tool which assesses the potential impact of MGNREGA works, enabling the comparison of performance over time and across different villages, blocks, and districts.

Suggestions from Dr Raghav Langer, Director, Atal Bhujal Yojana on tools

Training Module: Water Budgeting is being rolled out nationwide. The Ministry of Jal Shakti (MOJS) is coordinating with the National Rural Employment Guarantee Scheme (NRLM) and Women Self-Help Groups, who will act as community resource members. These groups will assist Panchayati Raj Institution (PRI) members in implementing the water budget for their Gram Panchayats (GPs). MOJS will be signing a Memorandum of Understanding (MOU) with NRLM to formalize this water budgeting initiative. In the first phase, 151 districts have been selected. We will develop training modules for PRI members and Community Resource Persons (CRPs) and have finalized templates for information gathering and meeting organization. There are plans to collaborate with IWMI to refine these training formats, drawing on their experience with community engagement. This collaboration, with support from the Ministry of Panchayati Raj, will help create effective training modules, videos, and curricula for community work.

Watershed Tool: What parameters are needed to calculate water balance, and what are the data sources? First, we need information on land use, including agricultural and other land types. Second, soil health and type, which provide primary data for the water balance. Third, we require data on crop areas and runoff. Rainfall data from the Indian Meteorological Department (IMD) is also essential. These datasets form the basis for our calculations.

For irrigation, we consider options like surface water and canal water. Dr Langer suggested that IWMI review the water budget template prepared under Atal Jal and enhance it to ensure it is user-friendly for the community, making it easier for them to generate accurate figures.

MGNREGA - Impact Tool: Why isn't this tool integrated with the MGNREGA Management Information System (MIS)? IWMI and GIZ responded that the ministry seeks solutions to assess MGNREGA's community-level contributions and tool impacts. We piloted the tool in 17 states with MGNREGA MIS integration in mind. It will soon be integrated into MIS Secure. The tool has been shared with the Joint Secretary.

CLART TOOL: It should be part of MGNREGA and other NRM related schemes, so people know what type of interventions need to be planned.

Field insights

Marcella D'Souza, Director, Watershed Organisation Trust (WOTR)

Marcella D'Souza described two tools for groundwater management. The first tool used aquifer mapping to help communities visualize their local groundwater resources. The second tool was a water governance standard and certification toolkit with four modules on water supply and demand. The water governance standard included a water score to assess community performance. It helped in identifying areas for improvement and incentivizes well-performing villages. It is a valuable tool for practitioners, donors, and communities to make informed investments and achieve social benefits. WOTR has applied this toolkit to the Atal Bhujal Yojana in Maharashtra, supporting villages in water governance competitions.

Dinesh Kumar, DIP, Mahoba District

A video of Urwara Gram Panchayat was shown. Although Urwara was not part of the Atal Bhujal Yojana, it featured the Chandalkali Pond, which had been dry for the past decade. The pond covers approximately 150 hectares. He mentioned that the primary issue was extensive Peppermint (*Mentha*) farming. After implementing the Atal Bhujal Scheme, discussions between the District Implementation Plan (DIP) and Pradhan led to the establishment of new rules to encourage farmers to transition away from *Mentha* farming. Farmers were given three notices urging them to switch crops. Through Atal Bhujal Yojana (ABY) trainings, they were educated about crop cycles and alternative crops, such as groundnut, moong, matar, and pulses, that could sustain their income.

As a result, groundwater levels in Urwara have risen by 9 feet, and the pond is now filled with water. The Gram Pradhan enforced regulations to prevent the sale of water extracted from the pond. A Jal Committee was formed to oversee water use and ensure the pond's resources were managed properly. Today, the village has achieved a water surplus.

Sanjay Singh, CEO, Parmarth Samaj Sevi Sansthan

He emphasized the importance of community-led initiatives for river revival and water management. Jal Sahelis, active in Uttar Pradesh (UP) and Madhya Pradesh (MP), play a key role in this process. River revival involves assessment, planning, and community involvement. Parmarth promotes the formation of local water cadres and Community Based Organisation (CBOs) like Nadi-Ghanti Sangthan. Jal Sahelis are working in 500 villages across 10 districts in UP and in MP. The goal is to expand this initiative to 8000 villages in 14 districts. Jal Sahelis are knowledgeable about water budgeting and auditing. They participate in water security plan preparation and strive to create water-sufficient villages.

Group discussions

Group 1: Leadership Training Group

Community mobilization is crucial for Atal Jal. Selecting the right leaders and fostering a competitive spirit like the Pani Panchayat Cup can be effective. Ongoing training and support are essential to maintain community engagement. Evaluating the effectiveness of community mobilization is important. We need to identify key participants and focus on outcomes rather than just documentation. Training mid- to low-level CRPs is a priority. Investing in community mobilization is as important as NRLM investments. Promoting a sense of collective ownership of groundwater resources is vital.

Group 2: CLART Tool

The group highlighted the use of a 3D model presented by WOTR to communities and its potential as a tool for demystifying complex concepts. As we advance in technology with developments like artificial intelligence and hydrological modelling, it is crucial to simplify these scientific concepts so that individuals at the grassroots level can effectively engage in creating water budgets. Our goal is to determine how Gram Panchayats (GPs) can take on this process with less reliance on Civil Society Organizations (CSOs) and experts and integrate these plans into mainstream development policies and discussions. It is also important to make this information widely available to the public, allowing continuous reference and engagement.

Group 3: MGNREGA and Watershed tool

The group focused on how these tools will fit into planning process of schemes such MGNREGA, and Atal Jal. Participants were interested in success stories of using these tools in MNREGA. Agricultural water management typologies developed with by IWMI-GIZ were discussed and how MIS data is further being used for pan-India analysis. Additionally, participants raised concerns about unplanned structures and inquired about effective planning methods. The discussion highlighted the importance of tool selection for environmental planning.

Panel discussion: Scientific tools for strengthening groundwater governance

Moderator: Mr Archisman Mitra, Regional Researcher, IWMI-India

Panellists: Marcella D'Souza; Ranjan Kumar; SK Gupta; Thomas Falk and Vivek Singh Grewal

Marcella D'Souza, Director, WOTR: She mentioned that it is crucial to ensure that communities fully understand their situation, as they often lack clear visibility into their own circumstances. Providing tools that help them visualize and highlight their conditions can foster greater ownership and engagement. The key is to emphasize ownership and involvement, not just the implementation of tools. Scientific tools and data, such as GIS and remote sensing, play a vital role in this process. These tools can help communities analyse historical data, such as changes in water flow and drying patterns over time. For example, comparing data from 2001 and 2011 can reveal significant differences and help explain current conditions.

Understanding these changes and aligning them with community experiences can make the data more relevant and actionable. It is important to provide these tools in a way that directly addresses their needs and integrates with their local context.

Ranjan Kumar, General Manager, CMF: He emphasized the importance of building a strong, community-based approach for developing local leaders. Currently, we are focusing on understanding the specific needs of the communities, beginning with understanding the process of how District implementation partner (DIPs) works, focusing on the issues faced by them and exploring potential solutions to them. While some queries remain, the process is mostly straightforward. We need to ensure effective communication and provide any necessary support. It is crucial to consider the timing and lessons learned from our planning. Many households are not yet fully engaged, so we must address their concerns and ensure that they understand and can benefit from the proposed structures. We are considering increasing the involvement of CSOs to enhance community engagement in science and its application. Additionally, there is a need to discuss and strengthen the role of CRPs, which is promising. On the other hand, there is a need for greater investment in building capacities, ensuring that the tools and resources available are utilized effectively. We should focus on increasing outreach and understanding the effectiveness of current processes, as only a small percentage of people are currently engaged. Our strategies may need adjustments based on ongoing evaluations and feedback. It is essential to collaborate with CSOs and ensure they are well-equipped to contribute effectively.

SK Gupta, Soil Scientist, Formerly in Indian Council of Agricultural Research (ICAR): He stated by providing some historical context about groundwater in Punjab and Haryana to help understand the issues discussed during the workshop discussing, and the type of groundwater governance followed. In 1910s, groundwater levels were relatively high, particularly in Punjab region. Recognizing this potential, the Punjab government installed 10 tubewells for pumping groundwater. After a decade, the government shifted its focus, leaving the management of groundwater to individual farmers. By 1955-56, Irrigation Research Institute was established, and surface drains were built to manage water resources. Punjab had established measures to manage the water table. Initially, this led to a rise in the water table. However, by 1969, the water level was about 30 cm below the surface, and by 1974, it had fallen below 2 meters. The government continued with various management schemes, including demand management, which is a significant part of our strategy.

He discussed a few technologies that could be implemented, their limitations, and successes. Firstly, technology improvements such as Laser Land levelling save about 20% of water and increase wheat yield by 10-15% are noteworthy. However, there were limitations, such as high costs of laser land levellers (around ₹7-10 lakhs/ approximately \$8,400 to \$12,000 USD) and misunderstandings among farmers regarding crop replacement. Farmers often think that replacing crops will be beneficial, but only a 25% replacement of rice area is needed. For instance, shifting to shorter-duration rice varieties, which take 120-140 days to mature compared to longer-duration varieties, can help. However, misconceptions about crop replacement and costs hinder adoption.

Another technology is Direct Seeded Rice (DSR), which, if well-implemented, can be effective. The major limitation with this technology has been the lack of suitable machinery and local expertise. There is a need for better equipment and more understanding of this technology.

He mentioned it is important to educate users on managing water effectively with solar pumps. In Punjab and Haryana, rice and wheat cultivation needs careful management to ensure sustainability. We should focus on technologies that save water and can be realistically implemented, considering local conditions and resources. In summary, effective demand management technologies can save substantial amounts of water. However, proper care and education are necessary to overcome challenges and ensure successful implementation.

Thomas Falk, Research Fellow, IFPRI: He highlighted that the key issue is to understand how to set up an effective framework for managing groundwater. In some states, implementing these participatory tools is challenging, particularly when women are not well represented in decision-making roles. For better outcomes, we need to ensure that leadership is diverse and inclusive. Studies show that sessions with more women leaders tend to be more effective. This effect is particularly strong when female leaders are present in significant numbers, rather than just a token presence. It is crucial to consider the composition of leadership in your sessions. Effective leadership diversity can greatly influence the success of your initiatives. So, if you're aiming to make substantial changes, it is essential to address these issues and ensure that women are adequately represented. This approach will improve the likelihood of successful outcomes and more meaningful local institutional change.

Vivek Singh Gerwal, Managing Partner, WELL Labs: He pointed that in India, there are political and administrative boundaries to consider, and it is crucial to select the right scale for implementation. It is important to start at the GP level because it aligns with the participatory approach that Atal Bhujal Yojana has adopted. However, the limitation is that GP boundaries don't align with hydrological units. It is important for everyone to understand that while starting at the GP level is beneficial, expanding the approach is crucial. For example, if someone reduces their water consumption while a neighbouring village increases theirs, the overall impact might be limited. To address this, we need to consider extending the approach to a broader area, such as the aquifer boundary, though this could take time. So, while the GP is an appropriate starting point, we need to think about how much to expand within the scheme. This involves understanding the scope of the expansion and addressing the different aspects of the problem. There is a need to differentiate between the basic approach and more complex solutions. The basic approach might involve more straightforward methods, while the complex solutions may require a participatory groundwater management strategy, especially in smaller, active areas. Understanding these distinctions is crucial. For instance, in some regions, a highly participatory approach might be more effective due to the smaller scale of the community. Overall, we need to balance starting with a localized approach while planning for broader implementation as we move forward. This means addressing mismatches between the proposed scales and practical, on-the-ground realities. Implementing changes effectively requires understanding both the administrative and political landscape. Simply starting from the top is often ineffective because successful implementation relies on a bottom-up approach. Therefore, it is important to align our strategy with local needs and ensure that proposed solutions match the actual scale and context of the issues at hand.

Closing remarks

The key takeaway is the need for closer interaction between scientists and policymakers. This is exactly what we aimed to achieve during the dialogue. The Science Policy Dialogue has been a promising start, but it is crucial that we continue this discussion moving forward to ponder the important aspects and highlights that were explored.

Suggested citation

Taneja, G.; Lamnganbi, M.; Meinzen-Dick, R.; Sikka, A. 2024. *Proceedings of Science-Policy Dialogue on Groundwater Governance*. Proceedings of the Science-Policy Dialogue on Groundwater Governance, New Delhi, India, 30 July 2024. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Initiative on NEXUS Gains. 9p.

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Disclaimer: This publication has been prepared as an output of the CGIAR Initiative on NEXUS Gains and has not been independently peer reviewed. Responsibility for editing, proofreading, and layout, opinions expressed and any possible errors lies with the authors and not the institutions involved.

We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund: www.cgiar.org/funders.

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