Arghyam

Source Sustainability

Strategies For And Learning From Scaling Of Source Sustainability Initiatives During 2018 - 2025

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Foreword

Water security has never been just a technical problem. It is a problem of patience—the patience to work at the pace of aquifers and ecosystems rather than project cycles, to invest in institutions that outlast any single programme, and to remain honest when the evidence shows that what we are doing is not enough.

That honesty is where this report begins. In 2017, after more than a decade of supporting water conservation and security projects across India, we confronted an uncomfortable truth: while the work was meaningful, it was not operating at the scale required. Groundwater was being depleted faster than it could be recharged, springs were disappearing, and communities dependent on borewells were facing increasing uncertainty. The gap between incremental project efforts and the magnitude of the problem was widening.

The years that followed were an attempt to close this gap, not by discarding earlier learnings, but by applying them within larger systems. We began engaging with government programmes such as MGNREGA, the Atal Bhujal Yojana, and the World Bank-supported programme in Meghalaya. Alongside this, we invested in digital tools, frontline capacity, and the often-overlooked yet critical aspects of programme management and data governance, seeking to influence not just implementation but also how programmes are designed, measured, and sustained.

This report is an account of seven years, three sub-themes, four major programme engagements and four structured studies across six states. We have called the frame ‘Source Sustainability’, by which we mean something specific: not merely connecting households to water but keeping the sources that feed those connections alive over time. The keys to this are: replenishing groundwater; reducing demand, especially from agriculture; and reusing the greywater that the improved supply has generated.

None of these is a simple technical fix. They require science to reach communities, institutions to function beyond the programme period, and to track outcomes over time.

We learned many lessons in the process, some confirming expectations, some surprising us, and some posing still unresolved questions, as we have stated plainly. This report is offered in that spirit: not as a record of achievement, but as a contribution to shared learning on sustaining water security at scale in India, for government partners, civil society organisations, and others working to bridge the gap between what is possible and what endures.

Anuj Sharma
CEO, Arghyam

Acknowledgments

The Arghyam team gratefully acknowledges the commitment and sincere efforts of its partners in strengthening the capacities of diverse stakeholders to address water management challenges in a systematic manner. Their openness to learning, willingness to embrace new ideas, and readiness to adapt programme designs have been invaluable. It has been particularly encouraging to see partners respond thoughtfully to evolving needs, especially given the scale and complexity of the challenges.

We sincerely acknowledge the collaboration of ACWADAM, ACT, PSI, CHIRAG, PRASARI, and INREM Foundation, who partnered closely with Arghyam to simplify scientific concepts and to make them accessible to communities. Their efforts in creating modular digital learning content and sharing it widely across the ecosystem have been both innovative and impactful.

We also extend our appreciation to WELL Labs, DSC, Water For People, and Kalike Trust for generating rigorous field-based evidence that continues to shape our strategy and deepen our learning.

Above all, we recognise the contributions of field facilitators, whose on-ground efforts make these insights and lessons possible.

We also acknowledge the important role played by technical agencies such as SOCION, Sattva, and Vrutti, whose programme management expertise has significantly strengthened our efforts and supported our journey towards scale.

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A special thanks to the Ministry of Jal Shakti and State Government champions across Meghalaya, Karnataka, and Gujarat who showed interest in our work and engaged with us to explore and adopt innovative practices. Their trust, collaboration, and leadership have been instrumental in advancing these efforts.

Gratefully
Team Arghyam

Abbreviations

AAP	Annual Action Plan
ABY / ABHY	Atal Bhujal Yojana
ACT	Arid Communities and Technologies
ACWADAM	Advanced Centre for Water Resources Development & Management
AWD	Alternate Wetting and Drying
BFT	Barefoot Technician
BIRD-K	BAIF Institute for Rural Development-Karnataka
CHIRAG	Central Himalayan Rural Action Group
CLART	Composite Landscape Assessment and Restoration Tool
MCLLMP	Meghalaya Community-Led Landscape Management Project
DSC	Development Support Centre
DLI	Disbursement-Linked Indicator
DIP	District Implementation Partner
DPR	Detailed Project Report
FES	Foundation for Ecological Security
GIDC	Groundwater Information Dissemination Centre
GKM	Grama Kayaka Mitra
GP	Gram Panchayat
GPDP	Gram Panchayat Development Plan
IEC	Information, Education and Communication
INREM	India Natural Resources Economics and Management
JJM	Jal Jeevan Mission

KVK	Krishi Vigyan Kendra
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
NGO	Non-Governmental Organisation
NPMU	National Programme Management Unit
NRM	Natural Resources Management
PDA	Participatory Digital Attestation
PDO	Panchayat Development Officer
PGWM	Participatory Groundwater Management
PGWMC	Participatory Groundwater Management Committee
PMT	Programme Management Team
PSI	People's Science Institute
SBM-G	Swachh Bharat Mission-Grameen
SOP	Standard Operating Procedure
SPMU	State Project Management Unit
SWCD	Soil and Water Conservation Department
VB-G RAM G	Viksit Bharat Guarantee for Rozgar and Ajeevika Mission Gramin
VCF	Village Community Facilitator
VNRMC	Village Natural Resources Management Committee
VWSC	Village Water and Sanitation Committee
WASSAN	Watershed Support Services and Activities Network
WELL Labs	Water, Environment, Land and Livelihoods Labs
WSP	Water Security Plan

Executive Summary

The problem that is outpacing the solutions

Since 2005, Arghyam has been working towards domestic water security by supporting diverse projects across India. After nearly 12 years of small-scale interventions, an honest stocktaking in 2017 confronted us with an uncomfortable reality: our projects, however well-designed, looked like islands of excellence while the problem was compounding everywhere. Groundwater levels were falling, springs were disappearing, and water quality threats were intensifying at a pace that our grant-making alone could not match. This pushed us towards a fundamental shift in strategy: move from supporting individual projects to partnering with large government programmes, work at the scale where funds and functionaries already existed, and invest in digital technology and capacity building as the means to reach that scale with speed.

The 2024 iteration of our strategy consolidated this direction under the frame of Source Sustainability, keeping drinking water sources functional over time, not just connected in the short term. We organised our work around three sub-themes.

Replenish

Recharging groundwater through scientifically planned natural resource management

Reduce

Cutting demand, particularly from water-intensive agriculture

Reuse

Treating and recycling greywater, a challenge that has grown with the JJM expansion of tap connections

This report brings together seven years of learning from 2018 to 2025, across these three sub-themes, reorganised not as a programme-by-programme account but as a set of cross-cutting lessons for practitioners, government partners, and funders working on rural water security.

The programmes and studies this report draws on

The evidence in this report comes from four major programme engagements and four structured studies, spanning six states and multiple tiers of government:

- **MCLLMP, Meghalaya** (2019–2023): Capacity building for NRM across 6,500 villages under a World Bank-funded landscape management programme, in partnership with the Meghalaya Basin Management Agency and the SWCD.
- **MGNREGA Karnataka: Jala Sanjeevini** (2020–2023): Scientific NRM planning at scale across 8 districts, embedding GIS-based tools and virtual mentoring into the government's rural employment scheme, in partnership with FES and the Department of Rural Development.
- **Atal Bhujal Yojana, Gujarat** (2021–2022): Community groundwater management across 216 GPs in Kutch and Mehsana districts, in partnership with ACT and DSC as District Implementation Partners under a World Bank-supported central scheme.
- **Kalike Trust AWD Study, Karnataka** (2025–26): Action research on alternate wetting and drying in paddy cultivation in Yadgir district, engaging KVKs and the Agriculture Department on water-efficient farming.
- **MGNREGA Dipstick Study, Karnataka** (2025): Field investigation of planning and implementation processes across 3 GPs in 3 districts.
- **Greywater Management and Potential for Reuse Study** (2024–25): A study across 20 villages in Gujarat, Haryana, Karnataka, Rajasthan, and Punjab on greywater generation, treatment, and institutional gaps.
- **Atal Jal Learning Study** (2025): A joint study with the Ministry of Jal Shakti, Water For People, and WELL Labs, covering 16 GPs across 4 states, capturing lessons from the programme's implementation against its five Disbursement-Linked Indicators.

What we found, what we learned and what we still do not know

Three findings stand out across programmes. First, the gap between what is planned and what is sustained is structural, not incidental: whether it is MGNREGA Annual Action Plans that allocate less than the mandated 65% of funds to NRM, Water Security Plans that are prepared to meet programme indicators but never revisited, or greywater systems built without any O&M institution or budget assigned, the pattern is consistent. One-time delivery thinking is embedded in how schemes are designed, how funds flow, and how accountability is measured. Second, scientific tools work when they are designed for the frontline: the GIS-based CLART tool, deployed through structured training and weekly virtual mentoring, demonstrably improved the quality of NRM site selection. Treatment areas showed 77% structural consistency with scientific recommendations versus 54% in control areas, with seven times higher tool adoption. Third, community institutions such as VNRMCs in Meghalaya, PGWMCs under Atal Jal, and VWSCs in greywater management, are necessary but not self-sustaining; their effectiveness depends entirely on formal recognition within government systems, continued access to data, and clear authority over decisions that affect their community's water.

Two recommendations recur across all three sub-themes. Embed scientific planning into administrative mandates, not just programme guidelines. CLART maps should be a mandated document in MGNREGA work files; Water Security Plans should be formally integrated into GPDPs; greywater management plans should be a required input for SBM-G funding applications. Without administrative anchoring,

scientific tools remain optional extras that disappear when programme support ends. Redesign funding norms to reflect need, not population size. Across MGNREGA, SBM-G, and Atal Jal, per-capita allocation formulas systematically underserve smaller, more water-stressed and more vulnerable villages, precisely the communities for which source sustainability is most critical.

Two questions remain open and suggest further investigation. The first is attribution at the aquifer level: how much of the groundwater improvement observed in Atal Jal blocks is attributable to programme interventions versus rainfall variability, and how can future programmes design monitoring systems that can answer this question with confidence? The second is institutional sustainability after programme closure: the VNRMCs formalised through a Cabinet Resolution in Meghalaya and the 2,100 Grama Parisara Abhivruddhi Samitis formed in Karnataka represent significant investments in community governance, but whether these institutions remain functional and effective five years after programme support has ended is not yet known. Tracking post-programme institutional health is the missing evidence link in the sector's understanding of what it actually takes to sustain source sustainability at scale.

Preamble

Access to safe water, sanitation and hygiene is the most basic human need for health and well-being (Sustainable Development Goal 6). Demand for water is rising owing to rapid population growth, urbanisation and increasing water needs from agriculture, industry and energy sectors.

Protecting water sources like rivers and aquifers prevents contamination, reduces the risk of waterborne diseases, and mitigates environmental damage, securing water for future generations. By protecting water at the source, whether it be lakes, rivers, or underground aquifers, communities can ensure a safe and reliable water supply.

Arghyam has been working since 2005 in partnership with civil society organisations and government agencies to ensure safe domestic water in India. Source protection has been an important theme in our work since the beginning.

Groundwater has been the major source of domestic water, tapped through open wells, borewells and springs. Hence, source protection meant different things to communities in different regions. Wells were drying up or getting polluted, borewells stopped yielding water, especially during summer, new borewells had to be sunk deeper and deeper, leading to geogenic contaminants mixing with water and springs started disappearing in the mountains, resulting in people, especially womenfolk, spending long hours fetching water from farther springs. Hence, tackling source sustainability involves improving groundwater recharge through scientific planning, reducing wastage wherever possible and finding new ways of reusing and recycling water.

Diverse interventions were taken up in different geographies to protect the sources. Arid regions needed judicious water management practices such as reviving and renovating traditional water bodies, harvesting scanty rainfall and promoting water-saving household practices since every drop mattered. Protecting springs and their surroundings with strong social protocols and increasing discharge through springshed management were attempted in high-rainfall mountainous regions.

Arghyam promoted rooftop rainwater harvesting in its initial years to combat severe water scarcity, rising demand and falling groundwater levels. Several small-scale projects by NGOs were supported in diverse geographies, such as with Disha in Bodhgaya, the Sachetana project with BIRD-K in 60 Fluoride-affected villages in Karnataka, Dhan Foundation in Chittoor (Andhra Pradesh), and with MYRADA in a few villages in Karnataka.

We also supported the open well recharge programme named “Mazhapolima”, initiated by the District Collectorate in Thrissur, which was our first partnership with the Government that helped revive open wells by diverting rainwater to over 40,000 open wells, resulting in better water availability during summer.

The partnership with Sambhaav Trust in Rajasthan helped revive a number of traditional water harvesting structures such as *Bavris*, *Beris*, *Tankas*, *Tanklis*, *Nadis*, *Kunds* and *Khadeens* in Barmer and Jaisalmer districts.

Community participation, cost sharing, and institution strengthening with a focus on sustaining the efforts were integral parts of all these projects. Groundwater management became a key agenda of Arghyam for ensuring domestic water security and hence the need for understanding aquifers. This led to the formation of four PGWM Resource Centres housed at ACWADAM-Pune, ACT-Bhuj, PSI-Dehradun and WASSAN-Hyderabad in 2011 for mainstreaming hydrogeology in various groundwater-related programmes.

Small-scale Action Research, training/capacity building of other practitioners (mainly NGO teams) and advocacy for promoting science-based groundwater management were the three specific roles played by these resource centres. However, in a few years, we realised the knowledge gap related to aquifer management (hydrogeology) prevalent in the sector and the difficulty faced by the Resource Centres to cater to the capacity building demands from various quarters.

The problem was outpacing the solutions offered by these groups and we went back to the drawing board in 2017 to brainstorm how we could catalyse change at scale and speed. It was clear that working with the Government was imperative for scaling up the solutions, and embedding IT technologies was identified as a key enabler. Hence, we started partnering with large-scale government programmes such as MGNREGA, MCLLMP and Atal Jal Yojana from the year 2018.

Currently, efforts are on for working on sustaining drinking water sources in partnership with the Government Departments under the Jal Jeevan Mission. The strategy chalked out in 2024 identified three sub-themes under Source Sustainability namely, Replenish, Reduce and Reuse for ensuring domestic water security. The details of our engagement during 2018-25 are captured as learnings and insights in the following chapters.

Chapter 1: Source Sustainability: The 3R Framework

India is among the most water-stressed countries, with nearly 18% of the global population but only about 4% of its water resources. Groundwater, which meets around 85% of rural drinking water needs, is under severe stress, with over 1,200 assessment units out of 7,089 classified as semi-critical, critical, or over-exploited. This directly impacts Jal Jeevan Mission systems, where many groundwater-based sources are becoming unreliable and often run dry during the summer months.

At the same time, agriculture accounts for nearly 80–85% of total freshwater use, placing significant pressure on already stressed aquifers. In contrast, a large proportion of rural greywater, about 60–70% of household water use, remains untreated, despite its potential for reuse and reducing freshwater demand.

Arghyam's Source Sustainability strategy is anchored in three interconnected pillars: Replenish, Reduce and Reuse, which together guide its efforts to support the Jal Jeevan Mission and advance long-term water security. Building on years of experience in groundwater management and community-led approaches, this framework responds to the dual challenge of declining water sources and increasing demand. It reflects a shift towards integrated water management by combining supply augmentation, demand management, and resource recycling, ensuring that drinking water systems remain sustainable while carrying forward Arghyam's legacy of water conservation.

Replenish

Focuses on strengthening groundwater systems by enhancing natural recharge through scientifically planned interventions. Arghyam's experience shows that sustaining water sources requires a combination of hydrogeological understanding, community participation, and effective programme design, coupled with strong governance systems. By working with large-scale government programmes such as MGNREGA and landscape-based initiatives, the approach emphasises building capacities of frontline functionaries, using data and digital tools for planning and ensuring that interventions are aligned with local ecological contexts. This enables restoration of degraded landscapes, improves aquifer health and secures drinking water sources over the long-term.

Reduce

This highlights the importance of managing water demand, especially in agriculture, which accounts for the largest share of groundwater use. Arghyam's work under programmes like Atal Bhujal Yojana and its partnerships with organisations on field-based action research demonstrate the need for promoting water-efficient practices. These include crop diversification, improved irrigation methods such as alternate wetting and drying, and better water budgeting at the community level. The emphasis is on driving behaviour change by improving water literacy, making water use visible, and creating institutional support systems that encourage efficient use without negatively impacting farmer livelihoods.

Reuse

Focuses on closing the loop by promoting the treatment and reuse of greywater for non-potable purposes. Evidence from Arghyam's studies indicates that a substantial portion of household water can be reused if supported by appropriate infrastructure and institutional mechanisms. However, challenges such as fragmented systems, limited awareness, water quality testing and inadequate maintenance need to be addressed. Strengthening greywater management involves improving system design, ensuring water quality monitoring and building community awareness and ownership. By enabling reuse, this approach reduces pressure on freshwater sources while contributing to better sanitation and environmental sustainability by safeguarding water quality.

Chapter 2: Projects Highlights From The Journey

2.1
Building Capacities For Natural Resource Management Under Community-Led Landscape Management Project (CLLMP), Meghalaya

Year of engagement: 2019 - 2023
Project location: Meghalaya
Partners: MBMA, SWCD, Socion, Sattva, FES, ACWADAM, Prasari, PSI and Chirag

Meghalaya's CLLMP, launched in 2018 by the Government of Meghalaya with support from the World Bank, is a flagship initiative aimed at strengthening Natural Resource Management (NRM) across the state. In 2019, Arghyam partnered with the Meghalaya Basin Management Agency (MBMA) to support the programme's ambition of scaling NRM planning and implementation across all 6,500 villages using digital tools and capacity-building approaches. Arghyam's role as a technical and capacity-building partner focused on enabling a distributed, community-led model of planning. Central to this was the creation of a cadre of Village Community Facilitators (VCFs), drawn from within villages and trained to lead planning, implementation, and monitoring of landscape-level interventions. This approach ensured strong local ownership, inclusion, and institutional legitimacy, particularly through the participation of women and community institutions.

However, the programme initially faced several challenges. There was limited technical capacity at the frontline to translate scientific planning into action, a lack of accessible and contextualised training materials and fragmented access to tools and data. Additionally, systems for real-time data-driven decision-making were weak, and pathways for sustained engagement of trained cadres were limited. To address these gaps, the programme introduced a set of innovative and scalable solutions. Atomized training content was developed in multiple languages to ensure accessibility. Digital tools such as the Participatory Digital Attestation (PDA) platform enabled on-field training, content access, and verification, while the Composite Landscape Assessment and Restoration Tool (CLART) supported scientific planning by identifying context-specific interventions. The iECHO guided mentoring model further strengthened capacities through regular virtual engagement and problem-solving support for frontline workers.

These efforts led to significant outcomes at scale. Over 14,000 VCFs were trained across more than 6,500 villages, making it one of the largest community-based NRM capacity-building initiatives in the country. More than 1,000 geotagged NRM plans were developed using CLART, enhancing transparency and integration with government systems. Institutional sustainability was strengthened through the formation of Village Natural Resource Management Committees (VNRMCs) in every village and the integration of NRM plans into MGNREGA. The programme also led to the establishment of a Centre of Excellence for NRM in the state.

Key learnings suggest that scale is possible when programmes are designed with a first-mile focus. VCFs, recruited from within communities and supported through regular virtual mentoring, outperformed externally deployed staff, but only when remuneration systems sustained their engagement over time. Embedding data capture within the PDA platform, rather than as a parallel reporting burden, gave programme managers and state leadership simultaneous real-time visibility, enabling course corrections that would otherwise have taken weeks. Demystifying CLART for VCFs with no prior GIS experience proved as consequential as the tool itself, because adoption barriers are rarely technical; they are almost always about accessibility and confidence. The expansion from 400 to 6,500 villages within the same funding envelope was ultimately held together by structured governance rhythms, regular reviews, clear milestones and defined accountability between partners, which kept a complex, multi-agency programme aligned even through the disruptions of the COVID period.

2.2
Scientific Planning Of NRM Interventions Under MGNREGA In Karnataka

Year of engagement: 2020 - 2023
Project location: Karnataka
Partners: Rural Development Department (MGNREGA), Govt. of Karnataka, FES

To address growing groundwater stress in Karnataka, the Department of Rural Development and Panchayat Raj, Government of Karnataka, partnered with the Foundation for Ecological Security (FES) to strengthen Natural Resource Management (NRM) planning under MGNREGA. Named Antarjala Chethana, the programme aimed to improve groundwater recharge and governance of commons by building capacities of government functionaries and Gram Panchayats across eight districts, covering nearly 71 lakh people. Arghyam supported this effort as a technical and funding partner, helping reimagine capacity building at scale.

A key challenge was the limited ability of frontline functionaries to plan and implement scientifically sound NRM interventions, despite mandates to allocate 65% of MGNREGA funds for such works. Planning was often fragmented, lacking technical rigour and clarity on roles and processes. To address this, the programme adopted a structured, first-mile-focused approach to capacity building and system design.

Field Functionaries being trained in the field

A training needs assessment mapped stakeholders and defined roles, informing hybrid learning models that combined in-person training, field demonstrations, and virtual mentoring. Localised digital content enabled continuous learning, while tools such as the Participatory Digital Attestation (PDA) platform improved visibility and tracking. The GIS-based Composite Landscape Assessment and Restoration Tool (CLART) supported scientific site selection and planning of recharge interventions.

These efforts led to the preparation of 950 Gram Panchayat NRM plans and the formation of over 2,100 village institutions. More than 2,600 MGNREGA functionaries were trained in watershed-based planning, commons management, and the use of digital tools. A pilot across 53 Gram Panchayats demonstrated the effectiveness of ridge-to-valley planning and informed a statewide scale-up.

Building on this, the Government of Karnataka scaled the initiative as Jala Sanjeevini in 2022. A robust “Phase 0” design mapped roles, tasks, data flows, and governance structures, emphasising accountability and data-driven decision-making. Regular virtual mentoring strengthened engagement and problem-solving among frontline workers. At scale, over 3,300 functionaries were trained through nearly 1,000 sessions, with 74% of works vetted using CLART and over 1.2 lakh works submitted under MGNREGA. Micro-watershed-based planning was also piloted to move beyond administrative boundaries.

A learning study by WELL Labs highlighted improved technical capacity, higher adoption of scientific planning tools, and better alignment with ecological needs, while pointing to the need for stronger community participation. The experience underscores that strong upfront design, investment in frontline capacity, and integration of digital tools with governance systems are critical for achieving sustainable groundwater outcomes.

2.3
MGNREGA Study in Karnataka: Understanding the Process of Planning and Implementation

Year of engagement: 2025
Project location: Karnataka
Partners: Rural Department (MGNREGA), Govt. of Karnataka and FES

Around 40% of households in Karnataka depend on groundwater-based schemes under the JJM, with sources becoming unreliable during the summer months in both quantity and quality. Ensuring sustainability in such contexts requires a combination of source augmentation through groundwater recharge and demand management, particularly in agriculture, which consumes the largest share of water. While MGNREGA offers a strong platform for implementing recharge interventions, and scientific tools like CLART are available, their adoption in planning and linkage to implementation remains limited.

Field observations and a focused study across three Gram Panchayats in water-stressed districts highlighted several gaps in the planning and implementation process. MGNREGA planning begins with Ward Sabhas, where community demands are aggregated and later consolidated into Annual Action Plans (AAPs) at the Gram Sabha level. While participatory in design, these plans often become extensive “wish lists” with limited prioritisation, making them difficult to implement. The guideline of allocating at least 65% of funds to NRM works is also not consistently followed, as seen in the sample GPs, where allocations ranged widely.

A key challenge lies in the weak linkage between planning and execution. In one case, a Gram Panchayat with a high allocation for NRM works implemented only a small fraction of its plan, while others performed relatively better. Labour shortages, lower wage rates compared to market conditions, and higher demand for individual household work further constrain the execution of community-based NRM interventions. At the same time, scientific planning tools like CLART, though mandated, are not embedded in the official workflow or documentation, limiting their visibility and usage.

Channel development in Muduvadi GP

The implementation process involves multiple functionaries at the Gram Panchayat and taluk levels, including Barefoot Technicians and Gram Kayaka Mitras, who play a critical role in mobilising communities, preparing estimates, and monitoring works. However, increasing compliance requirements, such as frequent geotagged monitoring, add to their operational burden. The introduction of digital platforms like NREGA Soft has improved transparency by enabling end-to-end visibility of planning and implementation and has also led to more realistic planning through early-stage estimation.

The study underscores the need to strengthen MGNREGA as a vehicle for groundwater sustainability by improving both planning and execution. Moving from annual, demand-driven plans to multi-year perspective planning can enhance feasibility and impact. Greater emphasis is needed on prioritising community-based NRM works, supported by appropriate incentives and enforcement of allocation norms. Embedding scientific tools like CLART into mandatory processes, aligning plans with available labour, and strengthening frontline capacities are critical steps.

Overall, while MGNREGA remains a powerful instrument for rural development and natural resource management, there is a clear opportunity to enhance its effectiveness in addressing groundwater challenges. A more integrated approach, combining scientific planning, improved governance, and stronger alignment with water security goals, can significantly improve outcomes and ensure sustainable service delivery under the JJM.

2.4
Building Capacities Of Gram Panchayats And CSOs For Promoting Sustainable Groundwater Management Under The Atal Bhujal Yojana And Learning Focused Study

Year of engagement: 2022 - 2023
Project location: Kachchh and Mehsana Districts, Gujarat
Partners: Arid Communities and Technologies (ACT) and Development Support Centre (DSC)

Learning Focused Study in the Year: 2025
Partners: Ministry of Jal Shakti, GoI, Arghyam, Water for People and WELL Labs

India is the world's largest user of groundwater, accounting for nearly 25% of global withdrawals. It underpins the country's water security, supporting about 62% of irrigation, 85% of rural drinking water, and 50% of urban supply. However, this dependence has led to widespread over-extraction, with 1,226 out of 7,089 assessment units classified as water-stressed. Structural drivers such as subsidised electricity, water-intensive cropping patterns, and weak regulation of groundwater extraction have further intensified the crisis, limiting agriculture's resilience to climate variability.

The Atal Bhujal Yojana (ABY), launched in 2020–21, was designed to address this challenge through a community-led, data-driven approach to groundwater management. Covering 229 water-stressed blocks across seven states, the programme focused on strengthening institutions, improving groundwater monitoring, promoting demand-side management, and incentivising sustainable practices. In Gujarat, Arid Communities and Technologies (ACT) and Development Support Centre (DSC) were engaged as District Implementation Partners (DIPs), covering 216 Gram Panchayats. Arghyam supported these partners in embedding design-at-scale principles, strengthening participatory groundwater management (PGWM) and building capacities, with programme management support from Sattva.

At the community level, Participatory Groundwater Management Committees (PGWMCs) were trained to understand local water resources, prepare water budgets, and develop water security plans. These efforts were complemented by exposure visits, IEC campaigns and on-farm demonstrations promoting crop diversification, soil management and water-efficient practices in collaboration with agricultural institutions. Together, these interventions improved community awareness, strengthened planning processes and increased adoption of demand management measures.

A key learning from implementation was the importance of continuous engagement and structured review mechanisms. Regular virtual interactions enabled timely problem-solving across different levels of functionaries. The use of atomised digital learning content supported frontline workers, though access to smartphones remained a constraint. The need for stronger convergence across schemes such as MGNREGA, watershed programmes and agriculture initiatives also emerged as critical for translating plans into action.

PGWMC training in progress

To deepen these insights, a learning-focused study was undertaken in 2025 in partnership with the Ministry of Jal Shakti, Water for People, and WELL Labs. The study assessed ABY through its Disbursement Linked Indicators (DLIs), examining how institutional processes, community participation, convergence and demand-side interventions translated into outcomes. Fieldwork across multiple states highlighted that ABY significantly strengthened groundwater monitoring systems and improved data accessibility through tools such as mobile applications and local information centres. Water budgeting proved effective in building community awareness, although integration of granular data into planning remained a challenge.

The study also found that convergence played a crucial role in financing and implementing water security plans, with several states exceeding their targets when supported by strong institutional coordination. Demand-side interventions saw substantial uptake, driven by context-specific approaches such as micro-irrigation, crop diversification and emerging technologies. While improvements in groundwater levels were observed in several regions, future assessments require more robust methodologies to isolate programme impacts from climatic variability.

Overall, the ABY experience highlights that sustainable groundwater management requires a combination of strong data systems, empowered local institutions, and effective convergence of public investments. Embedding water security planning within Gram Panchayat processes, strengthening the role of local committees, and linking awareness efforts with access to technologies and financing are critical next steps. As India continues to grapple with groundwater stress, these lessons offer a pathway to scale community-led, data-driven approaches for long-term water security.

2.5
Reducing Water Use In Agriculture: The Partnership With Kalike Trust

Year of engagement: 2025 - 2026
Project location: Yadgir District, Karnataka
Partners: Kalike Trust

Sustaining drinking water sources is a growing concern in groundwater-dependent districts under the Jal Jeevan Mission, particularly during the summer months when source reliability declines. Since agriculture is the largest consumer of freshwater, and groundwater-based irrigation dominates, managing agricultural water demand is critical to ensuring long-term water security without compromising farmers' incomes.

Paddy, the country's primary staple crop, is also highly water-intensive. Cultivated across nearly 46 million hectares in India, it consumes about 45% of total irrigation water. Karnataka alone has around 1.3 million hectares under paddy, producing about 4 million tonnes annually. Despite the availability of improved irrigation methods that can reduce water use by 20–30%, adoption remains low due to limited awareness and inadequate technical support.

To address this, Arghyam partnered with Kalike Trust during Kharif 2025 to pilot the Alternate Wetting and Drying (AWD) method among groundwater-dependent paddy farmers in Yadgir district, Karnataka. The initiative aimed to understand the potential and challenges of scaling water-efficient practices. Farmers were supported through interventions such as the installation of Pani Pipes for irrigation scheduling, soil testing for fertilizer application, the use of certified seeds, and the promotion of eco-friendly inputs like Azolla. Water use in trial and control plots was monitored using bulk flow meters.

Training session on AWD method of irrigation

The programme also engaged scientists from Krishi Vigyan Kendras, Agriculture Department officials, and academic experts to strengthen technical guidance and build momentum for adoption. In addition to water savings, AWD offers benefits such as reduced methane emissions and lower energy use.

Unusually high rainfall during the 2025 monsoon limited the ability to assess water savings under typical conditions. The study has therefore continued into the Rabi season with a smaller group of farmers to better understand groundwater use and adoption challenges.

Early learnings highlight that scaling such practices requires a multi-pronged approach. Farmers' decisions are driven by income security, and adoption remains low without clear benefits. Strengthening extension systems, sustained behaviour change campaigns and providing incentives and timely advisory support are critical to building farmer confidence. As groundwater stress intensifies, demand-side management in agriculture is essential for safeguarding drinking water sources and ensuring long-term sustainability.

2.6
Greywater Management And Reuse Potential In Rural India – A Study In Five States

Year of engagement: 2024 - 2025
Project location: Gujarat, Haryana, Karnataka, Punjab, Rajasthan
Partners: Not Applicable

India's rapid progress toward universal rural water access under the Jal Jeevan Mission (JJM) has significantly transformed the rural water landscape. By October 2025, over 15.7 crore households (81%) had tap connections, compared to just 16.7% in 2019. While this expansion has improved quality of life, it has also led to a sharp rise in greywater generation, now estimated at 24–30 billion litres per day. In the absence of adequate management systems, untreated greywater is often discharged into the environment, leading to waterlogging, vector breeding, and contamination of shallow groundwater, undermining the health gains of improved water supply. Although programmes such as Swachh Bharat Mission–Grameen Phase II (SBM-G 2.0), MGNREGS and 15th Finance Commission grants provide a policy framework, implementation gaps remain significant.

To better understand this emerging challenge, Arghyam undertook a Greywater Management Study across rural areas in Gujarat, Haryana, Karnataka, Rajasthan and Punjab; regions characterised by high groundwater dependence, water stress and strong progress under JJM. The study aimed to generate field-level evidence on greywater generation, handling and disposal practices, and to identify institutional, financial, and technical barriers to sustainable management. Using a mixed-method approach, the study combined field observations, stakeholder consultations, expert interviews, and analysis of national datasets and programme dashboards.

Findings highlight the scale and complexity of the issue. With near-universal tap coverage in some states, actual water use and, consequently, greywater generation often exceed official norms. Across sampled villages, water supply ranged from 35 to 200 litres per capita per day, with treatment systems frequently under-designed and operating below full coverage. Institutional fragmentation across multiple schemes limits integrated planning, while financial

constraints, particularly for smaller villages, result in piecemeal infrastructure rather than system-level solutions. The technical performance of systems varies widely depending on local conditions: infiltration-based systems fail in high water table or clayey soils, while arid regions face constraints of land and evaporation. Incomplete drainage networks and the absence of regular water quality monitoring further weaken system effectiveness and reuse potential.

The study underscores the need to shift from fragmented, infrastructure-led approaches to integrated greywater management systems. This includes a comprehensive assessment of greywater quantity and quality, village-level planning aligned with water and sanitation plans and decision frameworks for selecting context-appropriate technologies. Financing mechanisms must move beyond uniform norms to needs-based allocations, while also exploring revenue-generating reuse models such as irrigation and composting. Strengthening institutional roles, building local capacities, and establishing monitoring systems are equally critical for sustained outcomes.

Overall, the study highlights that greywater management is not merely a sanitation issue but a central component of source sustainability. Integrating greywater reuse into water security planning can reduce freshwater demand, improve groundwater recharge without compromising quality and protect environmental health. As rural water infrastructure continues to expand, addressing greywater proactively will be essential to ensure that gains in water access translate into long-term sustainability.

Chapter 3: Learning And Insights From The Projects

3.1
Community Participation

Who plans, who acts and who is left out

Community participation is not a box to tick; it is the mechanism through which scientific knowledge becomes local action and through which programme investments become sustained outcomes. Across Arghyam's three sub-themes, the quality, depth and structure of community participation were consistent differentiators between programmes that produced durable change and those that produced activity without lasting impact. The question that runs through every engagement is the same: participation in whose interest, designed by whom and accountable to whom?

Replenish

Mobilising communities for landscape management

In Meghalaya's MCLLMP, community participation was structurally embedded from the start. Representation was required from every village, with a deliberate emphasis on women's inclusion. Village Community Facilitators (VCFs) were drawn from within communities, not parachuted in from outside, and trained to support local NRM planning, implementation and monitoring. This produced locally anchored decision-making and enhanced institutional legitimacy.

14,000 VCFs trained across Meghalaya	**6,500+** villages sensitized	**Largest** community NRM capacity-building effort in India

In Karnataka under MGNREGA, community participation follows a formal statutory process: Ward Sabhas are typically conducted in September, presided over by the elected Ward member, who identifies the works, which are then discussed and prioritised at the Gram Sabha on October 2 each year. This is well-structured on paper, but field evidence shows that community participation in NRM-specific works (as distinct from individual household works) remains shallow. The demand for individual benefits outpaces collective NRM investment, partly because individual work carries no requirement for geo-tagged photographs or a collective agreement. A third-party assessment found that community participation data were not available in the control GP samples in any structured manner; thus, the benefits of increased community participation could not be quantified.

A specific lesson from Karnataka: the original hypothesis that Panchayat Development Officers (PDOs) would be effective first-mile actors for community mobilisation proved incorrect. Field experience showed that Grama Kayaka Mitras (GKMs)—women social mobilisers—were far more effective at facilitating transect walks with community members, gathering local knowledge about the landscape and building the social trust needed for

collective NRM planning. This required a significant redesign of the programme's community engagement model.

Reduce

Water budgeting as a community awareness tool

Under the Atal Bhujal Yojana (ABY) in Gujarat, Participatory Groundwater Management Committees (PGWMCs) were the primary vehicle for community-level demand management. Communities were oriented on their own village's natural resource scenario, the roles and responsibilities of the PGWMC, the preparation of water budgets and water balance, and the creation of Water Security Plans (WSPs). Exposure visits to successful villages and intensive IEC campaigns supplemented formal training.

The Atal Jal study (2025) found that water budgeting was genuinely effective at raising community awareness by making groundwater "visible and quantifiable", helping communities assess both domestic and agricultural water use for the first time. However, the study also found a persistent participation gap: WSPs often relied on block-level groundwater estimates rather than GP-level data, weakening the direct link between a community's actions and measurable change in their own aquifer.

For the Kalike AWD pilot in Yadgir, farmer participation was shaped by economic self-interest. Farmers' primary concern is net farm return, and most are hesitant to try new technologies without peer evidence and assured income security. Participation in the AWD demonstration involved farmers setting up Pani Pipes, monitoring their own fields against control plots, and engaging with KVK scientists and Agriculture Department officials, building multi-institutional credibility for the technology alongside farmer-level evidence.

Reuse

The participation gap in greywater management

The study on exploring the potential of greywater reuse for irrigation and groundwater recharge across five states (2024–25) found that community awareness and engagement around greywater management remain low. Unlike drinking water, where the connection between supply quality and health is visceral and immediate, greywater is perceived as a sanitation and disposal problem rather than a water security concern. Waterlogging, vector breeding and shallow groundwater contamination from untreated greywater are experienced as environmental nuisances and not understood as health risks or resource losses.

Bridging this perception gap is a prerequisite for sustained community participation in greywater management. It requires targeted communication that reframes greywater as a resource available for irrigation, fisheries, composting and shallow groundwater recharge, not just waste. In this context, SBM-G 2.0 promotes community participation in managing liquid waste management, providing an enabling framework to institutionalise such efforts. Without this shift, O&M responsibilities are seen as burdens rather than stewardship, and systems fall into disrepair once programme-period supervision ends.

Key Lessons

1. Community participation is more effective when communities are participants in science, not just recipients of programme inputs. Water budgeting and transect walks with CLART are examples of science being taken to people rather than people being told what to do.

2. Women's participation as agents, not just beneficiaries, consistently improves both the quality of planning (local ecological knowledge) and the durability of institutional ownership (VNRMCs, GKMs).

3. Participation in collective NRM works requires active incentive design. When individual benefit works compete with community NRM works (as in MGNREGA), households will default to individual benefit unless the incentive structure explicitly favours collective action.

4. The PDO-to-BFT/GKM pivot in Karnataka illustrates a broader principle: the right first-mile actor is the one whose daily life is most connected to the programme's goals, not necessarily the most senior or formally positioned.

5. Participation without agency erodes trust. Communities that prepare Water Security Plans but cannot track whether line departments are implementing them lose faith in participatory planning as a process worth investing in.

3.2

Frontline Workers

Roles, daily-life challenges and the tools that help them

Frontline workers (FLWs) are the human infrastructure through which every programme reaches the ground. They carry the weight of documentation, community mobilisation, technical planning, monitoring and reporting, often with minimal support, inadequate incentives and tools that were not designed for field conditions. Understanding the daily realities of FLWs, their workloads, skill gaps, connectivity, language context and incentive structures is a prerequisite for programme design that actually scales.

Replenish

The diverse FLW cadre in NRM programmes

NRM programmes at scale depend on a layered system of frontline workers with distinct roles:

- Village Community Facilitators (VCFs) in Meghalaya: community-drawn, trained to support local NRM planning, implementation and monitoring. Over 100 VCFs were certified by the Agriculture Skills Council of India (ASCI), creating a portable credential. However, livelihood pathways for VCFs post-programme, whether in government schemes, NGOs, or local enterprise, remained a structural gap.

- Barefoot Technicians (BFTs) in Karnataka: responsible for collecting demand for work, supervising worksites, taking measurements, geotagging, ensuring worker facilities and maintaining documentation. Each BFT manages a physical file of 23 mandated documents per work. From FY 2025–26, geo-tagged real-time photographs must be uploaded twice daily per worksite, creating a significant additional load.

- Grama Kayaka Mitras (GKMs) in Karnataka: exclusively women, responsible for social mobilisation, community engagement, and supporting NRM planning. GKMs receive an honorarium of Rs. 12,250/ month, slightly above the unskilled daily wage rate (Rs. 370/day). Their combination of gender sensitivity and local presence makes them the most effective first-mile actors in community NRM planning, a lesson that emerged only through field experience.

- Panchayat Development Officers (PDOs): initially assumed to be key first-mile actors, but insufficient bandwidth and incentive alignment meant that BFTs, GKMs and Data Entry Operators were consistently more effective in practice.

Tank restoration in Dabbeghatta GP

Daily challenges at the frontline

Documentation overload is the most consistent structural challenge for BFTs. Maintaining 23 physical documents per MGNREGA work, with no digital integration for most of the study period, consumed time that should have gone into site quality and community engagement. The introduction of NREGA Soft (2025–26) digitises this workflow, but transition costs are real, and the system requires device access and connectivity that are not uniform across field locations.

Skill gaps in hydrogeological science created a second category of challenge. FLWs were expected to select appropriate recharge structures and plan interventions, but few had the technical background to do this without hand-holding. This was the central problem that CLART and the virtual mentoring model were designed to solve.

Incentive misalignment affected both BFTs and the labourers they supervise. MGNREGA daily wage rates (Rs. 370 in Karnataka) are significantly below market rates (Rs. 500–650) in many districts, discouraging able-bodied workers from participating in community NRM works. Since community works require more coordinated effort than individual household works, and individual works carry less documentation burden, the incentive structure actively deprioritises NRM.

Reduce

FLWs in demand management and water-efficient agriculture

The frontline workforce for water demand management is different in composition from NRM recharge programmes. Community Resource Persons (CRPs) and PGWMC members formed the primary community-level cadre under ABY, oriented on water budgets, groundwater monitoring and WSP creation. Their main challenge was the gap between groundwater literacy (making visible what is invisible) and the technical complexity of water balance calculations, which often required support from block-level data rather than GP-level measurements.

District Implementation Partners (DIPs) — organisations like ACT and DSC in Gujarat served as bridge institutions between the programme and community-level FLWs. The Atal Jal study identified states where DIPs played an especially effective role in community mobilisation as a programme best practice. The DIP model effectively extends the FLW system by bringing specialised organisations into a structured implementation role.

For the Kalike AWD programme in Yadgir, agriculture extension workers (KVK scientists, Agriculture Department officials, College of Agriculture faculty) were essential for technical credibility. However, the broader lesson was stark: KVKs and the Agriculture Department need to dramatically scale up their extension activities on water management in farming. The current density of extension support is wholly insufficient for the size of the behaviour change challenge, since an extension worker has to cover multiple GPs, unlike a GKM under the MGNREGA.

Reuse

The missing FLW cadre in greywater management

The Greywater Management Study revealed a structural gap that distinguishes greywater from both NRM recharge and drinking water supply: there is no defined frontline worker cadre for greywater management in rural India. No dedicated person at the village level is responsible for monitoring system performance, conducting water quality tests, or managing routine maintenance. The consequences are predictable: quality testing of input and output water is almost absent; small repairs are deferred until systems fail; and O&M

responsibilities fall to no one in particular.

State, district and block-level functionaries in SBM-G implementation are typically engineers and programme managers with design and construction expertise, but limited exposure to the full operational lifecycle of treatment systems, including community engagement, O&M protocol design and water quality monitoring. Building a defined FLW cadre for greywater with clear roles, appropriate compensation, and access to technical backstop support is a prerequisite for the sustainability of any greywater infrastructure investment. This cadre may need to be deployed even if only across a few GPs per person, given that greywater systems require continuous maintenance and follow-up. Training inputs should also go beyond technical aspects to enhance the ability of functionaries to assess local contexts and suggest appropriate reuse options to GPs, strengthening both system performance and long-term sustainability.

Key Lessons

1. Tool design for FLWs must start from field reality: workload, literacy level, language, device access and connectivity. Tools designed from the programme management level and pushed down to the frontline consistently face adoption barriers that were predictable from the start.

2. The 23-document MGNREGA filing requirement is a proxy for a broader problem: documentation systems designed for administrative accountability, not for frontline usability. Redesigning documentation to be digital, lightweight and simultaneously useful to the FLW (not just to the auditor) is a leverage point for FLW effectiveness.

3. Incentive structures must align with desired outcomes. When individual works carry lower documentation burden and higher community acceptance than NRM works, BFTs and GKMs will face constant pushback from community members that prefer individual works. Wage differentials and recognition systems for NRM-focused GPs are practical responses.

4. The greywater sector needs a defined FLW role. Creating this cadre, rather than expecting existing VWSC members to absorb an additional technical responsibility, is the foundational investment for greywater system sustainability.

3.3
Local Institutions and Committees

The last mile of accountability and the first mile of ownership

Local institutions like VNRMCs, VWSCs, PGWMCs, Gram Sabhas, VCF cadres, and Grama Parisara Abhivruddhi Samitis are the most critical and most consistently under-resourced components of sustainable water management. They are “last mile” in terms of programme delivery, but “first mile” in terms of long-term ownership. Their effectiveness determines whether capital investments in water infrastructure survive programme closure, whether community knowledge is applied to ongoing management decisions, and whether accountability for water quality and availability has a local address.

Replenish

Formal anchoring of NRM institutions

In Meghalaya, Village Natural Resources Management Committees (VNRMCs) were formed in every village and formalised through a Cabinet Resolution, giving them statutory standing within the state governance framework. This formal anchoring transformed VNRMCs from programme-period entities into permanent village institutions with defined roles, government recognition and a basis for accessing scheme funds. The NRM plans developed by VNRMCs were subsequently integrated as master plans under MGNREGA for three years, creating a formal link between community-generated planning and government financial flows.

A Centre of Excellence for NRM was established as a state-level technical support institution, providing a support platform for VNRMCs beyond the programme period. Over 100 VCFs were certified by ASCI, creating portable credentials that VCFs could use to seek livelihood opportunities in the NRM domain. These institutional sustainability investments, including the Cabinet Resolution, Centre of Excellence, and ASCI certification, represent a programme design philosophy of building lasting assets, not just completing activities.

In Karnataka under MGNREGA, over 2,100 Grama Parisara Abhivruddhi Samitis (village ecology committees) were formed to manage village commons and ecology. These committees exist within the MGNREGA institutional architecture, but their effectiveness in sustaining NRM outcomes after the Jala Sanjeevini programme period is not yet documented, a gap that reflects the broader upkeep data problem discussed in *Section 7: One-Time Delivery vs.Sustained Upkeep.*

Reduce

VWSCs and PGWMCs: Authority, accountability and the WSP

Under ABY, Participatory Groundwater Management Committees (PGWMCs) were the primary community-level institutions for demand management. They were trained on water budgets, WSP preparation and groundwater monitoring. However, the Atal Jal study found that their formal authority within the programme structure was limited: they could prepare WSPs but had no formal mechanism to hold line departments accountable for implementing those plans, no access to GP-level groundwater data for plan updates, and no tracking visibility in programme management systems.

PGWMC Meeting in Haryana

The study's recommendation is specific: VWSCs across states should be given greater formal control over interventions identified through participatory planning. Future programmes should establish procedures whereby line departments report implementation progress to VWSCs and communities. The Atal Jal App should incorporate WSP tracking functionality so that communities can view their planned interventions and monitor implementation status. These are not aspirational design principles; they are practical, implementable changes that would transform the relationship between community institutions and government departments.

The recommendation to formally integrate WSPs into Gram Panchayat Development Plans (GPDPs) is equally specific: a WSP that sits outside the GPDP is a supplementary planning document; a WSP integrated into the GPDP is a budget commitment. This integration, requiring a combination of state government instruction and technical facilitation, would give local water institutions direct influence over GP-level resource allocation.

Reuse

GPs and VWSCs as O&M institutions for greywater

The O&M of the greywater system is sustainable where a formally empowered local body, such as the GP or a VWSC has explicit authority, technical capacity and reliable financing for ongoing maintenance. In most of the 20 sampled villages, this institutional foundation was absent: VWSCs had unclear mandates for liquid waste management, lacked technical skills for system maintenance, and had no dedicated O&M budget beyond the general 15th Finance Commission allocation.

Where VWSCs had stronger institutional capacity, typically where they had been engaged with JJM implementation and had experience managing drinking water infrastructure, they were demonstrably better positioned to absorb greywater O&M responsibilities. This points to a design principle: JJM's investment in VWSC capacity for drinking water management is a platform that can be extended to greywater management, but only with deliberate role definition, additional technical training and protected O&M financing.

Revenue-generating reuse models, where treated greywater is sold to farmers for irrigation or used in fisheries and composting, offer a pathway to financial sustainability for local institutions that manage greywater systems. These models exist in pilot form but have not been systematically scaled or documented. Linking local institutional authority over greywater to revenue from greywater reuse creates an incentive structure for sustained management that government grant dependency alone cannot provide.

Key Lessons

1. Formal anchoring of community institutions–Cabinet resolutions, integration into GPDPs, ASCI certification of community cadres—is what converts programme-period participation into post-programme ownership. Programme designs that skip formal anchoring are built on sand.

2. The Cabinet resolution for VNRMCs in Meghalaya is a replicable model for other states. A state government notification formally recognising village NRM committees, defining their functions, and establishing their authority to participate in MGNREGA AAP preparation would have a transformational effect on NRM planning quality.

3. WSP integration into GPDPs, combined with VWSC authority to track line department implementation, would transform the Water Security Plan from a compliance document into a community governance instrument. This requires both a policy instruction and a facilitation process at the GP level.

4. JJM's VWSC capacity built for drinking water O&M is an underutilised platform for greywater management. Extending VWSC mandates, training and financing to cover liquid waste management is more efficient than building a parallel institutional structure.

5. Revenue-generating reuse models (greywater for irrigation, fisheries, composting) are the missing sustainability mechanism for local greywater institutions. Piloting and documenting these models with a focus on GP-level financial viability should be a priority investment in the Reuse sub-theme.

3.4

Systems Thinking And Demystifying Science

Making the invisible visible

Water management is fundamentally a systems problem: groundwater recharge depends on upstream landscape treatment; drinking water source sustainability depends on agricultural demand patterns in the neighbourhood; greywater management determines whether increased tap connectivity improves or worsens the shallow water table, as well as water quality. Yet most programme designs, government schemes and field functionary training treat these as separate domains. Systems thinking, and the science that underlies it, must be demystified and made accessible if field actors are to make decisions that are good for the system, not just for their specific mandate.

Replenish

Hydrogeology as community science

The central scientific challenge in Replenish programmes is groundwater recharge: a domain where expert knowledge had historically been locked in technical institutions (hydrogeologists, PGWM Resource Centres) and inaccessible to the functionaries and communities who most need it. The four PGWM Resource Centres established by Arghyam in 2011 (ACWADAM, ACT, PSI, WASSAN) represented a first attempt to mainstream hydrogeology, but the knowledge gap across the sector proved too wide for a resource-centre model to bridge at the required speed.

The ridge-to-valley watershed approach became the most important systems-thinking framework deployed across Replenish programmes. Its core principle is that NRM interventions must follow hydrological logic, saturating each reach within a micro-watershed from ridge to valley floor rather than administrative boundaries (GP or village limits). This approach ensures that recharge structures are placed where hydrology dictates maximum impact, not where demand is loudest or works are easiest to execute. Its application requires understanding of drainage lines, rock permeability and recharge potential, exactly the knowledge that field functionaries lacked before the introduction of CLART.

The CLART tool, developed by FES, operationalises this systems approach into a GIS-based interface accessible to a trained Barefoot Technician. By integrating topography, drainage, rock strata and recharge potential, CLART recommends the most suitable intervention structures for a given location, converting expert hydrogeological knowledge into a field decision-support tool. The WELL Labs comparative study in Karnataka found that areas where CLART was applied showed stronger alignment with scientifically identified intervention sites, significantly higher adoption of the tool, and a clear increase in the use of effective recharge structures such as trenches in upland areas.

77% Sites consistent - Treatment areas with CLART	**54%** Sites consistent - Control areas without CLART	**7x** higher tool adoption in treatment vs. control areas

Demystifying science also required content innovation: short audio and video modules on specific topics (watershed principles, soil types, recharge structures) developed in local languages (Khasi, Garo, Bengali in Meghalaya and Kannada in Karnataka) by partners including ACWADAM, ACT, PSI, CHIRAG, PRASARI and

INREM Foundation. These atomised content pieces, consumed on demand via mobile apps, allowed FLWs to access science when they needed it in the field, not just during residential training.

Reduce

Making groundwater depletion quantifiable

The fundamental system challenge in the Reduce programmes is that groundwater depletion is invisible to the farmers causing it. Communities cannot see the aquifer declining; the impact of individual irrigation decisions is diffuse and delayed. ABY's water budgeting methodology was specifically designed to close this visibility gap: quantifying the water balance at the GP level, showing communities the gap between recharge and extraction, and making the link between cropping patterns and groundwater depletion concrete and actionable.

The Atal Jal study found that water budgeting succeeded as an awareness tool but faced a data limitation: WSPs often used block-level groundwater estimates rather than GP-level measurements, weakening the direct connection between community action and observable change in their own aquifer. Strengthening GP-level monitoring data is the system upgrade needed to make water budgeting a genuine feedback loop rather than a one-time planning exercise.

The science of Alternate Wetting and Drying (AWD) in paddy cultivation illustrates both the promise and challenge of demystifying technical knowledge for farmers. AWD reduces water use by 20–30% compared to flood irrigation by applying water only when the field dries to a defined threshold, monitored through Pani Pipes (simple perforated tubes). Its additional co-benefits, reduced methane emissions and energy savings, make it a systems solution rather than a narrow agricultural intervention. However, farmer adoption requires not just knowledge of the science but confidence in its application to their specific soil type, crop variety and seasonal conditions, a form of contextualised science communication that current extension systems struggle to provide at scale.

Reuse

Greywater as part of the water cycle

The most fundamental systems-thinking shift required in the Reuse sub-theme is reframing greywater from sanitation waste to a water resource. India is now generating an estimated 24–30 billion litres of greywater per day from rural households, a direct consequence of JJM's success in expanding tap connections. Untreated, this water causes waterlogging, vector breeding and shallow groundwater contamination. Treated, it can irrigate crops, support fisheries, enrich compost and recharge shallow aquifers.

The greywater study's science-based findings reveal how local hydrogeology and the spread of households must shape treatment choices. Infiltration-based systems (soak pits, leach pits) work effectively in permeable soils but fail in high-water-table or clayey zones common in Punjab and Haryana. Greywater systems in arid regions such as Rajasthan need to be carefully planned to minimise evaporation losses and ensure efficient reuse of water. In Punjab and Haryana, where per capita water use exceeds the JJM norm of 55 lpcd due to easy groundwater access, actual greywater generation substantially exceeds planning estimates, creating treatment capacity shortfalls in systems designed to national-norm quantities. Local hydrogeology, climate and settlement density must all inform treatment system selection; uniform national design norms produce mismatched infrastructure.

Key Lessons

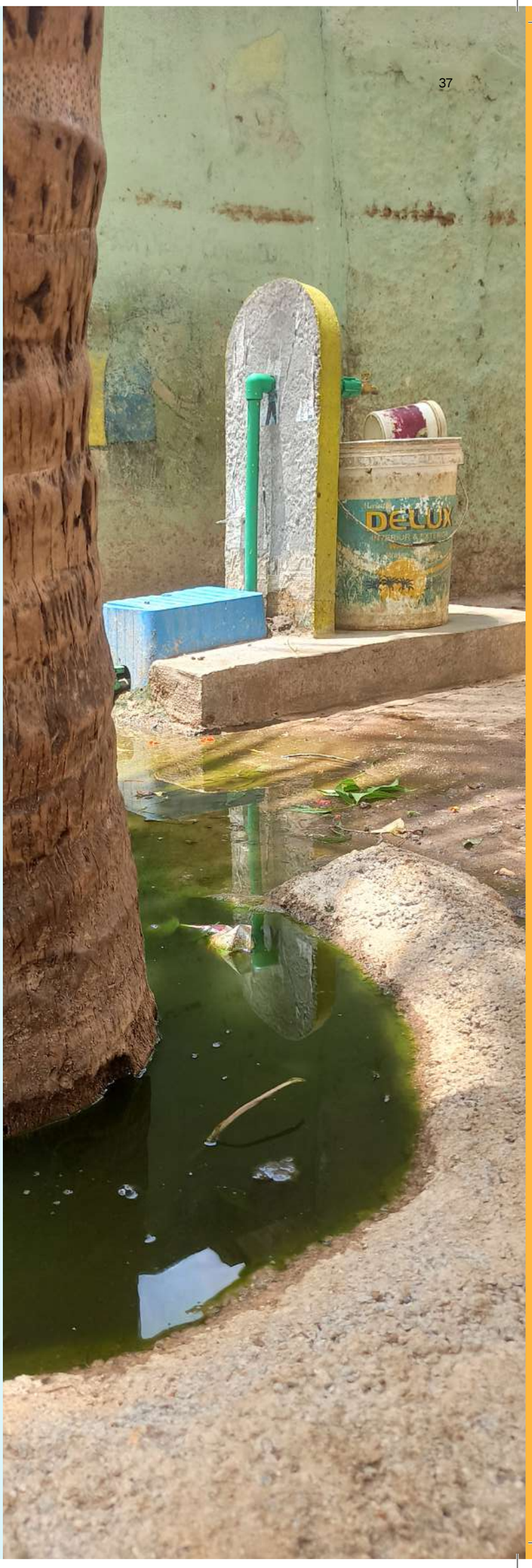
1. Science scales when it is embedded in tools that field actors can use independently in the field, not just explained in training. CLART is the strongest example: expert hydrogeology translated into a field decision interface that BFTs can operate after structured training and mentoring.

2. The ridge-to-valley watershed approach is a systems thinking framework that should inform all NRM planning under MGNREGA. Its current absence from mandated planning documents despite being promoted under Jala Sanjeevini means it exists as an aspiration but not as an administrative requirement.

3. Making the invisible visible (groundwater levels, water budgets, greywater volumes) is a precondition for behaviour change. Communities cannot act on information they do not have or cannot interpret. Data dissemination tools (Atal Jal App, GIDCs, QR codes on monitoring wells) are science-communication infrastructure, not just data systems.

4. Contextualised science, adapted to local soil, crop, hydrology and language conditions, is more actionable than generic science. Atomized, language-specific content modules represent a scalable approach to contextualisation that the sector should invest in systematically.

5. Systems thinking calls for moving beyond departmental silos. Drinking water, natural resource management, agriculture and sanitation are often managed by separate departments, each with its own data systems and programme logic. However, water systems operate as interconnected systems and programme design must reflect this interconnectedness rather than institutional boundaries.



3.5

Technology For Capacity Building At Scale

Enabling distributed learning, accountability and course correction

Traditional capacity building in government programmes has relied on residential training events: expensive, infrequent and subject to rapid knowledge decay once participants return to field conditions without reinforcement. Arghyam's experience across all three sub-themes demonstrates a more effective model: a technology-enabled ecosystem of continuous, low-dose, high-frequency learning, accountability and problem resolution. The shift from training events to learning ecosystems is the central technology lesson from this period.

Replenish

The technology stack for NRM capacity building

Three technology components worked together across Meghalaya (MCLLMP) and Karnataka (Jala Sanjeevini) to enable capacity building at scale:

- CLART (GIS-based NRM planning tool): Converts hydrogeological knowledge into a field interface. BFTs and Technical Assistant Engineers were trained to conduct community transect walks, capture local knowledge, verify site suitability and generate intervention estimates, a process that previously required a hydrogeologist. In Karnataka, 74% of submitted works were vetted remotely using CLART; 1.2 lakh works were submitted for approval under MGNREGS.

- PDA (Participatory Digital Attestation platform by Socion): Used for delivering training content, creating verifiable attendance records, and tracking post-training task completion by FLWs. In Meghalaya: 1,000+ geotagged NRM plans were produced; training was delivered through COVID lockdowns. In Karnataka: 3,300+ functionaries were trained in 943 sessions across 156 content pieces.

- The PDA platform gave the programme something it had not had before: reliable, real-time visibility of who had been trained, on what, and where. For a programme operating across thousands of villages and multiple partner organisations simultaneously, this was a significant operational advance. Yet as implementation progressed, a more difficult question emerged: knowing that a VCF had attended a training session said little about whether they could apply that knowledge independently in the field, resolve a planning problem without handholding, or produce an NRM plan that met quality standards. Training attendance, it turned out, was the easier half of the visibility challenge; what happened after training, task completion, quality of output, and ability to troubleshoot on the ground remained largely opaque to programme managers and largely unaddressed by the data systems in place.

- iECHO Guided Mentoring Model: Weekly or fortnightly virtual sessions between Master Trainers / technical experts and frontline workers for problem resolution and knowledge reinforcement. In Karnataka, the frequency of interaction increased between Master Trainers and Field Trainers, enabling faster problem resolution and building practical confidence among FLWs.

6 times/year
Mentor–FLW interaction frequency before using iECHO

30 times/year
Mentor–FLW interaction frequency after using iECHO

A critical design insight: before deploying any technology, the programme team created a functional grid mapping all actors, their roles, tasks, training requirements and accountability linkages. This Phase 0 investment ensured that technology addressed real capacity gaps rather than defaulting to off-the-shelf tools. The functional grid also clarified that PDOs were not effective first-mile actors, redirecting effort toward BFTs and GKMs before at-scale deployment began.

Digital tools enable scale only when deployed to near 100% adoption. Reaching this threshold requires facilitation and programme management support, tracking adoption gaps weekly, identifying HR and process barriers from field feedback, and making decisions at the state leadership level in real time. In both Meghalaya and Karnataka, this kind of active programme management was a decisive factor in reaching scale.

Reduce

Technology for groundwater data access and demand management

ABY catalysed significant innovation in groundwater data dissemination, making previously inaccessible government monitoring data available to communities through user-friendly formats:

- Atal Jal App: Provides groundwater level and quality data, programme information and scheme updates in a mobile-friendly format. The Atal Jal study recommends it as a one-stop platform for all groundwater-related scheme information, with WSP tracking functionality added so communities can monitor implementation of their own plans.

- QR codes at monitoring wells and MIS dashboards: Enable communities to access groundwater trends at their specific field location, translating abstract monitoring data into locally relevant information.

- Groundwater Information Dissemination Centres (GIDCs): Physical access points for community members without smartphone access, ensuring data dissemination is not limited by digital access inequality.

- IoT-enabled smart irrigation and sensor-based systems: Emerging demand management tools for regions where conventional micro-irrigation has reached saturation. These are still beyond the reach of most smallholder farmers without significant subsidy, but they point the way forward for precision agriculture-based demand management.

For capacity building of FLWs under ABY in Gujarat, atomized learning content shared through mobile apps proved highly effective, consistent with the Replenish experience. Smartphone access gaps among some FLWs remained a barrier, pointing to the need for multi-channel content delivery (app + WhatsApp + SMS + physical job aid) rather than exclusive reliance on smartphone-based learning.

Sensor-based drip irrigation supported under ABY in Karnataka

Reuse

Technology gaps in greywater planning and management

The most significant technology gap in greywater management is decision support for system selection. A GIS-based platform that integrates village population, soil type, groundwater depth, land availability and BOD load estimates could guide GP-level planners toward context-appropriate treatment designs, analogous to how CLART guides NRM intervention selection in soil and water conservation programmes. This tool does not yet exist for greywater in a form accessible to block-level functionaries.

Regular greywater quality testing systems and monitoring protocols linked to programme implementation are recommended but currently absent in most studied villages. Building this monitoring backbone is a prerequisite for evidence-based O&M and for assessing public health impact. The integration of JJM's MIS dashboard data (connection density, per capita supply) with SBM-G 2.0 data (treatment system status, O&M condition) could provide a powerful planning layer, but this data integration has not yet been operationalised at the state level.

Key Lessons

1. Technology is a multiplier, enabling speed and scale at relatively lower cost. It is not a substitute for programme management.

2. Technology can dilute the quality of knowledge transfer if not complemented with strong human interfaces. Blended approaches that combine digital tools with on-ground facilitation are critical to ensure depth of understanding and sustained behaviour change. CLART, PDA and the Atal Jal App are effective because they are deployed within structured programme management frameworks with active governance and real-time course correction. Without this, technology tools reach 60% adoption and plateau.

3. Visibility of capacity built must extend beyond training attendance to what happens after training: task completion quality, field problem resolution and output quality. The PDA platform provided training visibility; the harder challenge is building visibility into post-training performance.

4. Low-dose, high-frequency learning (virtual mentoring, on-demand content modules) consistently outperforms high-dose, low-frequency training events. The 6-to-30 interaction frequency shift in Karnataka is the most quantifiable demonstration of this principle in the portfolio.

5. Phase 0 (functional grid mapping, actor role definition, content mapping, technology selection) is where scale is made or broken. Programmes that skip Phase 0 and go straight to technology deployment create adoption failures that are expensive to correct.

6. Data dissemination is science communication infrastructure. The Atal Jal App, GIDCs and QR codes are as much about making scientific information accessible to communities as they are about programme accountability. Separating these two purposes, treating data as a monitoring tool but not a community empowerment tool, misses the full value.

7. A GIS-based digital tool for greywater treatment system selection would transform the quality of infrastructure investment decisions at the GP level. This is the most actionable technology investment identified across the Reuse sub-theme.

3.6

Policies And Programmes

Leveraging public systems for source sustainability

The water security issues Arghyam has been working on cannot be solved at the required scale without the government: the funds, the mandated presence in every village, and the formal authority to embed norms and standards are only available through public systems. At the same time, government programmes come with their own constraints, including administrative boundaries that cut across hydrological units, fund flows tied to population metrics rather than need, and scheme designs that reflect priorities from a different era of rural India. Engaging productively with government programmes requires both opportunistic alignment with existing structures and an honest diagnosis of where those structures need reform.

Replenish

Source Sustainability programmes

MGNREGA is the largest government scheme for asset creation and NRM in rural India, with a statutory mandate to allocate 65% of funds to NRM-related works. Field evidence from Karnataka consistently shows this mandate is not adhered to, with sample GPs allocating only 27–59% of their Annual Action Plan to NRM. The gap between policy intent and field reality is driven by several factors: higher community demand for individual household works; documentation burden for community NRM works; lower daily wage rates compared to market rates; and the absence of systematic enforcement by approving authorities.

The World Bank-funded MCLLMP in Meghalaya ($48M World Bank + $12M Government of Meghalaya) created a governance framework that produced transformative community capacity building, expanding from 400 villages to 6,500 villages within the same funding envelope. The NRM plans developed under MCLLMP were subsequently integrated as master plans under MGNREGA for three years, a rare, replicable example of community-generated plans that could potentially be absorbed into formal government financial flows.

Jala Sanjeevini, the Karnataka state NRM programme born from the 53-GP pilot by FES and Arghyam, established state guidelines for CLART-based NRM planning and a dedicated Programme Management Team (PMT) comprising the RD&PR Department, FES, Socion and Arghyam. This institutionalisation of programme governance within a state department is an important precedent for embedding technical capacity in government structures rather than perpetuating external NGO dependency.

The Government of India has recently replaced MGNREGA with the Viksit Bharat Guarantee for Rozgar and Ajeevika Mission Gramin (VB-G RAM G) Act, 2025, offering 125 days of guaranteed annual employment (up from 100) with an explicit focus on water security, livelihood promotion, sustainable infrastructure and climate resilience. This policy transition creates an opportunity to embed source sustainability principles at the design stage of the successor scheme rather than retrofitting them later.

Reduce

Atal Bhujal Yojana: Design innovations and gaps

ABY was a landmark programme, the first major central scheme to make community participation and demand management central to groundwater governance, backed by World Bank Programme-for-Results (PforR) financing and Disbursement-Linked Indicators (DLIs). Its design innovations were significant: Community-led Water Security Plans as a formal programme accountability mechanism; incentive-based state allocations tied to groundwater improvement outcomes; and joint training with line departments to build shared understanding of priorities.

The DLI framework created a results chain with five explicit accountability links:

1. Public disclosure of groundwater data;
2. Preparation of community-led WSPs;
3. Public financing of approved WSPs;
4. Adoption of efficient water-use practices;
5. Improvement in the rate of groundwater level decline.

ABY study found that
180/229
blocks qualifying for DLI-5 across three assessment rounds

States achieved
198%
of target area achieved for water-efficient practice adoption (DLI-4)

However, the study also identified critical policy gaps. Subsidy disbursement mechanisms and incentive fund allocation require structural reform to ensure geographic targeting of demand management support toward truly groundwater-stressed areas. WSPs need formal integration into GPDPs to function as planning instruments rather than compliance documents.

On-farm demonstration of water-efficient practices in Gujarat

For large-scale adoption of water-efficient crop technologies like AWD, the policy requirement goes beyond a single programme: BCC campaigns of the scale and ambition of the Swachh Bharat Abhiyan, extension support systematically scaled through KVKs and the Agriculture Department, and financial incentives and disincentives aligned with water-saving outcomes. These are cross-scheme, cross-departmental policy decisions, not programme-level choices.

Reuse

SBM-G 2.0, 15th Finance Commission (FC) and the fragmented policy landscape

Greywater management sits at the intersection of three major government schemes, each with its own mandate, fund flow and approval process. SBM-G Phase II provides the primary policy framework for rural liquid waste management, but its per-capita funding norms (Rs. 280/person for villages under 5,000 population) are insufficient for community-scale treatment systems. MGNREGS provides labour and asset creation financing that can be leveraged for drainage networks and treatment structures, but only through convergence planning that is largely absent in practice. The 15th FC grants primarily support O&M, but in the absence of adequate construction financing, O&M funds are used for gap-filling construction rather than sustaining functioning systems.

Critical policy reforms identified by the Greywater Study include shifting from population-based to needs-based funding allocations; promoting revenue-generating reuse models (irrigation, fisheries, composting) to reduce dependence on government grants for O&M; developing state-level decision frameworks for treatment system selection based on local parameters; and defining clear institutional roles with assigned technical capacity at each level of government.

Key Lessons

1. The 65% NRM allocation rule under MGNREGA is a policy instrument without adequate enforcement. Creating incentive mechanisms, e.g. higher GP-level resource flows to GPs that comply with NRM allocation, or differential wage rates for community NRM works, would do more than exhortation alone.

2. The integration of MCLLMP community NRM plans as master plans under MGNREGA is a replicable model for embedding community-generated scientific plans into government financial flows. Formalising this mechanism so that GP-level CLART-generated NRM plans are recognised as planning inputs for MGNREGA AAPs would be a significant policy advance.

3. The VB-G RAM G (successor to MGNREGA) transition is an opportunity to embed source sustainability from scheme inception. Arghyam's experience with Jala Sanjeevini and MCLLMP provides a ready evidence base for designing the new scheme's NRM component.

4. ABY's DLI framework, which makes community participation, data disclosure and behaviour change into formal disbursement conditions, is a governance innovation worth replicating in the JJM and its source sustainability components.

5. Funding norms based on population rather than groundwater stress or greywater generation create perverse incentives: the most vulnerable and water-stressed villages tend to be smaller and receive the least support per capita. Shifting to needs-based allocation is the single most important funding reform across all three sub-themes.

3.7

One-Time Delivery Vs. Sustained Upkeep

Built and forgotten: The gap between infrastructure and sustainability

Across all three sub-themes, programme designs optimise for delivery metrics, such as the number of structures built, the number of farmers trained, and the number of households connected, while systematically underinvesting in the data infrastructure and institutional arrangements needed to sustain outcomes after the programme period. This is not a new critique, but Arghyam's experience provides unusually specific evidence of where the data breaks down, why the institutional gaps emerge, and what it would take to close them.

Replenish

The MGNREGA plan-to-implementation gap

Until FY 2025–26, MGNREGA Annual Action Plans (AAPs) were submitted by Gram Panchayats as physical hard copies to Executive Officers. There was no systematic way to know the total plan size, which works were implemented, what percentage was NRM versus non-NRM, or whether the works planned based on CLART recommendations were the works executed. The gap between planning and implementation was structurally invisible.

A dipstick study in three Karnataka GPs found striking variation, partly due to a mismatch between job card families and the labour force required to execute the planned works. These patterns were invisible to state-level programme reviewers and could only be surfaced through field investigation.

Muduvadi GP
80%
of NRM plan implemented; about Rs 93 lakh spent

Dabbeghatta GP
12%
of NRM plan implemented
Despite NRM share at Rs 5.68 Cr (59% of total), only Rs 66 lakh spent

The introduction of NREGA Soft (2025–26), a comprehensive workflow-based e-governance system, is a significant step forward. It provides digital visibility of plans versus implementation, requires BFTs and Technical Assistants to visit sites and provide cost estimates at the planning stage (producing more realistic plans) and has already reduced overall plan sizes by making them more grounded in available labour and resources. However, a critical gap persists: CLART maps are still not a mandated document in the MGNREGA work file. Despite being promoted under Jala Sanjeevini, CLART usage remains invisible in the official administrative record, meaning its scientific contribution to NRM planning cannot be verified, tracked, or rewarded.

Reduce

Water Security Plans: from compliance to living document

The Water Security Plan is the centrepiece of ABY's participatory planning approach and carries significant policy weight as a DLI outcome. Yet field evidence from the Atal Jal study shows that WSPs frequently function as compliance documents rather than living governance instruments. They are prepared to meet DLI-2 requirements, submitted to district authorities, and then rarely revisited. VWSC members expressed a desire for greater control over interventions identified through participatory planning, but had no mechanism to track whether line departments were acting on their WSP commitments.

The data gap here is specific: the Atal Jal App does not include WSP tracking functionality. Line departments do not report implementation progress back to VWSCs. GP-level groundwater monitoring data is not systematically integrated into WSP updates. The result is a planning loop that is open at both ends: communities prepare plans based on incomplete data and cannot observe whether those plans are being implemented.

For the Kalike AWD programme, the upkeep challenge is agronomic: AWD requires seasonal guidance adapted to local soil type, crop variety and rainfall conditions. Extension visits once or twice per season are insufficient to sustain farmer adoption across the full growing cycle. A model of continuous digital advisory (alerts triggered by local weather conditions, linked to the AWD schedule) could bridge this gap but has not yet been tested at scale.

Reuse

The JJM greywater blind spot

JJM's rapid expansion of household tap connections from 16.7% in 2019 to 81% of rural households by October 2025 has created a greywater surge that national data systems did not anticipate and still do not adequately track. In states like Punjab and Haryana, where household tap coverage approaches 100%, per capita water use substantially exceeds the JJM norm of 55 lpcd due to easy groundwater access. Actual greywater generation is therefore significantly higher than SBM-G 2.0 planning estimates, creating treatment capacity shortfalls in systems designed to national norms.

There is no seamless national data system that tracks actual greywater generation, treatment system coverage and output water quality at the village level. JJM's MIS dashboard and SBM-G 2.0 data exist in separate systems with no integration layer. The Greywater Study recommends comprehensive state-level assessments of greywater quantity and quality beyond supply-based estimates, and village-level mapping of flows, infrastructure and hotspots integrated into Village Greywater Management Plans.

The O&M crisis documented by the study is the most immediate consequence of one-time delivery thinking. Many greywater systems exist in states of disrepair because no institution has clear O&M responsibility, no budget is specifically allocated for maintenance, and no monitoring data exists to signal when systems are failing. Where systems exist, they are often fragmented or poorly maintained. The funding structure, with construction and O&M financing from separate, uncoordinated sources, reinforces piecemeal investment rather than system-level planning.

Key Lessons

1. The absence of CLART maps in the work files is a specific gap and an actionable policy fix. Making CLART maps a mandated document in MGNREGA work files would immediately create administrative visibility of scientific planning, enable remote vetting quality, and allow the government to track and reward CLART adoption at scale.Z

2. WSP tracking functionality in the Atal Jal App, combined with a formal requirement for line departments to report implementation progress to VWSCs, would transform WSPs from compliance documents to living governance instruments. This does not need large investment or administrative overhead.

3. JJM and SBM-G data integration at the state level is the minimum data infrastructure for responsible greywater management planning. Until tap connection density, per capita supply and treatment system coverage are visible in a single data layer, greywater plans will systematically underestimate the challenge.

4. O&M budgets must be committed at the time of construction approval, not sought retrospectively. A capital project without an O&M cost plan and an identified responsible institution should not be approved. This norm change would do more for asset sustainability than any monitoring system.

5. The shift from one-time delivery metrics (works completed, people trained, households connected) to sustainability metrics (assets functional after three years, communities able to manage systems independently, water quality maintained) requires different governance rhythms, different data and different accountability structures, all of which need deliberate design.

3.8

Governance

How programmes are designed, managed and held accountable

The systems through which decisions are made, progress is tracked, accountability is assigned, and course corrections are implemented are consistent differentiators between programmes that reach scale with sustained impact and those that produce islands of good practice. Governance is often treated as a support function rather than a programme design component, but Arghyam's experience shows that getting governance right is among the highest-leverage investments a programme can make.

Replenish

Programme governance models in NRM at scale

In MCLLMP Meghalaya, governance was structured around a clear institutional hierarchy: the MBMA as implementing agency, the SWCD for NRM guidance, the World Bank for funding and periodic reviews, and Arghyam as technical and capacity-building partner. Socion served as strategic advisor on the digital planning architecture and Sattva as the PMU for programme coordination and progress tracking. This multi-party structure created both specialisation and accountability, with each partner clearly understanding its role and being held to specific deliverables. Importantly, the programme was designed with outcomes at the centre, ensuring that governance structures, roles, processes and tools were aligned from the outset to get it right the first time, rather than relying on iterative corrections later.

In Karnataka's Jala Sanjeevini, governance evolved through the programme. The initial 53-GP pilot established evidence before state-level scale-up. The state then established a Programme Management Team comprising the RD&PR Department, FES, Arghyam and Socion—an important institutionalisation step, establishing technical capacity within a government structure. Structured governance rhythms, weekly data-based reviews with state leadership, regular planning interactions, and milestone-based progress tracking were identified as critical for maintaining momentum and alignment at scale.

A specific governance lesson from Karnataka: when thousands of people are trained and expected to follow a structured process, there will inevitably be gaps in information flow and execution. The programme management team's role was to track these gaps through digital dashboards on a weekly basis and escalate decisions about HR and process barriers to state leadership in real time. Without this feedback loop from field to state, gaps accumulate until they become programme-derailing failures.

The MGNREGA Study highlights a governance accountability gap: Social Audit processes, conducted twice annually by the Social Audit Society, verify work execution and record documentation, but do not assess whether the NRM works executed were hydrologically appropriate or whether objectively verifiable scientific tools were used for site selection. Social audit verifies process compliance; it does not assess technical quality or programme intent.

Reduce

DLI-based governance in Atal Bhujal Yojana

ABY's DLI framework represents an important governance innovation for the water sector: making disbursements contingent on verified programme outcomes rather than activity completion. This created accountability at the national programme level for community participation (DLI-2: WSP preparation), convergence financing (DLI-3: public financing of WSPs), behaviour change (DLI-4: water-efficient practice adoption) and hydrological outcomes (DLI-5: groundwater level improvement). The framework incentivised states to not merely implement activities but to produce verifiable results.

However, the Atal Jal study identified governance weaknesses within the DLI framework. For DLI-5 (groundwater improvement), future assessments need to incorporate rainfall normalisation to more accurately separate the impact of ABY interventions from natural climatic variability. Without this, high-rainfall years can produce DLI-5 qualification that does not reflect programme-attributable change. For DLIs 2 and 3, journey mapping as a governance diagnostic tool, tracing the end-to-end process of WSP preparation and implementation across governance levels, revealed institutional bottlenecks that aggregate DLI achievement scores could not surface.

A structural governance gap was identified across states: effective convergence (DLI-3) depends on top-down directives from state and district leadership, combined with bottom-up accountability between line departments and communities to align planning cycles. Where this two-directional accountability was absent, WSPs remained planning documents rather than operational instruments.

Reuse

Institutional fragmentation as a governance failure

The Greywater Study's central governance finding is institutional fragmentation: SBM-G, MGNREGS, 15th Finance Commission grants, and Panchayati Raj departments each manage greywater-related functions under separate administrative processes, with no single body accountable for the integrated performance of the greywater management system in each village. This is not a resource scarcity problem; multiple schemes allocate funds for greywater-adjacent activities. It is a governance design problem: accountability is opaque, decision-making authority is fragmented, and system-level performance is no one's specific responsibility.

The study recommends defining clear institutional roles with assigned technical capacity at each level of the government hierarchy. At the state level: programme design and technical standards. At district/block level: planning support, technical facilitation, and quality oversight. At GP level: O&M responsibility, community accountability and maintenance reporting. Without this vertical clarity, each level substitutes activity for outcome, and no one is accountable for whether the system works.

Key Lessons

1. Phase 0 governance investment, including functional grid creation, milestone definition, actor role clarity, and decision escalation protocols, is as important as any field activity. Programmes that invest in Phase 0 governance design before deployment consistently outperform those that improvise governance as they go.

2. Data-based weekly governance rhythms with state leadership are a practical mechanism for closing the field-to-state feedback loop. This is not bureaucratic overhead; it is the mechanism through which scale-adoption gaps are identified and resolved before they become programme failures.

3. Social audit in MGNREGA verifies process compliance; it does not assess the technical quality of NRM works. Complementing social audit with technical quality audit using CLART-based criteria for NRM structure appropriateness would create a governance accountability mechanism aligned with programme intent.

4. DLI-based governance creates genuine accountability for outcomes rather than activities. This model is worth replicating in JJM's source sustainability components, with DLIs covering source condition monitoring, community WSP preparation, convergence financing, and actual source functionality.

5. Institutional fragmentation is a governance design choice, not an inevitable feature of complex programmes. Assigning a single body (e.g. a District Water Security Committee) with clear authority and accountability over the integrated water system, covering recharge, demand management and greywater would consolidate fragmented governance into a coherent structure.

Chapter 4: Synthesis Of Lessons

Across the sections and sub-themes, six consistent learning patterns emerge that reflect the broader structural challenges of achieving source sustainability at scale in India.

1. **First-mile design determines scale outcomes:** Programmes that invest in understanding the actual context of frontline actors, their workloads, incentives, skill levels, connectivity and language produce tools and processes that get adopted. The PDO-to-BFT/GKM pivot in Karnataka is one example; the absence of a defined FLW cadre for greywater is another, in the negative. Designing from the programme management level down consistently produces adoption failures that were predictable from the start.

2. **Making the invisible visible is the core science communication task:** Groundwater depletion, greywater volumes, watershed hydrology—the key systems that Source Sustainability must address are invisible to community members and many field functionaries. Tools and processes that make these systems visible and quantifiable (CLART, water budgeting tools, Atal Jal App, village-level greywater mapping, etc) are the infrastructural stepping stones for behaviour change. Without them, even well-resourced programmes produce activity without durable change.

3. **Technology is a multiplier, not a substitute for management:** CLART, PDA, the Atal Jal App and NREGA Soft are all effective within structured programme management frameworks. Deployed without active governance, functional grid clarity, weekly data-based review and real-time course correction, technology tools plateau at partial adoption and produce the illusion of scale without the substance.

4. **Formal anchoring of community institutions converts participation into ownership:** Cabinet resolutions for VNRMCs, WSP integration into GPDPs, VWSC authority over implementation tracking and ASCI certification for VCFs—these formal anchoring mechanisms are what distinguish community participation as a programme input from community ownership as a sustainability outcome. Without them, institutions dissolve when programme support ends.

5. **The data-accountability loop is structurally broken across all three sub-themes:** CLART usage is invisible in MGNREGA work files. WSPs are prepared but not tracked for implementation. JJM tap connection data does not link to greywater generation or treatment coverage. In every sub-theme, the data chain breaks between what is planned, what is implemented, what is maintained, and what the outcome is. Closing this loop requires deliberate data system design, not just better monitoring protocols.

6. **Scale requires government; government requires patient navigation with clear evidence:** Water security issues cannot be solved without government funds, mandated presence and formal authority. But successful government partnership requires finding champions, building trust through demonstration at a manageable scale, maintaining agility when political or administrative changes create roadblocks and providing evidence in formats that busy government officials can act on. The Jala Sanjeevini PMT, the Atal Jal MoU with the Ministry of Jal Shakti and the VNRMC Cabinet resolution are examples of consistent support creating long-term institutional change.


Har Ghar Jal
FHTC

Arghyam is an Indian philanthropic organisation working on water security and sustainable water management. It supports initiatives across the water lifecycle, from source sustainability and water quality to service delivery and governance through research, partnerships and technology-enabled solutions. Arghyam works closely with governments, communities and civil society organisations to strengthen water systems and enable safe, sustainable access to water for all.

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