Jal Jeevan Mission IT Systems

As Is Study Report

Arghyam

FOREWORD

It is with great pride and deep appreciation that I present the consolidated As-Is Study Report on State IT Systems across West Bengal, Gujarat, Assam, Rajasthan, and Punjab. This study has been prepared under the Jal Jeevan Mission (JJM) as part of a national effort to assess, document, and strengthen the digital capabilities of rural drinking water departments across India. The report has been developed through a collaboration between SPM-NIWAS and Arghyam. This partnership brings together institutional expertise in water governance and a long-standing commitment to strengthening water security, reflecting a shared conviction that data-driven decision-making is fundamental to achieving universal and sustainable access to safe drinking water.

The states covered in this report collectively present a rich and diverse landscape of digital evolution in the water sector. West Bengal's Public Health Engineering Department reflects early institutional foresight and technological ambition, having pioneered GIS-based asset mapping and advanced digital tools well ahead of national priorities. Gujarat's Water Supply Department demonstrates a strong example of coordinated institutional design, where multiple agencies function cohesively through structured digital systems for scheme monitoring, asset management, and service delivery. Assam's implementation of the JJM BRAIN platform showcases the power of integrated, platform-led governance, enabling end-to-end visibility, real-time monitoring, and strong community engagement. Rajasthan highlights a policy-driven approach to digital adoption, supported by a mature state-wide e-governance ecosystem and extensive use of integrated platforms. Punjab's Department of Water Supply and Sanitation stands out for its outcome-driven governance, where digital tools such as IoT-based monitoring and water quality systems are closely aligned with measurable improvements in service delivery, including the achievement of universal rural tap water coverage.

This report is organised around a comprehensive Digital Maturity Model for Rural Drinking Water. It is a structured framework developed to systematically assess digital capabilities across multiple stakeholder layers, including citizens, frontline workers, implementing agencies, departments, and state-level functionaries.

These are evaluated along key guiding principles such as citizen centricity, frontline worker empowerment, agency efficiency, departmental effectiveness, and interoperability across systems. Additional layers covering technology foundations and infrastructure further strengthen the assessment, enabling a holistic understanding of where each state stands today and where it must progress in the future.

The findings of this report affirm that the states studied possess strong institutional capacity and technical capability to lead the next phase of digital transformation in India's rural drinking water sector. While each state reflects a unique pathway, a common direction emerges—one that emphasizes the need for greater interoperability, shared digital registries, integrated platforms, and advanced data-driven decision-making systems.

By building on existing strengths and addressing these areas through thoughtful integration and architectural alignment, these states can set benchmarks for scalable and sustainable digital transformation across the country. I extend my sincere appreciation to all participating state departments, leadership teams, field functionaries, and technical personnel who contributed their time, knowledge, and institutional experience to this study.

I also place on record my gratitude to Arghyam for their continued partnership, intellectual contribution, and unwavering commitment to the mission of universal water access. Their collaboration has significantly strengthened both the depth and credibility of this report. I acknowledge as well the dedication of the technical team whose rigorous field engagements and analytical efforts have made this assessment possible.

It is my earnest hope that this report serves not merely as a record of the present, but as a compass for the future—guiding states towards building digitally enabled, equitable, and sustainable rural drinking water systems, where every citizen has access to safe water and every decision is informed by reliable data.

Priyatu Mandal, IAS,
Director SPM-NIWAS

MESSAGE

Water is not merely a resource; it is a fundamental right. The ability to govern it effectively, monitor it transparently, and deliver it reliably to every household is one of the most meaningful indicators of institutional commitment to public service. It is in this spirit that Arghyam is proud to have partnered with SPM-NIWAS in the preparation of this consolidated As-Is Study Report on State IT Systems across West Bengal, Gujarat, Assam, Rajasthan, and Punjab.

At Arghyam, our work has consistently been guided by the belief that lasting transformation in the water sector requires more than infrastructure—it requires robust systems, strong institutions, and the intelligent use of data. This collaboration with SPM-NIWAS represents a natural extension of that philosophy. By combining domain expertise in rural water governance with deep engagement in digital ecosystems, this study offers a credible, field-grounded, and analytically rigorous understanding of how states are leveraging technology to strengthen service delivery.

What stands out across the states covered in this report is not the presence of individual applications or technologies, but the institutional intent and approach that have shaped their evolution. West Bengal reflects a culture of early innovation and forward-looking institutional initiative. Gujarat demonstrates the strength of a coordinated and multi-agency ecosystem operating with clarity and alignment. Assam showcases the effectiveness of integrated digital platforms such as JJM BRAIN in connecting stakeholders and enabling real-time visibility. Rajasthan highlights how policy-led digital governance frameworks can drive structured adoption at scale. Punjab presents a strong example of outcome-oriented implementation, where digital systems are closely tied to measurable improvements in service delivery.

These are not isolated achievements, but evolving systems—each shaped by context, priorities, and institutional capacity. What unites them is a shared recognition that digital systems are not ends in themselves, but enablers of better governance, improved accountability, and more reliable service delivery.

As these systems mature, a clear direction for the next phase of transformation emerges. Strengthening interoperability across platforms, enabling seamless data exchange, and advancing the use of analytics for predictive and proactive decision-making will be critical. The opportunity ahead is not to replace what exists, but to build coherence across systems—connecting them through shared architectures, common standards, and integrated data flows.

This is precisely where studies such as this one become essential. A grounded understanding of the current state—rooted in operational realities rather than abstraction—is a prerequisite for meaningful transformation. By providing a structured and comparative view across states, this report helps create a shared language for reform, enabling stakeholders to prioritise investments, align efforts, and move forward with clarity and intent.

I extend my sincere gratitude to the state departments and teams across West Bengal, Gujarat, Assam, Rajasthan, and Punjab for their openness, collaboration, and willingness to share their experiences. I also acknowledge the SPM-NIWAS team for their partnership, rigour, and commitment in undertaking this important work. The depth of field engagement and analytical insight reflected in this report is a testament to their efforts.

Arghyam remains committed to supporting this journey—working alongside states, institutions, and partners to build digital ecosystems that are not only efficient, but also inclusive, resilient, and sustainable. It is our hope that this report serves as a meaningful step towards that shared vision of ensuring safe, reliable, and equitable access to water for every citizen.

Anuj Sharma
CEO Arghyam

PREFACE

India's rural drinking water sector is undergoing a profound transformation. The Jal Jeevan Mission (JJM), launched in 2019, marked a decisive shift by committing to providing safe and adequate drinking water to every rural household. As the Mission transitions from its initial phase of rapid infrastructure creation to a phase focused on assured and sustained service delivery, the role of digital systems becomes increasingly critical. Ensuring reliability, quality, and accountability at scale requires a strong foundation of data-driven governance.

While flagship initiatives such as the Jal Jeevan Mission (JJM) have substantially expanded rural drinking water infrastructure across the country, ensuring equitable, reliable, and measurable service delivery at scale now requires a fundamentally stronger digital foundation. The next phase of transformation depends not merely on asset creation, but on building an interoperable, intelligent, secure, and scalable digital ecosystem capable of enabling data-driven governance, service monitoring, institutional coordination, and citizen-centric delivery.

In this context, the need for a sectoral Digital Public Infrastructure (DPI) for rural drinking water has emerged as a strategic national requirement. To support this objective, SPM-NIWAS and Arghyam jointly undertake a baseline assessment of existing digital solutions, platforms, and governance practices in the rural drinking water sector across selected states. The study aims to evaluate current digital maturity, identify interoperability gaps and sectoral challenges, and recommend appropriate DPI principles, characteristics, and architectural considerations to inform the sector's future vision, approach, and strategic roadmap.

India's experience with foundational and sectoral DPIs such as Aadhaar, Unified Payments Interface (UPI), and emerging digital ecosystems in health and agriculture demonstrates the transformative potential of federated, open, and interoperable digital architectures. In the rural drinking water sector, a DPI can enable seamless data exchange, improved coordination, and informed decision-making across stakeholders ranging from water sources and household taps to frontline functionaries and national institutions.

However, such a DPI must evolve from existing operational realities rather than be designed in isolation. It should build upon effective systems, address fragmentation, and strengthen areas that are inadequate. Accordingly, the As-Is Study of State IT Systems was undertaken as a foundational step toward developing a robust and contextually relevant DPI architecture for the sector.

This As-Is Study is conceived not as an audit, but as a diagnostic and collaborative exercise. The study seeks to identify existing gaps, assess institutional capacities, and understand operational realities across the sector. It adopts a multi-pronged approach comprising structured questionnaires across States and Union Territories, virtual consultations for broader stakeholder engagement, and in-person visits to selected states for deeper field-level insights.

To support a comprehensive assessment, a customized Digital Maturity Model for the rural drinking water sector has been developed. The model evaluates digital capabilities across multiple stakeholder layers, including citizens, frontline workers, implementing agencies, departments, and state-level functionaries, thereby enabling a holistic understanding of the ecosystem and informing future digital transformation strategies.

A comprehensive As-Is Study of state IT systems across selected states—West Bengal, Gujarat, Assam, Rajasthan, and Punjab has been carried out. Each of these states represents a distinct and valuable pathway of digital evolution.

West Bengal reflects early institutional foresight and innovation, with advanced adoption of GIS-based asset mapping, mobile-first applications, and AI-enabled tools. Gujarat demonstrates a coordinated and program-driven ecosystem, where multiple agencies function cohesively through structured digital systems for scheme monitoring, grievance redressal, and asset management. Assam showcases a platform-led and integrated approach through JJM BRAIN, enabling end-to-end visibility, real-time monitoring, and strong community engagement. Rajasthan highlights a policy-aligned digital ecosystem, built on a strong state-wide e-governance framework with widespread adoption of SSO-enabled applications and structured MIS systems. Punjab represents an outcome-driven model, where digital tools such as IoT-based monitoring, water quality systems, and project management platforms are closely aligned with measurable service delivery improvements.

This study is not conceived as an audit, but as a diagnostic and collaborative exercise aimed at understanding existing systems, identifying gaps, and informing the design of a future-ready DPI. Using a structured Digital Maturity Model, the assessment spans multiple stakeholder layers—from citizens and frontline workers to implementing agencies and state leadership—providing a holistic view of the ecosystem.

The findings across these states collectively highlight a critical insight: while digital journeys may differ in approach and maturity, the next phase of transformation will depend on strengthening interoperability, enabling seamless data exchange, and building integrated, resilient, and intelligent systems. These insights form the foundation for designing a unified and scalable Digital Public Infrastructure for the rural drinking water sector.

It is hoped that this report contributes meaningfully to shaping this future—one that builds on existing strengths, addresses systemic gaps, and advances the long-term goal of ensuring safe, reliable, and sustainable drinking water for every rural household in India.

ACKNOWLEDGEMENT

The successful completion of this consolidated As-Is Study has been made possible through the invaluable support, cooperation, and openness of multiple state departments and mission teams across West Bengal, Gujarat, Assam, Rajasthan, and Punjab. The willingness of these institutions to engage constructively and share insights into their digital systems, operational processes, and institutional practices has been instrumental in enabling a comprehensive and meaningful assessment.

The depth and quality of this study have been significantly enriched by the detailed inputs provided by state teams on their IT applications, governance frameworks, and implementation experiences. The opportunity to undertake in-person interactions, system walkthroughs, and field-level engagements allowed for a nuanced and grounded understanding of the digital ecosystems and their role in strengthening rural water service delivery.

Special acknowledgement is extended to the leadership and officials from:

- **West Bengal (PHED):** Dr. Animesh Bhattacharya, Shri Aloke Saha, Shri Subhasheesh Bhattacharya, Shri Monojit Saha, Shri Rajib Kumar Sarkar, Ms. Soumyia Jit, and the SPMU team.
- **Gujarat (WASMO & GWSSB):** Ms. Stuti Charan, Shri Hemant Rajput, Shri Rahul Solanki, Shri Manish Modi, Shri Khant Shah, and Shri Dhananjay Dwedi.
- **Assam (PHED & JJM Assam):** Shri Kailash Karthik N, Smt. Preeti Kumari, Shri Biraj Boruah, Shri Arnav Kumar Baruah, Shri Hemanta Kumar Sharma, and the JJM BRAIN technical team.
- **Rajasthan (PHED):** Shri Akhil Arora, Dr. Ravindra Goswami, Dr. Suneet Sethi, Shri Himanshu Meel, Shri Sanjay Sharma, Ms. Poonam Rijwani, and Shri Dushyant.
- **Punjab (DWSS):** Dr. Pallavi Kaur, Shri Karanbir Singh, Shri Rohit Kumar, Ms. Gurjot Kaur, Shri Rajesh Bajaj, Shri Varun Kumar, Shri Pankaj Kumar, Shri Paramveer Singh, Shri Harsh Goyal, Ms. Mamta Bakshi, and associated teams.

All departments extended full support in facilitating structured discussions, enabling access to systems, and coordinating interactions with relevant teams. This openness and collaboration have been critical in developing an evidence-based and balanced understanding of the current digital landscape across states. This collective effort reflects a strong and shared commitment among states towards advancing digital transformation in the rural drinking water sector. The insights, experiences, and perspectives shared by all stakeholders have significantly enriched this study and contributed to shaping a comprehensive and forward-looking assessment.

Sincere appreciation is extended to Arghyam for their continued partnership, intellectual contributions, and steadfast support throughout the course of this study. Their engagement has been instrumental in shaping both the direction and depth of this assessment. Equal recognition is due to the technical team for their rigorous field engagements, detailed stakeholder interactions, and analytical diligence, which together have ensured a comprehensive, grounded, and high-quality outcome.

TECHNICAL NOTE

Towards Making a Drinking Water Digital Public Infrastructure (DW-DPI): Conceptualising the Digital Water Ecosystem of India

India's rural drinking water sector stands at a transformative juncture. Following the rapid expansion of infrastructure under the Jal Jeevan Mission (JJM), the sector's focus is now shifting toward long-term sustainability, operational efficiency, water quality assurance, and citizen-centric service delivery. This transition requires not only physical assets but also a robust digital foundation capable of enabling real-time governance, interoperability, accountability, and innovation across the ecosystem.

In this context, the need for a sectoral Digital Public Infrastructure (DPI) for rural drinking water has emerged as both a strategic and operational imperative. To inform this transition, these studies were undertaken to assess the sector's current digital maturity, identify interoperability gaps, understand operational and institutional challenges, and define key principles, architectural considerations, and building blocks required for a future-ready ecosystem.

Accordingly, detailed field studies and stakeholder consultations were conducted across multiple states. Comprehensive "As-Is Study Reports" were developed for Assam, West Bengal, Punjab, Gujarat, and Rajasthan, along with a consolidated national report. These studies document existing digital systems, institutional processes, data flows, governance mechanisms, and technological maturity within the sector. The insights derived from these reports serve as foundational inputs for shaping the strategic vision, implementation roadmap, and policy framework for a National Drinking Water Digital Public Infrastructure (DW-DPI).

The findings indicate that the next phase of sectoral transformation must be anchored in a federated, interoperable, and standards-driven digital ecosystem. The objective is not to build another centralized platform, but to establish common digital rails that connect schemes, assets, laboratories, institutions, field functionaries, and citizens. Such an approach enables seamless data exchange, reduces fragmentation, and fosters innovation across states and ecosystem participants.

A key priority in this journey is the creation of authoritative digital registries for water assets, schemes, laboratories, service entities, and sources. These registries will act as trusted "single sources of truth," enabling lifecycle management, traceability, and data consistency across administrative and technological boundaries. Complementing this, the sector must adopt common metadata standards, open APIs, device interoperability specifications, and shared vocabularies to ensure seamless collaboration.

The integration of emerging technologies—including IoT-enabled monitoring, GIS-based asset mapping, SCADA systems, AI-driven analytics, and advanced water quality surveillance—will further strengthen operational resilience and enable proactive decision-making. However, technology adoption must remain aligned with field realities, sustainability considerations, and long-term maintainability.

Equally critical is the need for strong data governance, cybersecurity, and trust frameworks. As digital systems and operational technologies converge, ensuring secure, reliable, and privacy-aware data exchange becomes essential. Robust mechanisms for access control, auditability, and authentication will be key to building confidence across stakeholders.

The transformation must also prioritize the empowerment of frontline institutions. Village Water and Sanitation Committees, Gram Panchayats, engineers, and field operators form the backbone of service delivery. Providing them with mobile-first, multilingual, and user-friendly tools—supported by capacity building and institutional strengthening—will be central to success.

Finally, an open and interoperable DPI ecosystem can catalyze participation from innovators, startups, research institutions, and civil society, enabling scalable solutions without fragmentation or vendor lock-in.

The journey toward DW-DPI is ultimately a governance transformation—shifting the sector from reactive operations to proactive, data-driven service delivery. By building trusted digital foundations today, India can ensure safe, reliable, and sustainable drinking water for all.

“Think Federated, Build Trusted, Scale Sustainably.”

The Technical Team consisting of Mr. C.K. Dhar, Chief Technology Officer, SPM-NIWAS; Mr. Manu Srivastava, COO, Arghyam; Mr. Deepak Gupta, Director Digital Infrastructure, Arghyam, Dr. Prerna Pandey, Consultant Arghyam, which undertook this study under the active guidance of Mr. Ashok Kumar Meena , Secretary; Mr. Kamal Kishore Soan, Additional Secretary & Mission Director; Ms. Swati Meena, Joint Secretary (JJM); Pradeep Singh, Director; Ms. Ankita Chakravarty, Deputy Secretary, Department of Drinking Water and Sanitation (DDWS) extends its sincere gratitude to the officers of DDWS, Mr. Mohammad Ishfaq , Advisor, SPM-NIWAS, Mr. Prasenjit Paul, Consultant, SPM-NIWAS and all participating individuals, institutions and State officials who actively contributed to the study through their valuable insights, experiences and continuous support during the process.

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Executive Summary

The **Jal Jeevan Mission (JJM)**, launched by the Government of India in 2019, aims to provide safe and adequate drinking water through individual household tap connections to all rural households by 2024. A mission of such scale and ambition demands a robust, scalable, and responsive digital ecosystem to ensure transparency, accountability, and efficient delivery of services.
In this context, the role of **Information Technology (IT) systems** has become pivotal in enabling effective planning, monitoring, implementation, and operation and maintenance (O&M), while keeping citizens at the centre of the water supply value chain. The Ministry of Jal Shakti, through the **National Jal Jeevan Mission (NJJM)**, has developed and implemented various digital systems and platforms at the central level. In parallel, states have also developed and deployed or adapted IT systems based on their specific requirements, institutional capacities, and local contexts. The IT journey of several states began much before the launch of JJM.

The figure below depicts the digital evolution of IT systems at the national level. The journey of States' IT systems in the rural drinking water sector is unique to each state, depending on multiple factors such as geographical, political, social, and financial, etc.

Foundational Phase (2019–2020)	Stabilization Phase (2020–2021)	Innovation Phase (2021–2022)	Engagement Phase (2023–2025)	Transformation Phase (2025 → onwards)
• JJM Launch • Basic IT tools (JJM-IMIS) • Household tap reporting	• Digitization of planning, monitoring & finance • Mobile apps for field data entry • WQMIS for water quality	• Geo-tagging & GPS tracking • IoT pilots & dashboards • Public dashboards for transparency.	• Web APIs • Real-time data unification • Citizen participation & analytics	• Digital Public Infrastructure (DPI) approach • Interoperability & Open APIs • Core Building Blocks

Figure 1: Digital Journey of NJJM IT Systems

Keeping the priorities in the transformation phase at the centre, the Ministry of Jal Shakti, via SPM-NIWAS, signed an MoU on February 19, 2025, with the objective of defining and designing the Digital Public Infrastructure (DPI) for the Drinking Water Sector, with an initial focus on Rural Drinking Water. One of the primary areas of DPI design is identifying the foundational building blocks, which include core registries, interoperable open APIs, and data standards & protocols. Leveraging the vast knowledge that resides in existing IT systems of the Centre and States has been identified as the first critical step in this DPI journey.

With this in mind, SPM-NIWAS and Arghyam embarked on the journey of conducting the As-Is study of Centre's and States' IT systems for rural drinking water management, with the following primary goals:

1. Understand the systems taxonomy

To identify the contextual variances in the structure and vocabulary of core system entities (like Scheme, Water Sources, Utilities etc.) from one state to another, so that informed decisions can be taken while designing the core registries of DPI.

2. Explore IT systems' features and functionality

To understand what types of data and APIs exist (or don't). This helps design DPI standards for data exchange, integration, and interoperability—a core requirement for federated systems.

3. Identify best practices and gaps (if any)

Different states have developed unique features (e.g., JalKosh, JalDoot, fully integrated Lab Information System, real-time chlorine monitoring, IoT-enabled real-time dashboards, etc.). DPI can provide the foundation for best-of-breed functionality and serve as reference solutions for others. This can act as a catalyst for the accelerated digital transformation in states.

On the other hand, a functionality review reveals what is missing (e.g., poor grievance redressal, lack of predictive analytics, lack of interoperability across systems, etc.). DPI can then focus on providing the foundation for building common services and reusable digital building blocks to fill these gaps.

4. Assess readiness towards DPI adoption

To evaluate the technological and data maturity of states/departments and determine their readiness for adopting DPI frameworks.

- **Technology readiness:**
- Availability of APIs, system modularity, cloud adoption, integration capabilities, and reliance on legacy/on-premise systems.
- **Data readiness:**
- Consistency, completeness, and digitization of data; presence of data standards, validation mechanisms, and security protocols; and the ability of systems to exchange data seamlessly.

This assessment helps identify priority areas for capacity building and phased DPI implementation.

5. Evaluate data governance and standardization frameworks

To examine whether formal data governance mechanisms exist, including data ownership, stewardship, quality assurance, audit trails, and standardization protocols.
This is critical to ensure reliability, trust, and consistency of data across systems, which forms the backbone of any DPI ecosystem.

6. Assess integration with national platforms and cross-sector systems

To understand how state systems interact with central platforms (e.g., IMIS, WQMIS) and other sectoral systems such as electricity, finance, and land records.
This helps identify gaps in vertical (State – Centre) and horizontal (inter-departmental) integration, which are essential for building a truly federated and interoperable DPI ecosystem.

7. Understand user journeys and adoption challenges

To analyze how different stakeholders—field engineers, administrators, lab technicians, and citizens—interact with existing systems.
This includes identifying usability challenges, dependency on connectivity, digital literacy gaps, and barriers to adoption, which are critical for designing inclusive and user-centric DPI solutions.

As-Is Study in Numbers

The following infographic depicts the summary of the As-Is Study in numbers.

Figure 2: As-Is Study in numbers

Key Findings

Fragmented IT Ecosystem Across States

- Wide variation in digital maturity across states—from highly integrated platforms (e.g., Assam's unified system) to multiple standalone applications (e.g., West Bengal, Rajasthan).
- Proliferation of application-specific tools (scheme monitoring, grievance, water quality, etc.) without a unified architecture.
- Absence of a common reference architecture leads to duplication of functionalities and inconsistent user experiences across states.

Limited Interoperability Between State and Central Systems

- Weak or non-functional API integrations with central platforms such as IMIS and WQMIS, leading to manual data uploads and reconciliation delays.
- State systems largely operate in silos, with minimal real-time data exchange between internal modules (e.g., asset, grievance, water quality).
- Data duplication and inconsistencies arise due to parallel data entry across multiple platforms and offline consolidation processes.

Siloed Data and Lack of Unified Data Architecture

- Data is distributed across multiple systems, such as ERP, SCADA, LIMS, GIS, and mobile apps, without a unified data layer or data lake.
- Limited establishment of a "single source of truth," affecting data reliability and cross-functional decision-making.
- In several cases, even within a state, applications do not communicate with each other, leading to fragmented scheme visibility.

Limited Data Governance and Standardization

- Lack of standardized data definitions, formats, and protocols across states and even within departments.
- Inconsistent data quality, completeness, and validation mechanisms were observed across districts.
- Absence of formal data governance frameworks, including ownership, stewardship, and audit mechanisms.

Underutilization of Data for Advanced Analytics

- While large volumes of operational data are being collected, usage is largely limited to descriptive dashboards and reporting.

- Minimal adoption of predictive or prescriptive analytics for use cases such as leak detection, demand forecasting, or asset failure prediction.
- Decision-making remains largely reactive rather than data-driven and proactive.

Limited Real-Time Monitoring and IoT Integration

- SCADA and IoT deployments are limited to select urban or large-scale schemes, with minimal penetration into rural systems.
- Water quality monitoring is still largely manual (FTK/lab-based), leading to delays in detection and response.
- Lack of integration between sensor data and central monitoring platforms reduces the effectiveness of real-time decision-making.

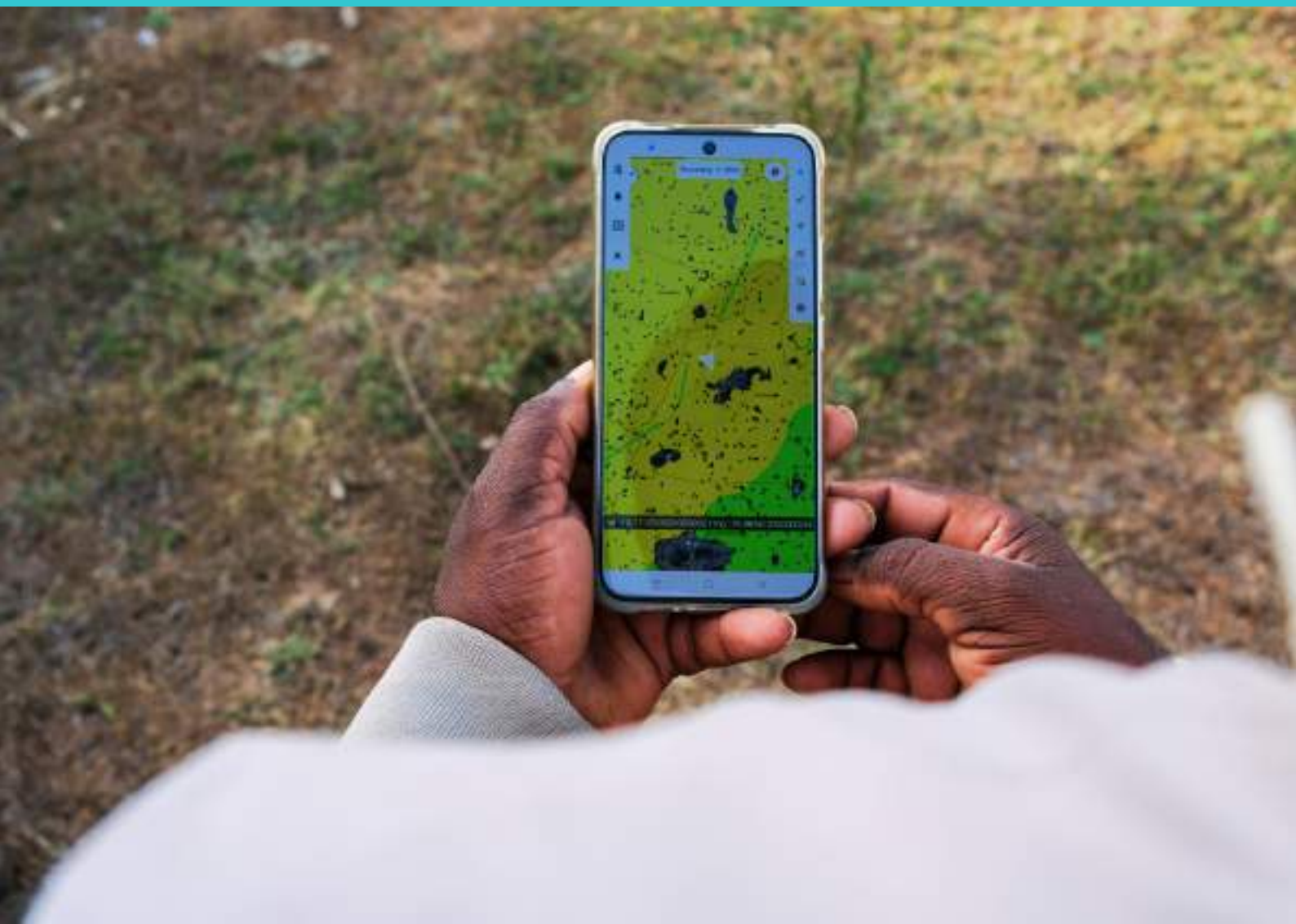
Gaps in Citizen-Centric Transparency and Engagement

- While grievance systems exist in most states, structured digital platforms with tracking, escalation, and feedback loops are inconsistent.
- Limited availability of citizen-facing dashboards for water supply status, service levels, or water quality data.
- Engagement mechanisms (QR codes, chatbots, apps) are present in some states but not standardized or scaled.

Operational Dependency on Connectivity and Manual Processes

- Many field applications depend on continuous internet connectivity, limiting usability in remote or weak network areas.
- Continued reliance on manual data entry and periodic reporting delays real-time visibility.
- Offline-first capabilities and automated data capture mechanisms are largely absent.

States' IT Systems Digital Maturity Model (DMM)



The development of IT applications in the rural drinking water sector across India is a mixed bag, with some States/UTs showcasing robust digital ecosystems, while others have yet to fully embrace the use of digital technology. Therefore, a States' Information Systems **Digital Maturity Model (DMM)** has been developed to systematically measure, improve, and manage the States/UTs IT Capabilities in the rural drinking water sector over time. DMM is a structured framework for assessing the maturity of advancements in IT systems & applications in state Rural Drinking Water Management. The model would provide structured inputs in IT governance and the strategic digital transformation planning of States/UTs.

The model adopts a holistic, stakeholder-centric view of the rural water supply ecosystem, organizing stakeholders into five layers with citizens at the core: **Citizens, Frontline Workers, Agencies, Departments, and State Functionaries.**

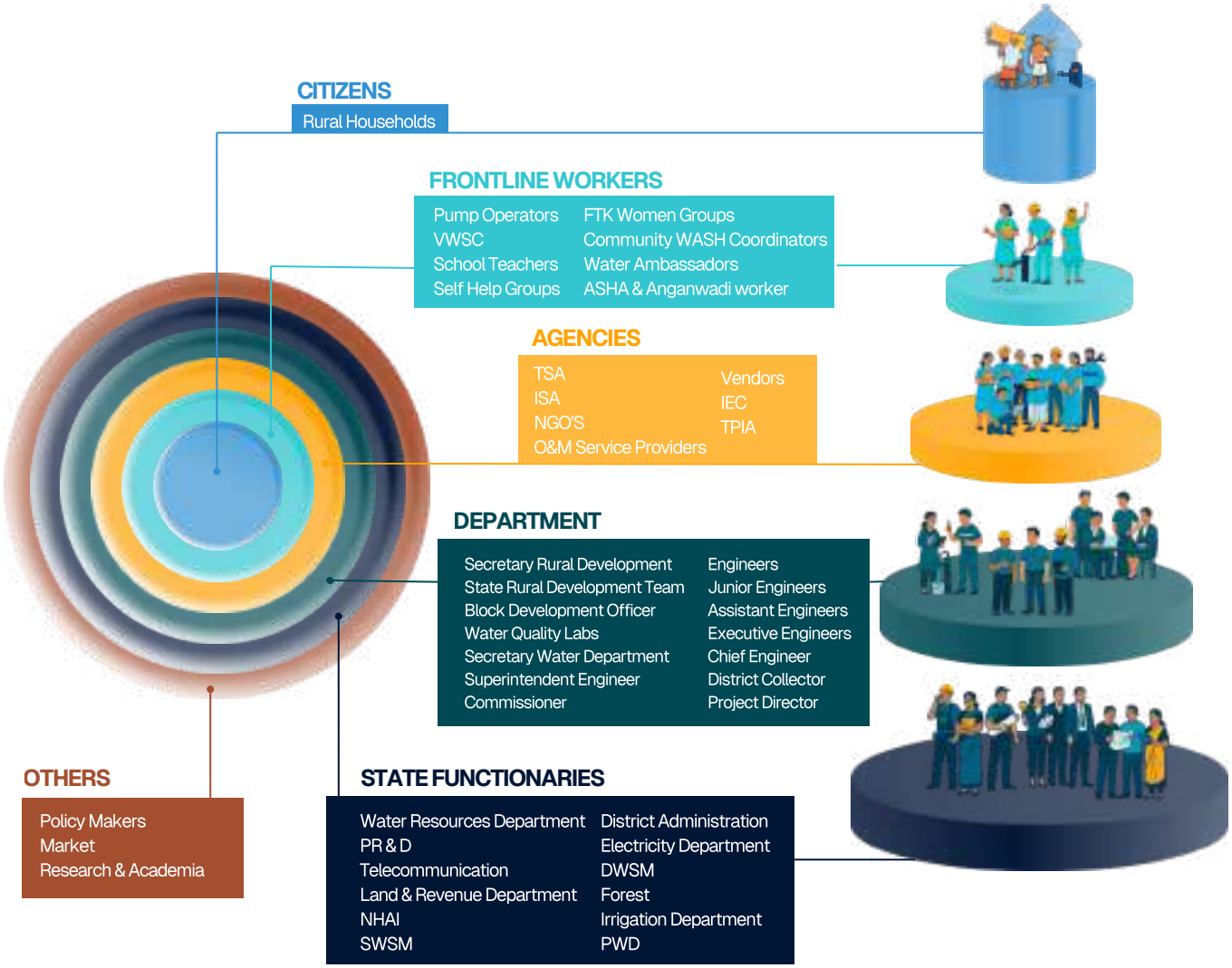


Figure 3: Stakeholders Mapping – State IT Systems

Based on a comprehensive analysis of water departments across several states, the above figure illustrates a holistic view of stakeholders involved in the rural water management ecosystem. While the specific names and number of stakeholders may vary by state, this representation broadly captures the full spectrum of actors typically engaged in the system.

Guiding Principles

The **Digital Maturity Model (DMM)** is built on six foundational principles that ensure that digital transformation efforts in the rural drinking water sector under the Jal Jeevan Mission (JJM) are effective, inclusive, and sustainable.

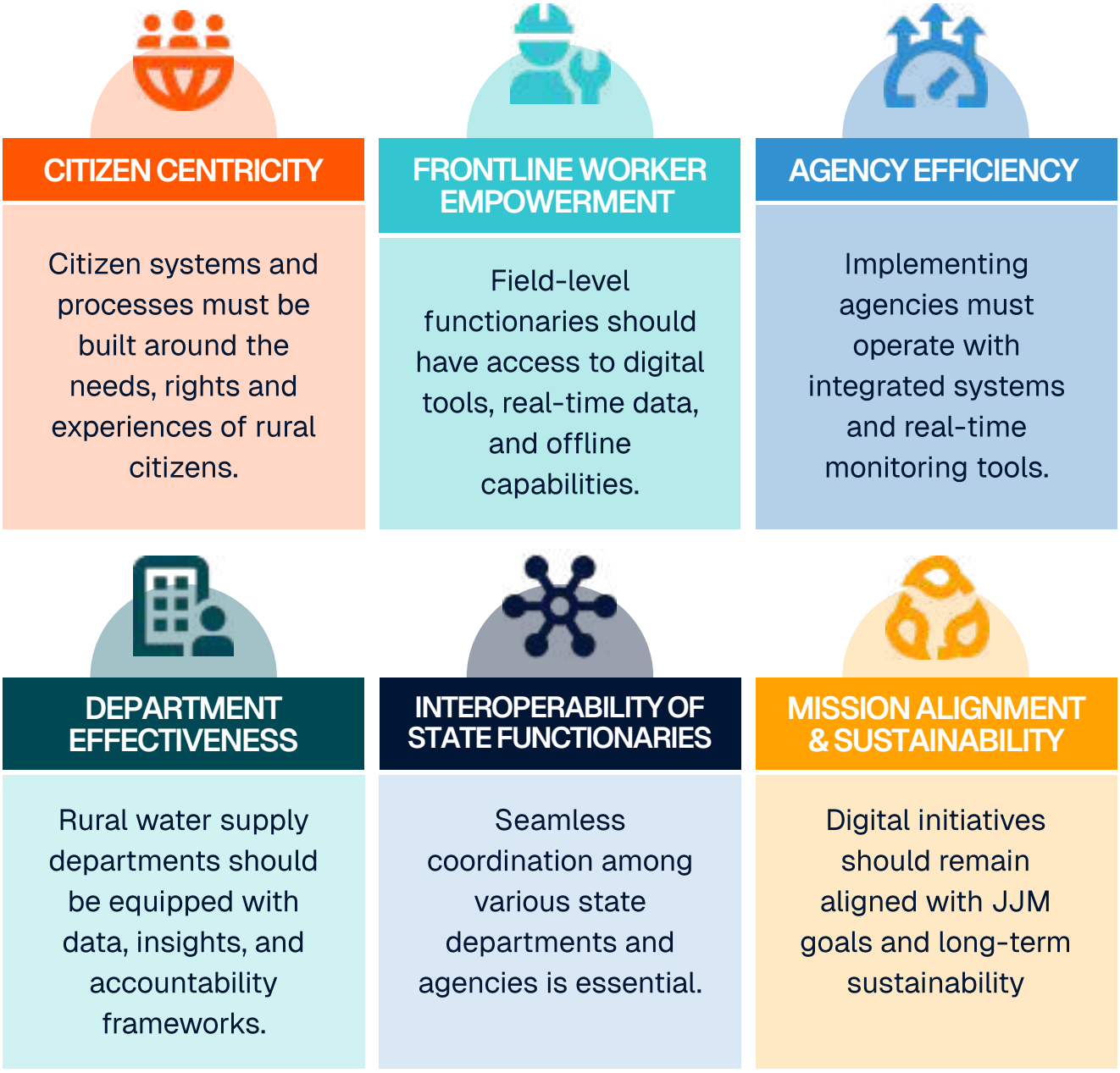


Figure 4: DMM Guiding Principles

These guiding principles ensure that digital maturity assessment under the DMM remains not just technically robust but also socially relevant and mission-aligned. The model defines 7 distinct capability areas per layer, resulting in 42 unique capabilities system-wide. In addition, 7 common capability areas, applicable across the ecosystem, are grouped under a separate layer of Common Capabilities to avoid duplication. 2 foundational layers further support this model: the Technology Foundation layer covering 7 core application-related capabilities, and the Infrastructure layer, which includes 7 capabilities related to hardware and connectivity. Departments have 14 distinct capabilities and are excluded from this enumeration. In total, the model defines 63 capabilities across 8 layers, with each capability evaluated against four maturity levels: Not Assessed, Aspiring, Performing, and Leading.

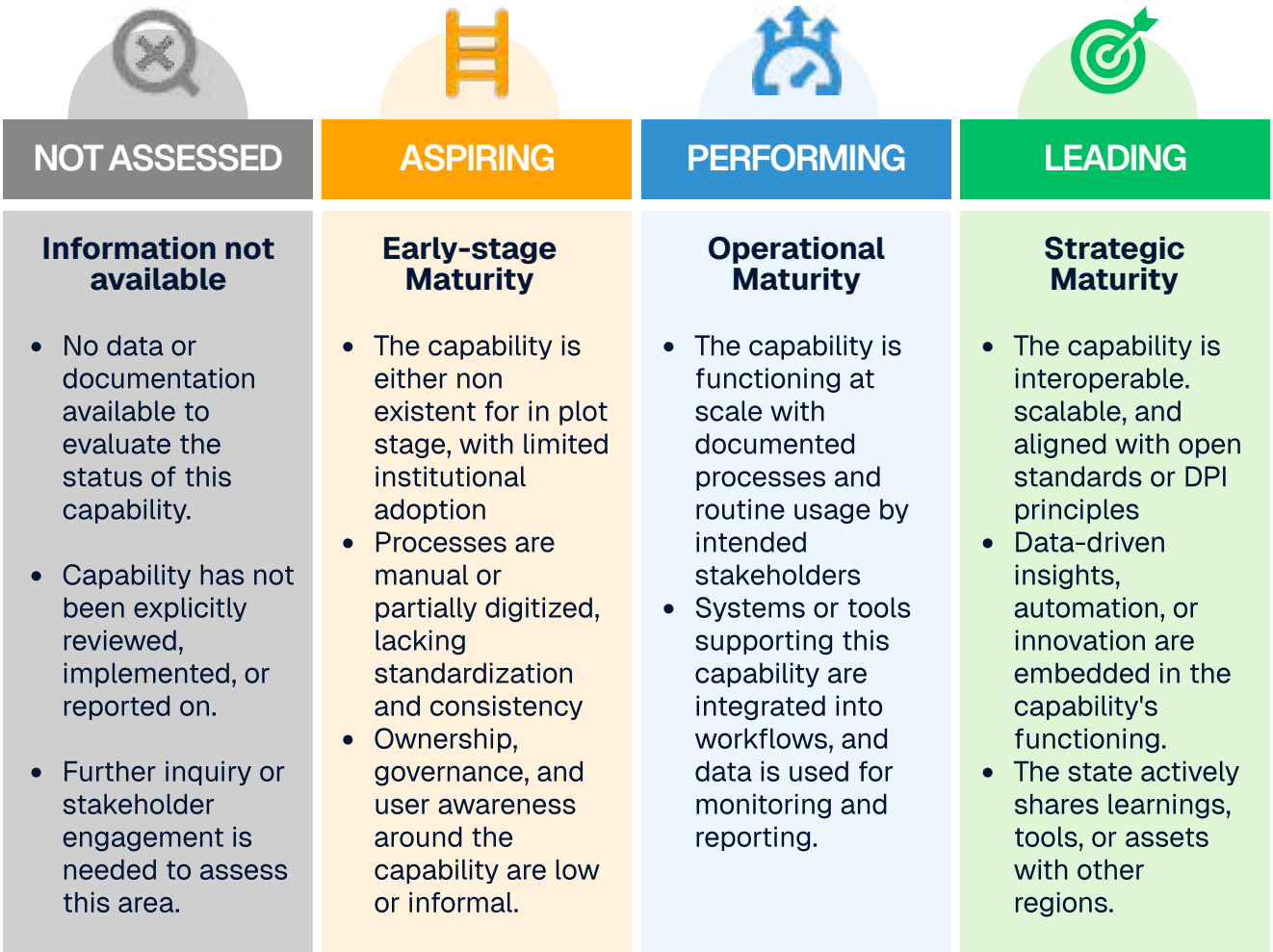


Figure 5: DMM Maturity Levels

Digital Maturity Model (DMM)

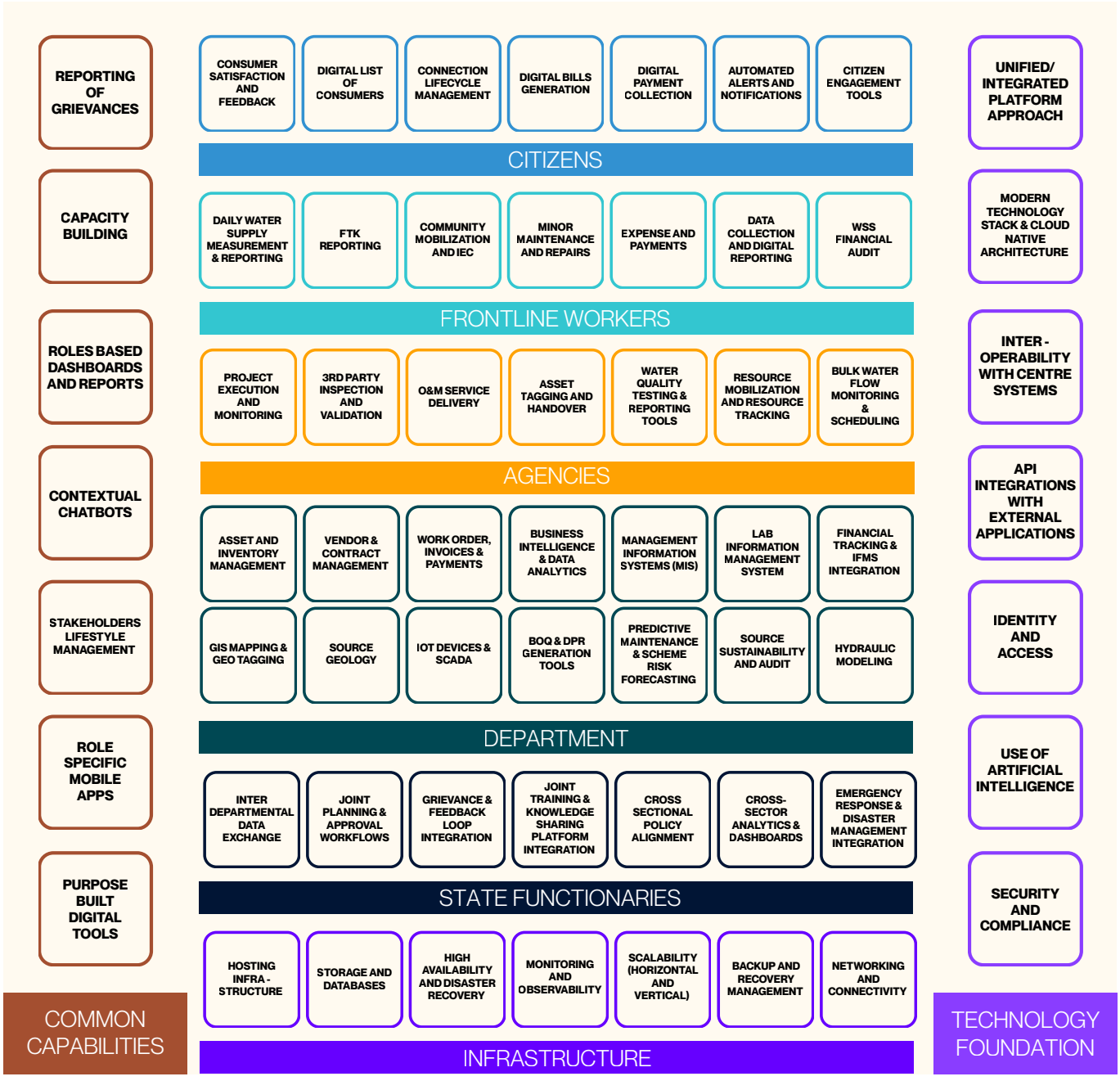


Figure 6: State IT Systems – Digital Maturity Model (DMM)

National Jal Jeevan Mission

Introduction

JJM Management Information System (MIS) is designed to ensure a seamless flow of data and information across various platforms and stakeholders involved in the mission. The JJM MIS comprises several interconnected systems, including the JJM MIS itself, the Water Quality Monitoring Information System (WQMIS), the Field User App, the Training Portal, NIWAS, and a WEB API for data integration and sharing.

Within the JJM MIS, a comprehensive data management system underpins the effective functioning of the Jal Jeevan Mission. The system comprises a total of 388 input tables, of which approximately 320 tables are actively used for JJM-IMIS. For data reporting, there are 522 tables, with around 450 currently in use for JJM-IMIS. Additionally, for the reporting of the Water Quality Management Information System (WQMIS), there are 148 tables, approximately 130 of which are actively utilized. On the input side for WQMIS, there are a total of 253 tables, with around 200 currently being employed.

These tables serve as repositories for a wide range of data, encompassing planning, monitoring, progress tracking, and special focus areas. Users such as NIC, NJJM (for monitoring), States (for data entry and approvals), and Divisions (for data entry) interact with the system to ensure that all relevant information is accurately captured and reflected in the system.

The WQMIS is another critical component of the JJM framework, focusing on resource management used in water quality monitoring. It involves various users, including Field Test Kit Users, Laboratories, and the Department, who contribute to the comprehensive data collection on water quality and resources.

The Field User App allows field users and divisions to input data related to geotagging of PWS assets, and scheme information boards, among other assets. This data is then integrated into the JJM MIS for further analysis and reporting.

The Training Portal is utilized by management-level personnel and the community to manage and disseminate information on training programs and Knowledge Resource Centres (KRCs), which are essential for capacity building within the mission.

NIWAS caters to sector partners, providing a platform for action taken reports and field visits, which are crucial for on-ground implementation and feedback.

The WEB API plays a pivotal role in ensuring data integration between States, Departments, and other stakeholders on a G2G basis. It facilitates the integration of data from various sources, ensuring that the information is up-to-date and accessible across different platforms.

The IoT Platform is at the demo stage and not yet productionalized.
Analytical Tool: While the system provides close to 100 pre-canned reports to multiple users, the full-fledged analytics tool is under development. As of now, there is no predictive analytics available.

In summary, any data or information captured in any of the MIS platforms of JJM is meticulously recorded in the designated tables and subsequently presented on the dashboard of the Jal Jeevan Mission. This integrated approach allows for efficient monitoring, management, and improvement of water resources, with a focus on ensuring the success of the mission's objectives.

Figure 7: Overview of the Digital Systems and Data Flow in the JJM Ecosystem

Key strengths, gaps, and challenges

Key Findings

- **Data Quality Issues:** There are significant inconsistencies in reported data and delays in updates.
- **System Usability Gaps:** Complex interfaces are impacting end-user adoption and data entry accuracy.
- **Interoperability Concerns:** Limited integration with other government systems and third-party tools. The MIS may need to be more thoroughly integrated with broader financial and administrative systems to improve decision-making and transparency.
- **Monitoring and Reporting:** Insufficient capabilities for real-time analytics and performance tracking.
- **Scalability Limitations:** The current infrastructure is not optimized for scaling to accommodate the growing number of users and data points across regions.
- **Data Redundancy:** Multiple instances of duplicate data entries were observed, leading to inefficiencies and inflated storage requirements.
- **Limited Field-Level Data Validation:** Lack of real-time data validation mechanisms at the point of entry, resulting in errors being propagated across the system.
- **Data Governance:** There might be a need for a stronger data governance framework to ensure data quality and integrity across the system.

Major Challenges

1. Fragmented data architecture leading to inefficiencies.
2. Limited training and support for field-level users.
3. Security vulnerabilities in data transmission and storage.

Recommendations

- Data Standardization: Implement consistent data validation mechanisms to ensure accuracy and reliability.
- User-Centric Design: Redesign system interfaces for ease of use, especially for field-level stakeholders.
- Enhanced Integration: Develop APIs to enable seamless data exchange with other relevant platforms.
- Advanced Analytics: Incorporate machine learning tools for predictive analysis and decision support.
- Capacity Building: Conduct regular training sessions and provide comprehensive documentation for users.

JJM Assam

JJM Assam has utilized technology for citizen engagement, empowering frontline workers, data collection, monitoring, risk management, and reporting, to execute the mission more efficiently and transparently, ensuring that its goals are met within the designated timeframe. Leveraging digital tools has allowed the state to improve infrastructure monitoring, enhance transparency, and optimize resource utilization.

Highlights

JJM Assam has demonstrated remarkable progress in strengthening water supply systems through the innovative use of the digital platform, 'JJM BRAIN'. This comprehensive system has enabled end-to-end visibility, efficient scheme management, and real-time monitoring of water infrastructure projects across the state. Assam's integration of tools such as Jalkosh QR codes, the Jal Mitra Mobile App, Multimodal Grievance Redressal, the Jaldoot chatbot, Pipeline Distribution Tracking, GIS & Geotagging, and the Litholog database reflects a forward-thinking approach to transparency, accountability, and community engagement. The collaboration between field-level users, engineers, administrators, and citizens through digital platforms stands as a commendable model for other states, showcasing how technology can enhance service delivery in the rural water supply sector.

Figure 8: A digital platform for monitoring and managing key aspects of JJM projects.

1. Unified Digital Governance Platform

Single Source of Truth: JJM BRAIN acts as a centralized platform integrating multiple modules such as schemes, work orders, WUCs, grievances, lab data, GIS networks, and more.
Real-Time Monitoring: Live dashboards and GIS-based updates ensure transparency and accountability across all implementation levels—from state to panchayat.

2. Field-First Mobile Architecture

Contractor App: Facilitates real-time pipe laying tracking using GPS, FHTC tagging, and task monitoring.
WUC App: Enables Water User Committee members to log O&M data, access bylaws, and update expenditure on mobile.
Jal Mitra App: Field functionaries can input flow meter readings, sample test data, and report scheme issues instantly.

3. Jal Kosh ID & Community Engagement

QR-Based Scheme Tracking: Jal Kosh provides each scheme with a unique QR code for citizens to access scheme data.
Citizen Feedback & Grievance Integration: Citizens can rate schemes, raise issues, and submit evaluations—ensuring bottom-up feedback loops.

4. Water Quality Surveillance & Lab Management

Lab Data Module: Tracks inventory, test results, and field sample collection.
Impact Analysis & Re-testing Triggers: Automatically notifies field teams when test results are outside permissible limits, prompting resampling.

5. Strong Grievance Redressal System

Multi-Channel Capture: Grievances received via WhatsApp, web forms, media, or calls are tracked.
Automated Routing & PDF Closure Reports: Issues are auto-assigned and documented with resolution reports approved by engineers.

6. Scheme Lifecycle Digitization

Full Lifecycle Coverage: From scheme sanction in SMT to handover to PNRD, with WUC assignment and O&M tracking.
Validation & Approval Workflows: Each stage—from WUC creation to scheme handover—is role-based and validation-bound.

7. Asset Tracking & GIS Network Visualization

Pipe Network Digitization: Geotagged pipe installation using contractor apps, with distance tracking and KML export for correction in QGIS.
Categorized Pipe Attributes: Tracks material, diameter, and installation timelines for quality and inventory control.

8. Flood Impact Monitoring

Disaster Preparedness: Special module to assess flood impacts, categorizing severity and tracking inundation for assets.

9. Capacity Building and Community Engagement

Extensive community involvement demonstrated by training over 1.14 lakh women in water-quality testing, promoting local awareness, empowerment, and sustainability.
Focused IEC campaigns and capacity-building are initiatives driving behavioural change, hygiene awareness, and sustainable water usage practices among rural populations.

10. Custom Campaign and Outreach Tools

Glific WhatsApp Bot Integration: Engages school students under the Jaldoot programme using educational nudges.
Campaign Builder: Allows for questionnaire design, public outreach, and data collection for behavior-change initiatives.

11. Strong Panchayat & WUC Empowerment

PNRD Portal Integration: Panchayat users can log O&M expenses, approve scheme handover, and monitor WUC activity.
WUC Dashboard: Real-time stats on scheme ownership, bank status, and committee functioning, empowering local ownership.

12. Visual Dashboards & Role-Based Insights

Data-Driven Decisions: Every module includes detailed dashboards (e.g., lab stock, WUC status, pipe installation progress) that allow easy tracking and action planning.
CSV Exports: Enables granular data analysis and offline reporting for various administrative units.

13. Transparency, Accountability, and Inclusivity

Audit Trails & Activity Logs: Every action in the system is logged, creating a complete audit trail.
Multi-Language Support: Most end-user interfaces support English, Hindi, Bengali, and Assamese, ensuring inclusive access.

Strategic improvement areas

1. Monolithic Application

Issue: JJM BRAIN is not a cloud-native, microservices-based application.
Impact: This limits the scalability of the application and is a potential barrier to taking certain modules of this application to the open source community and eventually publishing them as DPGs.
Recommendation: Start working towards gradually migrating to a cloud-native, microservices-based architecture.

2. Technology Stack

Issue: JJM BRAIN is built in PHP and the Laravel framework, which is not considered a modern technology stack.
Impact: While there is no immediate impact, and several world-class applications use PHP, it can hinder the migration of applications towards modern architectures in the long term.
Recommendation: With a microservices architecture in place, there would be an opportunity to build new modules in modern programming languages like Java, Python, etc.; this opportunity should be leveraged to build new modules in a modern technology stack.

3. Application Resilience and Reliability

Issue: The application has not been tested for its resilience and reliability, with no well-defined RPO and RTO.
Impact: In abnormal conditions or system failure, business continuity will be significantly affected.
Recommendation: Define RPO and RTO metrics and build a process to routinely conduct mock drills for disaster recovery. Conduct performance and load testing of the application to measure how much the application can scale.

4. Limited Offline Functionality

Issue: Many field apps (Contractor, Jal Mitra, WUC) are heavily dependent on continuous internet connectivity.
Impact: Field users in remote or flood-prone areas with poor mobile network coverage face challenges in uploading pipeline data, lab readings, and monthly reports.
Recommendation: Introduce offline-first data capture with later sync capabilities.

5. Lack of a Centralized Error Flagging System

Issue: While individual modules allow data corrections (like pipe geotagging), there is no centralized dashboard to flag errors across schemes (e.g., duplicate WUCs, missing Jal Mitra, and unverified FHTCs).
Impact: Errors can remain unresolved or unnoticed across departments.
Recommendation: Add a "Data Health Dashboard" or "Error Summary" for each district or division.

6. Grievance Module Lacks Smart Escalation

Issue: There's no SLA (Service-Level Agreement) or automatic escalation mechanism if a grievance remains unresolved for a defined period.
Impact: Some grievances may remain pending without accountability.
Recommendation: Introduce escalation tiers (SO → EE → HQ) based on time thresholds.

7. No Predictive or Analytical Intelligence

Issue: While JJM BRAIN is rich in operational data, it lacks predictive alerts (e.g., scheme likely to fail due to poor FHTC coverage or irregular lab testing).
Impact: Proactive decision-making is limited; most actions are reactive.
Recommendation: Introduce AI/ML-driven alerts for O&M, water quality, and asset degradation.

8. Integration with External Utilities is Partial

Issue: Electricity (APDCL) and Land Record (Sewa Setu) integrations exist, but are not two-way or automated.
Impact: Frequent manual intervention is needed, slowing workflows.
Recommendation: Move toward full automation of APDCL billing verification, land ownership validation, and subsidy mapping.

9. Lack of Real-Time Water Quality Analytics

Issue: Water testing is mostly manual with periodic sample updates; there are no live sensors or IoT-based analytics.
Impact: Delays in detecting contamination or ensuring consistent quality.
Recommendation: Pilot real-time sensor-based water quality modules (for turbidity, pH, etc.) with API integration to the lab dashboard.

Assam IT Capabilities Mapping

Based on a two-day onsite As-Is Study visit to PHED, this report attempts to map the capabilities of Assam PHED IT systems using the DMM framework.

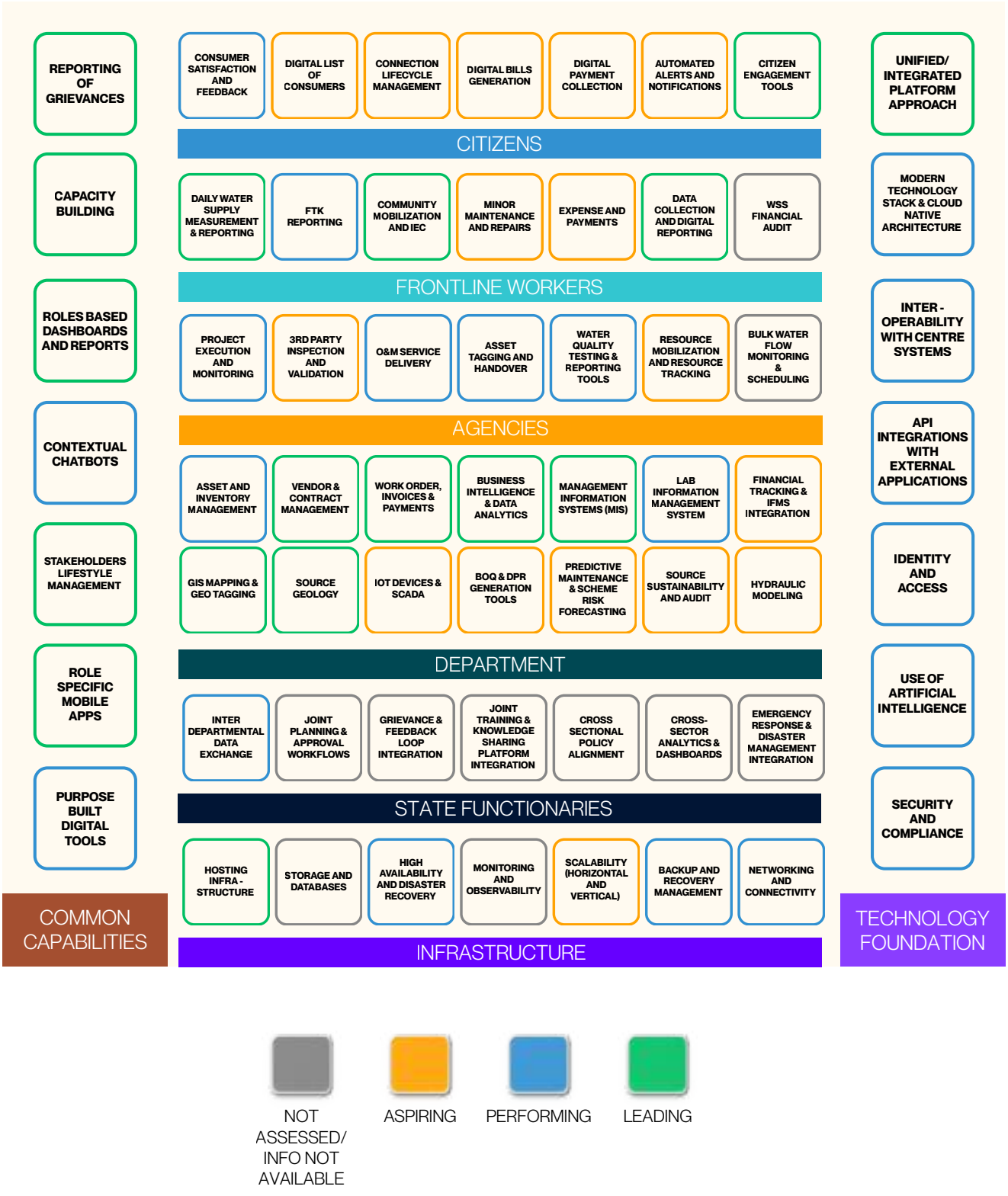


Figure 9: State IT Systems – Assam's PHED IT Capabilities Scorecard

Citizens Applications

CONSUMER SATISFACTION AND FEEDBACK	A dedicated voice helpline exists for consumers to submit their feedback. There are also dedicated call center staff who proactively reach out to consumers for their feedback. The department is in the advanced stage of rolling out an IVR-based customer satisfaction tool and post-survey analytics. A pilot is also progressing on an AI-enabled voice bot, which will provide a human-like voice interface for collecting users' feedback, providing support for language localization, and advanced analytics. The plan is to integrate this tool with a grievance reporting tool, so that grievances can automatically be raised based on user feedback.
DIGITAL LIST OF CONSUMERS	JJM BRAIN application has been designed with a notion of maintaining the digital list of consumers; however, at present, there does not seem to be a comprehensive process to maintain such a list.
DIGITAL PAYMENT COLLECTION	In the majority of schemes, bills are not generated. In some schemes, flat-rate tariff is collected from consumers. PHED Assam attempted to use the Nal Jal Seva application for managing the life-cycle of bills, however it got discontinued due to certain operational issues.
CONNECTION LIFECYCLE MANAGEMENT	Information is not available.
DIGITAL BILLS GENERATION	In a majority of schemes, bills are not generated. In some schemes, a flat-rate tariff is collected from consumers. PHED Assam attempted to use the Nal Jal Seva application for managing the life-cycle of bills; however it got discontinued due to certain operational issues.
AUTOMATED ALERTS AND NOTIFICATIONS	No alerts and notification system is available to consumers.
PURPOSE BUILT DIGITAL TOOLS	All purpose-built digital tools are covered in the above rows of this table, which include a chatbot for grievance reporting and citizen-facing dashboards.

CITIZEN ENGAGEMENT TOOLS	Every water supply scheme has a unique QR code. Consumers can scan the QR code via their mobile phones to access all the information on the scheme, such as capacity, date of installation, pump operator mobile number, and WUC members' details, along with general content like audio and videos on water awareness. This tool is called Jal Kosh and is a great example of a citizen engagement tool. Consumers can also raise grievances by scanning a QR code.

CONTEXTUAL CHATBOTS	For consumers, there is a contextual chatbot available for grievance reporting.
ROLE SPECIFIC MOBILE APPS	At present, there are no native mobile apps available for consumers. Jal Kosh provides QR code-enabled web-based mobile interface to consumers for getting scheme information, accessing citizen-facing dashboards, and raising grievances.
REPORTING OF GRIEVANCES	A multi-channel grievance reporting and tracking system is available via a dedicated helpline number, WhatsApp bot, and web interface.
ROLE BASED DASHBOARDS AND REPORTS	Public dashboards summarizing scheme performance, coverage, and water quality are being proposed for transparency.
STAKEHOLDER LIFECYCLE MANAGEMENT	As of now, there does not exist a well-defined process and automation for managing the lifecycle of consumers.
 **CAPACITY BUILDING**	There are several awareness programs being run at different levels: • **Awareness generation:** Educating communities about the importance of safe drinking water, water conservation, and its judicious use. • **Promoting ownership:** Encouraging villagers to take responsibility for their water supply infrastructure. • **Behavior Change Communication (BCC):** Fostering hygiene practices and the regular payment of water tariffs. **The Jaldoot Program:** Under this program, school students are trained to promote WASH practices and assist with community awareness and FHTC assessment.

Frontline Workers Applications

DAILY WATER SUPPLY MEASUREMENT & REPORTING

Jal Mitras use the Jal Mitra mobile app to record daily BFM readings from the scheme, which reflect the volume of water supplied to households. However, out of 27k schemes, only 6k Jal Mitras are sending BFM readings. The Department is in the process of rolling out a user-friendly AI-enabled solution, which will provide trusted BFM readings supported by nudges.

FTK REPORTING (FIELD TEST KIT REPORTING)

FTK women's groups conduct water quality tests using Field Test Kits (FTKs) and upload the data directly into the central WQMIS. There are discussions underway on introducing Optical Magnetic Reader (OMR)-based Field Tests Kits under the program 'Jal Virangana'. The plan is to have a WhatsApp-based chatbot which will use Optical Character Reader (OCR) technology to directly read the FTK test reports and upload them to the desired systems without any human intervention.

COMMUNITY MOBILIZATION & IEC

Through Jaldoot campaigns, Jalshalas, and ISA-led activities, awareness programs are conducted in schools and communities to promote water conservation and hygiene. There are dashboards that track these activities.

MINOR MAINTENANCE & REPAIRS

Jal Mitras report minor damages (e.g., valve issues, pipeline leaks) directly to Section Officers as of now, without any IT application. There are discussions in progress to extend the capabilities of the Jal Mitra mobile app, for Jal Mitras to report and manage minor repairs directly from the mobile app.

EXPENSE AND PAYMENT MANAGEMENT

Water User Committees (WUCs) record monthly expenditures, like Jal Mitra honorarium, electricity bills, etc., using the WUC mobile app.

DATA COLLECTION AND DIGITAL REPORTING

All frontline activities (FTK tests, water supply, grievances, and WUC data) are digitally captured in real-time via apps like Jal Mitra, Contractor, and WUC apps.

WSS FINANCIAL AUDIT

No information is available.

REPORTING OF GRIEVANCES

Jal Mitras can raise grievances directly from the Jal Mitra mobile app. Otherwise, a multi-channel grievance reporting and tracking system is available via a dedicated helpline number, WhatsApp bot, and web interface.

 **CAPACITY BUILDING**	Training is imparted regularly in the following areas: **Training of Village Water & Sanitation Committees (VWSCs)** • **Technical aspects:** Basic O&M of pumps, pipelines, and taps; minor repair identification. • **Financial management:** Collection of user charges, maintaining accounts, budgeting for O&M. • **Water quality surveillance:** Understanding the importance of safe water, how to use Field Test Kits (FTKs), and reporting contamination. • **Roles and Responsibilities:** Defining their mandate in planning, implementation, and sustainable management. **Training of Frontline Workers (Jal Mitras, Plumbers, Electricians, and Fitters):** These individuals are the backbone of daily operations. Training programs focus on: • **Skill development:** Practical training in plumbing, electrical work, pump operation, and troubleshooting common issues. **Training of FTK Women Groups:** **Water Quality Testing:** Detailed training on using FTKs, understanding parameters, and accurate data reporting.
STAKEHOLDER LIFECYCLE MANAGEMENT	JJM BRAIN has a well-defined lifecycle of key frontline workers such as Jal Mitras and WUCs.
PURPOSE BUILT DIGITAL TOOLS	All purpose-built digital tools are covered in the above rows of this table, which includes multiple chatbots, mobile apps, and dashboards.
CONTEXTUAL CHATBOTS	There are multiple contextual chatbots available: 1. For grievance reporting 2. For the Jaldoot programme nudges 3. For BFM reading-based daily water supply measurement & reporting (in pilot) 4. For FTK results reporting (in plan)
ROLE SPECIFIC MOBILE APPS	There are dedicated mobile apps for: 1. Jal Mitras 2. WUCs
ROLE BASED DASHBOARDS AND REPORTS	Several role-based reports are available for frontline workers.
REPORTING OF GRIEVANCES	Jal Mitras can raise grievances directly from the Jal Mitra mobile app. Additionally, a multi-channel grievance reporting and tracking system is available through a dedicated helpline number, WhatsApp bot, and web interface.

Agencies Applications

PROJECT EXECUTION & MONITORING

The Contractor module has been developed for contractors to capture and monitor scheme installation progress with real-time updates.

- Track pipeline distribution networks and add FHTCs for respective schemes.
- Update assigned task objectives using photos and data entry.
- Monitor project milestones to ensure timely execution.

ASSET TAGGING AND HANDOVER

Contractors use **GPS-enabled smartphones** to map pipeline installations and upload **geotagged Functional Household Tap Connection (FHTC)** details.

3RD PARTY INSPECTION & VALIDATION

At present, no dedicated app or module exists for Third-Party inspection and validation.

WATER QUALITY TESTING & REPORTING TOOLS

The Water Sample Collection and Testing System, integrated within JJM BRAIN, enables efficient tracking and analysis of water quality across Assam. It centralizes the process of sample collection, testing, and reporting to ensure that water supplied under the Jal Jeevan Mission meets safety standards. This system plays a critical role in maintaining the reliability and transparency of water quality data.

O & M SERVICE DELIVERY

The JJM Assam app is designed for officers to view and manage multiple schemes and to track work, tasks, and progress. This includes functionalities related to:

- **Work Progress Monitoring:** Officers can track the progress of ongoing construction activities (e.g., pipeline laying, OHT construction) against planned schedules.
- **Task Management:** Assigning and tracking specific tasks related to scheme implementation.

Geotagged Photo Uploads: Field officers can upload geotagged photos from site visits as evidence of work completion or issues, which serves as a crucial audit trail.

BULK WATER FLOW MONITORING & SCHEDULING

Sufficient information is not available in this area.

CONTEXTUAL CHATBOTS

There are contextual chatbots for agencies.

CAPACITY BUILDING

ISA & TPIA Training Programs

- **ISA engagement by TERI** across four divisions—including Silchar and Karimganj—to support scheme design, monitoring, and management; they were trained in FHTC delivery, water quality testing, and community mobilization.
- **TPIA /consulting agency empanelment** under JJM Assam via structured tenders, ensuring they meet technical and institutional standards.

Contractor & Vendor Skill Development

- **Regular workshops and refresher training** for contractors engaged under JJM, enhancing technical capacity and timely execution.
- **Clear empanelment guidelines and SOPs** for contractor selection—including turnover criteria and performance benchmarks—to ensure quality and accountability.
- **Empanelment of lab equipment and chemical suppliers** through statewide tenders ensures vendors are qualified to manage water testing labs.

Technical Support & Quality Assurance

- Tenders have been opened for **third-party inspection agencies**, enabling external oversight and technical validation of construction quality.
- TSA-backed **laboratory strengthening**, including empanelment of agencies for supplying water testing reagents and instruments under WQMIS and JJM frameworks.

ROLE SPECIFIC MOBILE APPS

There is a dedicated Contractor mobile app to do the following:

- Track pipeline distribution networks and add FHTCs for respective schemes.
- Update assigned task objectives using photos and data entry.
- Monitor project milestones to ensure timely execution.

REPORTING OF GRIEVANCES

There is no separate grievance reporting tool for agencies. Agencies can use the existing multi-channel grievance reporting and tracking system available for everyone.

RESOURCE MOBILIZATION AND RESOURCE TRACKING

Dedicated digital tools or application modules are not found for resource mobilization and resource tracking.

ROLE BASED DASHBOARDS AND REPORTS

Role-based reports and a public-facing dashboard, 'ISA Performance Evaluation Tool (I-PET)', exist.

STAKEHOLDER LIFECYCLE MANAGEMENT

JJM BRAIN has a well-defined lifecycle of key agency actors like ISAs, contractors etc., via their respective modules in JJM BRAIN.

PURPOSE BUILT DIGITAL TOOLS

The public-facing dashboard, 'ISA Performance Evaluation Tool (I-PET)' is one good example of a purpose-built digital tool. Custom ISA, Contractor, and PG modules are purpose-built digital tools.

Department Applications

ASSET & INVENTORY MANAGEMENT	For water quality labs, the inventory management system is part of the Lab module. Scheme Assets are tagged and stored with the Scheme master database. However, it cannot be stated with full confidence that there is a full-fledged Asset management system in PHED Assam.
BUSINESS INTELLIGENCE & DATA ANALYTICS	There are several role-based reports and dashboards available, such as the state dashboard, the division dashboard, the district dashboard, and multiple reports.
VENDOR & CONTRACT MANAGEMENT	With the Contractor and PG modules in place, JJM Assam has well-defined Vendor and Contract management systems.
MANAGEMENT INFORMATION SYSTEMS (MIS)	The SMT application, along with the Scheme module of JJM BRAIN, forms the core of MIS. The Scheme is the central entity in the whole information map which ties multiple facets of the water supply management system, including financial budgeting & tracking, scheme progress tracking, assets tagging, frontline workers' assignment, FHTC assignment, contractors, work order, and water sample for testing etc. All this information is managed via the MIS.
HYDRAULIC MODELING	Hydraulic modeling is not carried out.
WORK ORDER, INVOICES & PAYMENTS	The Contractor module has functionalities to manage work orders, invoices and payments to vendors.
 **LAB INFORMATION MANAGEMENT SYSTEM**	The Lab Management module is a comprehensive tool within JJM Brain, designed to facilitate the recording, monitoring, and management of laboratory inventory and stock data. However, it still lacks the advanced capabilities of a Lab Information Management System (LIMS), which provides end-to-end automation of lab operations and integration with test machines.
FINANCIAL TRACKING & IFMS INTEGRATION	The SMT application update is in progress, which will provide IFMS integration.

 **GIS MAPPING & GEO TAGGING**	JJM-BRAIN incorporates advanced GIS mapping technology, allowing users to visualize PWSS projects and related data on a map interface. This enables better spatial understanding, identification of patterns, and informed decision-making based on the geographical context. GIS mapping enhances data accessibility and analysis, providing valuable insights for project planning and execution. The Contractor mobile app is used to upload the GIS-mapped data into the system. Geotagging of assets is also carried out.
SOURCE SUSTAINABILITY AND AUDIT	Currently, such action is not taking place, but the department has future plans for the same.
IOT DEVICES & SCADA	The department has been actively exploring and implementing IoT (Internet of Things) solutions to bring real-time, data-driven insights into rural drinking water supply schemes. While full-scale deployment is an ongoing process, JJM Assam piloted IoT deployment in 13 schemes. However, as of now, most of the IoT systems are not in working condition.
REPORTING OF GRIEVANCES	Sufficient information is not available in this area.
SOURCE GEOLOGY	The Litholog module in JJM BRAIN is specifically designed to manage geological data for schemes dependent on groundwater sources. It allows users to record, store, and analyze information on lithology and aquifer characteristics at scheme locations. The JJM Assam mobile app is used to upload litholog data into the system.
BOQ & DPR GENERATION TOOLS	There are no digital tools for this specific area.
PREDICTIVE MAINTENANCE & SCHEME RISK FORECASTING	Currently, such action is not taking place, but the department has future plans for the same.
ROLE BASED DASHBOARDS AND REPORTS	There are several role-based reports and dashboards available, such as the state dashboard, division dashboard, district dashboard, and multiple reports.
CONTEXTUAL CHATBOTS	As of now, there are no contextual chatbots for department officials, however the department is considering building a chatbot, 'Jal Saathi', which will use AI capabilities to provide answers to frequently asked questions to staff members.

CAPACITY BUILDING

Engineers and Technical Staff Training: PHED engineers and technical staff (Assistant Engineers, Junior Engineers, Executive Engineers) receive training on:

- **Scheme Design & Planning:** Adherence to JJM guidelines, new technologies, and sustainable water source development.
- **Project Management:** Efficient execution, monitoring progress, and ensuring quality infrastructure.
- **Data Analysis & Utilization:** How to interpret data from JJM BRAIN and other IT systems for informed decision-making.
- **Contract Management and Procurement:** Ensuring transparency and efficiency in project implementation.

Water Quality Laboratory Personnel Training: Staff at district and state water quality testing laboratories are trained in:

- **Advanced Testing Protocols:** Using sophisticated lab equipment for accurate chemical and bacteriological analysis.
- **Quality Assurance/Quality Control (QA/QC):** Ensuring the reliability and validity of test results.
- **Data Upload to WQMIS:** Proper procedures for entering and synchronizing lab results with the central WQMIS (which integrates with JJM BRAIN).

ROLE SPECIFIC MOBILE APPS

There is a JJM Assam mobile app for field officers, used to:

- Upload QR installation updates for assigned schemes.
- Monitor individual task statuses and update scheme locations.
- Create lithologs to document geological data.

STAKEHOLDER LIFECYCLE MANAGEMENT

JJM BRAIN has a well-defined lifecycle of department officials which is managed by the user management module of the application. However, JJM BRAIN does not integrate with the department's authentication realm for onboarding officials. This mandates that officials remember a separate username and password for the JJM BRAIN application. Moreover in absence of Single-Sign-On (SSO) other applications like SMT have different usernames and passwords, impacting the adoption of these applications.

PURPOSE - BUILT DIGITAL TOOLS

1) The Flood Monitoring Module is one good example of a purpose-built digital tool, which provides a centralized platform where all data related to flood-affected schemes is stored and managed, ensuring that the impact of floods is accurately assessed, and that necessary measures are taken to mitigate their effects. This module is critical for maintaining the resilience and sustainability of the mission, as it ensures that all flood-affected schemes are promptly identified and addressed.

2) The PNRD (Panchayat & Rural Development) Module within JJM BRAIN is another good example of a purpose-built digital tool, which supports the management of handed-over water supply schemes by PNRD officials, including panchayat users, block administrators, and panchayat commissioners.

State Functionaries

INTER DEPARTMENTAL DATA EXCHANGE	• The APDCL (Assam Power Distribution Company Limited) Integration module is a specialized tool within JJM BRAIN, designed to facilitate the tracking of APDCL bill payments and power consumption for schemes under the Jal Jeevan Mission. Data exchange between JJM BRAIN and the land and revenue department is also mentioned. • Integration with the National Health Mission (NHM) is enabled by the NHM Module of JJM BRAIN.
JOINT PLANNING & APPROVAL WORKFLOWS	There is insufficient information in this area. There is partial involvement. Approvals are required from Panchayats for WUC formation and scheme handover; however, broader joint planning with other departments is not institutionalized.
CROSS-SECTOR ANALYTICS & DASHBOARDS	Dashboards exist (JJM-BRAIN), but they are focused on PHED-specific data only (e.g., scheme progress, flow data, and WUC formation).
JOINT TRAINING & KNOWLEDGE SHARING PLATFORM INTEGRATION	There is insufficient information in this area.
GRIEVANCE & FEEDBACK LOOP INTEGRATION	There is insufficient information in this area.
CROSS SECTORAL POLICY ALIGNMENT	There is insufficient information in this area.
EMERGENCY RESPONSE & DISASTER MANAGEMENT INTEGRATION	No integration with Assam SDRF, disaster dashboards, or contingency alert systems in case of drought/flood affecting water supply.

Assam's JJM has developed a strong internal digital ecosystem through the JJM-BRAIN platform and related apps, but inter-departmental and cross-sectoral integration is minimal or absent. This presents a major opportunity for future **DPI evolution**, where joint planning, shared analytics, grievance integration, and disaster responsiveness can be embedded into the next phase of platform development.

Technology Foundation

The table below outlines the mapping of a Capability from DMM to the Assam IT systems for Technology Foundation.

UNIFIED / INTEGRATED PLATFORM APPROACH	JJM BRAIN is a unified platform integrating several modules for scheme monitoring, grievance tracking, project management, GIS mapping, and community engagement to ensure transparency and efficiency.
SECURITY AND COMPLIANCE	There exists secure authentication, encryption, role-based controls, AWS security features, vulnerability management, and audit logging for compliance.
MODERN TECHNOLOGY STACK & CLOUD NATIVE ARCHITECTURE	The system is built on LEMP stack with Laravel, Node.js, MySQL, Redis, AWS/DigitalOcean, and ElasticSearch for scalability, performance, and modern DevOps practices.
IDENTITY & ACCESS	There is Role-Based Access Control (RBAC) for predefined roles like Jal Mitras, WUC members, engineers, and administrators. Role changes and account management are handled by the backend IT team, with no in-app role control. User accounts are created, updated, and deactivated as needed. Authentication uses username/password, but multi-factor authentication is absent, limiting protection for sensitive data. SSO is not present.
INTEROPERABILITY WITH CENTRE SYSTEMS	The provision of API-based integration with IMIS and WQMIS for real-time scheme is available; however, it exists at a primitive level.
USE OF ARTIFICIAL INTELLIGENCE	Pilots include an AI vision-based WhatsApp chatbot for meter readings and an AI-powered customer satisfaction tool.
API INTEGRATIONS WITH EXTERNAL APPLICATIONS	The system is linked with APDCL for electricity tracking and the NHM for sanitation data collection, enabling cross-sector coordination.

Infrastructure

Capability Matrix

The table below outlines the mapping of a Capability from DMM to the Assam IT systems for IT Infrastructure.

HOSTING INFRASTRUCTURE

AWS + Digital Ocean (public cloud) is being used as hosting infrastructure of JJM BRAIN application. Google Play Store is being used as a distribution channel for all the mobile apps.

1. Main Application Layer (JJM Brain - Monolith)
Server: AWS
- RAM: 8 GB
- CPU: 2 dedicated cores

Database: Managed MySQL
- RAM: 16 GB
- CPU: 4 cores
- Storage: 512 GB SSD

Purpose: Core business logic and operations.
In memory database: Redis for database caching

2. Elastic Server
Server: A separate server
- RAM: 2 GB
- CPU: 2 cores

Database: MongoDB
Purpose: Handles dynamic data indexing and search functionalities.

3. JJM NHM Application Layer (Monolith)
Server: A separate monolith server
- RAM: 4 GB
- CPU : 2 Core

Database Connection: Remotely connects to the JJM Brain database.
Purpose: Specific functionality dedicated to NHM processes, leveraging the JJM Brain data infrastructure.

4. API Gateway Layer
Functionality:
- Monitors API consumption and operational status.
- Handles all external API calls and ensures usage tracking and security.

Purpose: Centralized management of API interactions for both internal and external integrations.

Key Features of the Architecture
- **Scalability**: Layers can be independently scaled based on load.
- **Separation of Concerns:** Each layer focuses on specific responsibilities, improving maintainability and performance.
- **Centralized Monitoring:** API Gateway ensures operational visibility for all API interactions.
- **Performance:** Dedicated resources for the database and elastic server ensure optimized query handling and search operations.
- **Interoperability:** The JJM NHM application leverages the JJM Brain database seamlessly, ensuring data consistency.

STORAGE AND DATABASES

To develop a solid database architecture strategy for the JJM BRAIN application, various factors including scalability, data integrity, security, and interoperability with other applications like Panchayat and NHM_JJM initiative are taken into account. Given the use of multiple databases and caching mechanisms, a multi-tiered approach will help optimize data handling across the entire system.

- **Separation of Concerns:** Use specific databases for different purposes (MySQL for relational data, PostgreSQL with PostGIS for spatial data, Redis for caching). This aligns with the different data types you're managing.
- **Data Integrity:** Use foreign key constraints in MySQL (InnoDB) to ensure relational integrity for interrelated tables, such as tracking various tasks and work items under JJM.
- **Scalability:** Employ a modular design where data relatedto different applications (e.g., Panchayat and NHM_JJM) are separated but accessible via database links to prevent tight coupling.

Given the application's requirements, here's a strategic data-based architecture design that accommodates the different components, integrates GIS data, manages cache, and ensures scalability and performance.

Primary Database (MySQL with InnoDB Engine)

- **Database Type:** MySQL (Managed, DigitalOcean)
- **Engine:** InnoDB (for transaction-safe tables and foreign key support)
- **Purpose:** Main storage for core application data, transactional data, reports, and core application entities such as user information, work records, monitoring metrics, reports, and other structured data.
- **Features:** Optimized for high read/write performance, ACID compliance for reliability.
- **Structure:**
    - Core Tables: Tables for users, projects, work_items, reports, work_progress, status_logs, etc.
    - Indexing: Optimize indexing based on frequently accessed fields (e.g., project_id, status, user_id) to improve performance.
    - Data Access Layer: Implement a data access layer with Stored Procedures for complex queries, ensuring better maintainability and performance.
- **Primary Entities:**
    - Users and Roles: Manages application users, roles, and permissions.
    - Projects and Work Data: Stores data about different projects and ongoing work under the JJM initiative.
    - Monitoring and Reports: Holds monitoring logs, progress reports, and other key performance indicators.
    - Interconnection Data: Stores pointers or identifiers for connections with Panchayat and NHM_JJM Initiative applications.
- **Partitioning Strategy:**
    - Range or List Partitioning for large tables based on districts, project type, or date to improve performance and make backups manageable.

Cache Database (Redis)
Database Type: Redis
Purpose: Cache frequently accessed data to minimize direct database queries and enhance performance.
Use Cases:

- Session Management: Fast, secure storage of user sessions for quicker authentication.
- Frequently Accessed Data: Cache reports and other data that are frequently accessed but rarely updated.
- Data Replication: Cached copies of commonly accessed data across NHM_JJM and Panchayat apps to reduce query load on MySQL.

Data Expiration Policies: Implement TTL (Time-to-Live) on session data and other transient cached information to optimize memory usage.

- **Implementation**
    - Cache recently accessed data, such as **user sessions, recent work items, and high-demand reports.**
    - **Cache Expiration Policies:** Set Redis to expire cache keys based on the frequency of data change; for example, 5-10 minutes for high-update data or 1 hour for static data.
    - Use **Redis for locking mechanisms** when multiple applications (like Panchayat and NHM_JJM) access the same data, ensuring data consistency.

GIS Database (PostgreSQL with PostGIS Extension)

- **Database Type: PostgreSQL with PostGIS**
- **Purpose:** Stores and processes GIS data related to locations, pipelines, water sources, and other geospatial data enabling spatial queries and mapping.
- **Features:**
    - **Geospatial Queries:** Use PostGIS for location-based queries, such as finding nearby infrastructure, planning routes, or area-based reporting.
    - **Data Storage:** Store GIS data separately to optimize performance and avoid loading non-spatial data unnecessarily.
- **Data Sync and Transformation:**
    - **ETL Process:** Periodically extract and transform data from GIS tables into MySQL (for high-level summaries) if required for broader reporting.
- **Structure:**
    - **Core Tables:** Define tables for geolocations pipeline_routes, source_locations, and any spatially-referenced attributes.
    - **Spatial Indexing:** Use GIST indexing on PostGIS tables for faster spatial queries.
    - **Data Sync:** Regularly sync GIS-related data with Redis cache for quick access on commonly queried locations.

Document and Media Storage (S3-compatible Object Storage)

- **Storage Type:** Document Block object storage with S3
- **Purpose:** Store all non-relational assets like documents, images, reports, and files.
- **Integration:**
    - **Reference by URL:** Store file URLs or identifiers in the MySQL database for easy reference.
    - **Access Control:** Manage access to S3-stored files based on user roles and permissions, ensuring secure access to sensitive documents.
- **Structure:**
    - **S3 Keying Strategy:** Implement an S3 bucket structure based on entity types (e.g., work_items, reports) and date/time for easy retrieval.
    - **Metadata Table in MySQL:** Maintain a metadata table in MySQL to store information on each file in S3 (e.g., file_id, s3_url, associated_work_item_id).

Cross-Application Database Links and Integrations

Purpose: Allow cross-application data sharing while keeping each application's database distinct.

- **Database Links (ORM):**
    - **OMR (Object Relation Management)** for MySQL Database Links: Use DB links within OMR to read data from

Interconnected Applications:

- Panchayat and NHM_JJM Initiative: Both are interconnected within JJM Brain via DB links through the OMR.

Data Exchange:

- DB Links: Use secure DB links to allow direct querying from JJM Brain into Panchayat and NHM_JJM Initiative databases without duplicating data.
- APIs: Implement REST or GraphQL APIs for structured data access and interoperability between the systems, which can help with scalability and future integrations.

Data Sync Strategy:

- For frequently accessed cross-application data, sync essential parts into Redis to reduce real-time DB link load.

SCALABILITY (HORIZONTAL & VERTICAL)	JJM BRAIN is not a cloud-native application based on a microservices architecture. It is a monolith. Though deployed on the public cloud (AWS), the application will face horizontal scaling issues beyond a point. Redis cache has been used, but a detailed review of the application raises concerns about its effectiveness. The application should scale vertically owing to the decent use of PHP Laravel framework and the database strategies used. • **Load Balancing**: Use a load balancer for MySQL queries, directing read-heavy workloads to read replicas. • **Indexing Strategy**: Implement advanced indexing (spatial indexes for GIS, compound indexes for frequently joined MySQL tables) for fast querying. • **Query Optimization**: Optimize queries with caching, partitioning, and selective fetching techniques to minimize database load. • **Sharding (Future Scalability)**: Consider sharding large tables by geographic regions if data volume grows significantly. This architecture design leverages the strengths of each database component while ensuring scalability, performance, and data integrity across JJM BRAIN and interconnected systems. By following this structure, JJM BRAIN can efficiently handle reporting, monitoring, and geospatial queries while providing a seamless user experience.
MONITORING & OBSERVABILITY	There is insufficient information available in this area.
BACKUP AND RECOVERY MANAGEMENT	Database backups are taken every 24 hours and are stored at separate machines other than the production environment. However recovery from the backup has never been tried out. • **Managed MySQL**: DigitalOcean managed MySQL provides automated backups; configure daily and weekly backups with a secure retention policy. • **Redis Backup**: Periodic snapshotting of Redis for disaster recovery; ensure session data can be gracefully degraded or rebuilt. • **GIS Data**: PostgreSQL and PostGIS data should be backed up weekly due to lower write frequencies but significant importance. **Object Storage**: Enable versioning for document storage to allow recovery of previous versions.
HIGH AVAILABILITY & DISASTER RECOVERY	The production instance of JJM BRAIN is hosted on AWS, and the DR site is hosted on the State Data Centre, theoretically providing good coverage for high availability and disaster recovery. However, mock drills of disaster recovery have not been conducted. Also, RPO and RTOs are not well-defined.
NETWORKING AND CONNECTIVITY	There is insufficient information available in this area.

JJM Punjab

Punjab has emerged as a frontrunner in implementing the Jal Jeevan Mission (JJM), achieving 100% rural household tap water coverage and declaring the state as **Har Ghar Jal** by 2024. Starting from a base of 74.5% coverage in 2019, the state has consistently exceeded performance benchmarks, with over 95% of households receiving 70 LPCD (and in some cases 100 LPCD) and 94% of water samples meeting potability standards.

Highlights

Punjab's Department of Water Supply and Sanitation (DWSS) has been actively leveraging Information Technology (IT) to enhance the management and delivery of rural drinking water services, particularly under the ambit of the Jal Jeevan Mission (JJM). These advancements aim to improve efficiency, transparency, and sustainability in water resource management.

Here are the highlights of IT advancement in rural drinking water management in Punjab:

1. Online Water Quality Management System (WQMS)

Punjab utilizes comprehensive digital platforms to manage water quality testing. This includes online reporting of field test kit (FTK) results by trained community members, uploading laboratory test results, and displaying the water quality status, ensuring continuous monitoring and prompt action in case of contamination. State water quality lab have advanced features like Machine-to-Machine communication technologies for uploading water test results in LIMS directly from the testing machines without any human intervention.

2. Internet of Things (IoT) for Real-time Monitoring

Punjab is increasingly deploying IoT sensors to monitor key parameters like water flow, pressure, water levels in overhead tanks, and even groundwater levels. This real-time data allows for proactive identification of issues like leaks, low pressure, or excessive drawal, leading to more efficient operation and maintenance.

3. Grievance Redressal

The grievance redressal mechanism in DWSS is a good example of achieving extraordinary results with high process adherence and a great sense of ownership by the SNK team, even when the IT systems used in SNK are very basic at present. The Department is in the process of procuring a next-generation, multi-channel grievance redressal solution with built-in AI capabilities for smart routing and predictive analytics.

4. Streamlined Project Management via EPM (Engineering & Project Management)

- An EPM module—part of an enterprise IT solution—is used by engineering departments, including DWSS.
- It supports end-to-end workflows: estimate preparation, technical sanction, bidding, tendering, contract management, measurement, workflow automation, billing, and asset maintenance.

These IT advancements collectively contribute to a more efficient, transparent, and responsive rural drinking water supply system in Punjab, aligning with the broader vision of digital governance and empowering communities in water resource management.

Strategic improvement areas

While Punjab has made commendable strides in IT advancement for rural drinking water, there are always areas for further improvement to ensure the systems are robust, inclusive, and truly transformative. Here are key areas where IT advancement can be further strengthened in the rural drinking water space in Punjab:

1. Enhancing Last-Mile Digital Literacy and Adoption

- **Challenge:** Despite increased smartphone penetration, digital literacy remains a significant barrier for many rural residents and even some frontline workers, particularly older individuals or those with limited formal education. This impacts the effective use of mobile apps for data collection, grievance redressal, or accessing training.
- **Improvement:** Implement more intensive, localized, and hands-on digital literacy training programs, possibly leveraging local youth or community facilitators. Develop highly intuitive, vernacular-language interfaces for applications with strong visual cues to minimize learning curves.

2. Addressing Connectivity and Infrastructure Gaps

- **Challenge:** Reliable internet connectivity, especially in remote villages, can still be intermittent or slow, hindering real-time data uploads, the smooth functioning of online platforms like LMS, and effective IoT sensor data transmission.
- **Improvement:** Invest further in improving last-mile internet infrastructure (e.g., through BharatNet, local Wi-Fi hotspots). Design applications to function effectively in offline mode with seamless synchronization when connectivity is restored, reducing dependence on constant internet access.

3. Standardization and Interoperability of Data

- **Challenge:** While systems like IMIS and iGOT exist, there are variations in data collection formats, definitions, and reporting across different schemes, districts, or even within the same department. This leads to data silos and hinders holistic analysis.
- **Improvement:** Develop and strictly enforce granular data standardization protocols for all parameters (e.g., water quality, consumption, asset details, O&M records). Prioritise open APIs and robust interoperability frameworks to ensure seamless data exchange between different IT systems, both within DWSS and with other relevant departments.

4. Leveraging Advanced Analytics and Predictive Maintenance

- **Challenge:** While data collection is ongoing, the full potential of this data for predictive analytics is underutilized. Most dashboards show the current status rather than predicting future issues.
- **Improvement:** Move beyond descriptive analytics to predictive models. Use historical data on breakdowns, water quality fluctuations, and consumption patterns to predict potential equipment failures, water scarcity, or contamination events, enabling proactive maintenance and resource allocation.

By focusing on these areas, Punjab can further mature its IT ecosystem in the rural drinking water sector, making it more effective, resilient, and user-centric, ultimately contributing to better service delivery and achieving the goals of water security for its citizens.

Punjab IT Capabilities Mapping

Based on a two-day onsite As-Is Study visit to DWSS, this report attempts to map the capabilities of Punjab DWSS IT systems on the DMM scorecard as depicted in the figure below.

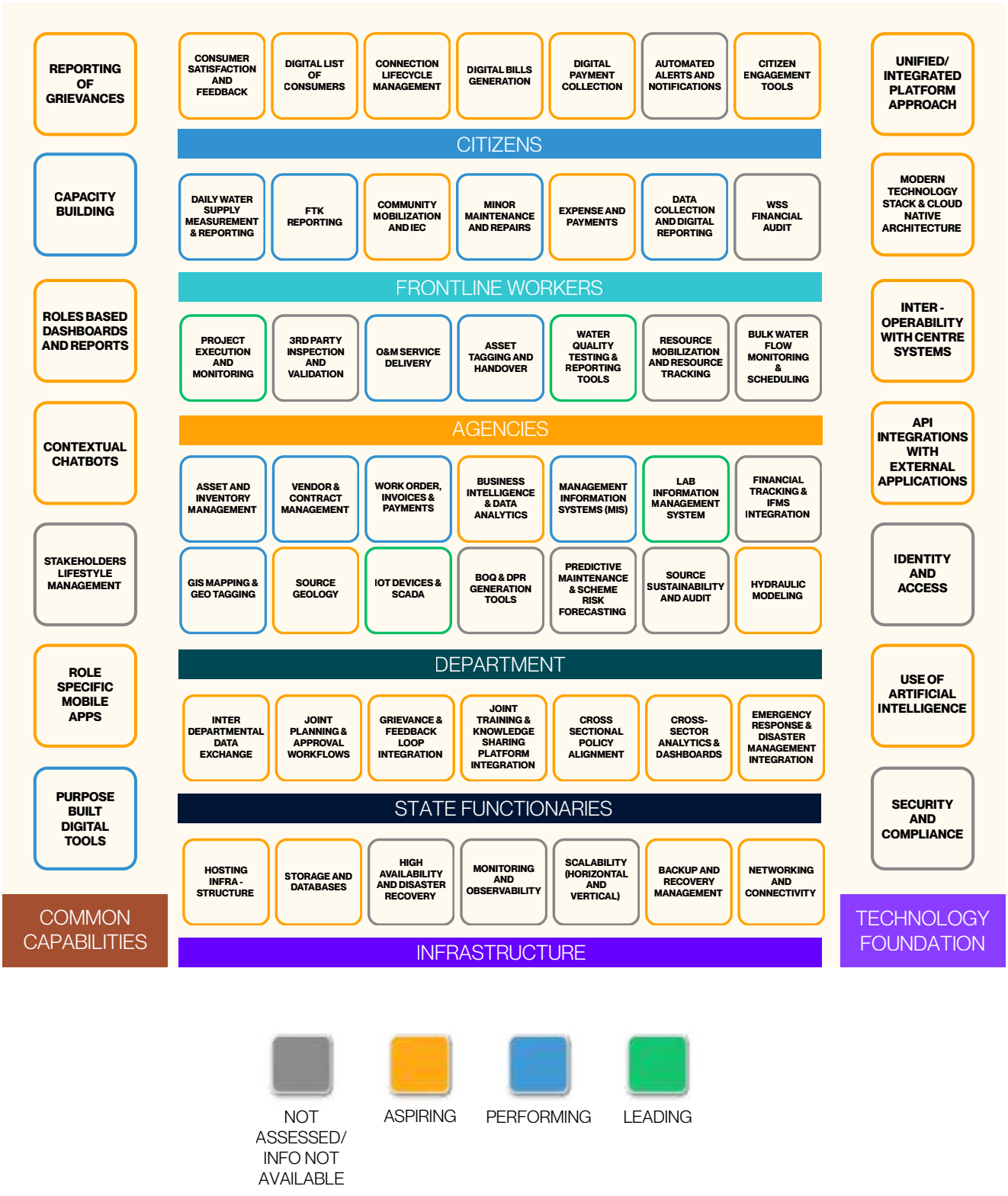


Figure 10: State IT Systems – Punjab DWSS IT Capabilities Scorecard

Citizens Applications

CONSUMER SATISFACTION SURVEY/FEEDBACK	Call center agents at SNK collect oral feedback during or after complaint resolution. There is no structured, recurring consumer satisfaction survey conducted throughout the department.
DIGITAL LIST OF CONSUMERS	The digital list of consumers is not available.
CONNECTION LIFECYCLE MANAGEMENT	At present, there is no conducive process and digital tools to manage the lifecycle of water connections.
DIGITAL BILLS GENERATION	After sunsetting the mGramSeva, there is no digital bill generation.
DIGITAL PAYMENT COLLECTION	At present, no active platform supports online bill payment for consumers.
AUTOMATED ALERTS AND NOTIFICATIONS	No information is available.
CITIZEN ENGAGEMENT TOOLS	No public-facing tool is available to access scheme-level details, operator information, or awareness content.
REPORTING OF GRIEVANCES	The Shikayat Niwaran Kendra (SNK) operates through a centralized voice-based grievance redressal system. Complaints are manually logged, assigned, and closed by call center agents.
CAPACITY BUILDING	Awareness programs are conducted through IEC campaigns, school programs, and community meetings focusing on safe water, hygiene, conservation, and tariff awareness; however, these activities are offline with no dedicated digital platforms.
ROLE-BASED DASHBOARDS AND REPORTS	DWSS has internal dashboards for scheme monitoring, but no public dashboards are published for consumers to track scheme performance, complaints, or water quality.

CONTEXTUAL CHATBOTS	No chatbot or AI-based interface is available for consumers, frontline workers, agencies, or the department. The SNK system is purely voice-based, with no WhatsApp or digital bot integration currently operational.
STAKEHOLDER LIFECYCLE MANAGEMENT	No information is available.
ROLE SPECIFIC MOBILE APPS	There is no system for managing the lifecycle of consumer engagement (onboarding, usage, payment history, complaint history, exit, etc.) across systems.
PURPOSE-BUILT DIGITAL TOOLS	N/A.

Frontline Workers Applications

DAILY WATER SUPPLY MEASUREMENT & REPORTING	The Jal Seva app captures daily water supply hours, disruptions, and operational status across schemes via monthly structured surveys by Junior Engineers. Data syncs with the MIS when connectivity is available.
FTM REPORTING (FIELD TEST KIT REPORTING)	The Jal Seva app records chlorine residual readings and water quality indicators submitted by field staff. It captures data on disinfection status and treatment practices.
COMMUNITY MOBILIZATION & IEC	Community engagement is conducted offline via Jaldoots and VWSC activities. No digital tools in Jal Seva or LMS support structured IEC campaign management or impact monitoring.
MINOR REPAIRS MANAGEMENT	Field-level issues like pump breakdowns and equipment faults are documented via Jal Seva's technical module. Geotagged photos and GPS tagging enable visual verification. However, resolution tracking remains semi-manual.
EXPENSE AND PAYMENT MANAGEMENT	Jal Seva records O&M-related expenditures manually entered by JEs (e.g., repairs, electricity). No digital integration exists with treasury systems or vendor payment platforms.
DATA COLLECTION AND DIGITAL REPORTING	The Jal Seva app captures 45+ parameters across technical, institutional, general, and financial domains monthly. Its offline-first design ensures functionality in rural areas. Data is partially synced to the MIS but lacks real-time dashboarding and analytics.
WSS FINANCIAL REPORTING	No information is available.
REPORTING OF GRIEVANCES	Grievances are managed via SNK, a centralized voice-based system, but not integrated with Jal Seva. Jal Seva does not provide a grievance registration interface as of now.
CAPACITY BUILDING	DWSS uses a department-wide Learning Management System (LMS) integrated with iGOT Karmayogi. It offers blended learning for engineers, frontline workers, and VWSC members. LMS tracks progress, completion rates, and supports offline access.

ROLE-BASED DASHBOARDS AND REPORTS	Data generated from the Jal Seva app is available to internal users only via restricted dashboards. No public dashboards accessible to consumers or Panchayats exist for transparency or community oversight. • There are revenue dashboards for GPs, blocks, and districts.
CONTEXTUAL CHATBOTS	No chatbot interface is available within Jal Seva or LMS. SNK does not currently support WhatsApp-based grievance reporting either.
STAKEHOLDER LIFECYCLE MANAGEMENT	No stakeholder management system exists across Jal Seva or LMS to track individual users (consumers, VWSCs) across their service journey or engagement lifecycle.
ROLE-SPECIFIC MOBILE APPS	The Jal Seva mobile app is role-specific for Junior Engineers, allowing scheme-wise reporting, asset tagging, and monitoring. The LMS is role-segmented across technical staff and community members.
PURPOSE-BUILT DIGITAL TOOLS	Jal Seva is the department's core field monitoring application. The LMS supports structured training. These tools are specialized but not yet fully interoperable.

Agencies Applications

PROJECT EXECUTION & MONITORING	**EPMS** (Public Works Department's E-Project Monitoring System) is used for estimate preparation, bidding, measurements, e-MBs, and progress tracking. It is integrated into the DWSS workflow for civil engineering works and infrastructure build-out.
THIRD PARTY INSPECTION & VALIDATION	No information is available.
O&M SERVICE DELIVERY	The Gram Panchayat Water & Sanitation Committee (GPWSC) operates the system and collects a monthly tariff from each household, which fully covers O&M expenses. They also manage meter reading, and grievance resolution.
ASSET TAGGING AND HANDOVER	The mission integrates with platforms like PM Gati Shakti to share geospatial infrastructure data (e.g., pipelines, reservoirs) for coordinated planning and asset tagging.
WATER QUALITY TESTING & REPORTING TOOLS	LIMS is fully functional across 33 labs for chemical and microbiological testing. Data is logged into JJM-IMIS. However, there is no sensor-based real-time water quality tracking integrated with SCADA or Jal Seva. Chlorine sensor data is used for alerts but not linked to LIMS or public platforms.
RESOURCE MOBILIZATION AND RESOURCE TRACKING	No data is available.
BULK WATER FLOW MONITORING & SCHEDULING	No data is available.
REPORTING OF GRIEVANCES	**SNK (Shikayat Niwaran Kendra)** is a voice-based manual grievance redressal system. No integration exists with SCADA, Jal Seva, or MIS. There is no digital public interface or automated routing system.

CAPACITY BUILDING	No dedicated mobile or digital tool exists for structured field inspections or audits. Monitoring is done via field visits and informal reporting.
ROLE-BASED DASHBOARDS AND REPORTS	No live, publicly accessible dashboards are available for IoT SCADA, LIMS, EPMS, or scheme-level performance. Internal dashboards exist within SCADA and MIS, but are not exposed to citizens.
CONTEXTUAL CHATBOTS	No chatbot or automated conversational interface is deployed for consumers, operators, or engineers in any digital platform under DWSS (e.g., Jal Seva, SCADA, SNK, EPMS).
STAKEHOLDER LIFECYCLE MANAGEMENT	No unified platform exists for managing the lifecycle of stakeholders (households, VWSCs, engineers) across schemes, training, billing, or grievances. Systems operate in silos (IoT, LIMS, HRMS, SNK, LMS).
ROLE-SPECIFIC MOBILE APPS	Jal Seva (currently inactive) was role-specific for Junior Engineers. No active mobile app exists for engineers, supervisors, or consumers to interact with SCADA, LIMS, or MIS data.
PURPOSE-BUILT DIGITAL TOOLS	DWSS has deployed multiple purpose-built tools • **SCADA + IoT system** for real-time monitoring • **LIMS** for lab testing • **EPMS** for project execution • **HRMS & eOffice** for internal management • These tools serve distinct functions but lack cross-platform integration.

Department Applications

ASSET & INVENTORY MANAGEMENT	Enabled through EPMS (PWDIMS) – it covers asset tagging, e-MB, and maintenance modules.
VENDOR & CONTRACT MANAGEMENT	Functional under EPMS – it includes digital workflows for bidding, approvals, and contract management.
WORK ORDER, INVOICES & PAYMENTS	Digitized under EPMS – it supports measurement book entries, billing modules, and workflow management.
BUSINESS INTELLIGENCE & DATA ANALYTICS	Business intelligence and data analytics do not exist.
MANAGEMENT INFORMATION SYSTEMS (MIS)	Fully implemented three-tier MIS – manual entry from the field, a centralized data layer, and reporting via PDF/Excel.
LAB INFORMATION MANAGEMENT SYSTEM	Fully implemented in 33 labs – digital data entry, result validation, and integration with JJM-IMIS, yet manual dependencies exist (e.g., no GPS or mobile app).
FINANCIAL TRACKING & IFMS INTEGRATION	No information is available
GIS MAPPING & GEO TAGGING	Currently, no public or internal GIS-based water scheme mapping system is available within DWSS for field access or asset visualization. GIS-based interfaces are not integrated with Jal Seva, SCADA, or MIS. However, geotagging of the assets is going on, data from which is getting stored on the PM Gati Shakti portal.
SOURCE GEOLOGY	Lithological data of borewells/tubewells is **not captured digitally** or linked to scheme or groundwater monitoring tools. No systematic integration exists with groundwater drawdown sensors.

IOT DEVICES & SCADA

The **IoT-Based Automation System** by DWSS Punjab digitally monitors and controls rural water supply schemes across **346 sites** (897 villages, ~9.1 lakh population), with ~240 schemes fully automated by **CIMCON Software**.

Core Features:

- **Sensors**: Groundwater, flow, chlorine, pressure, and energy meters
- **Connectivity**: MQTT over 2G/4G; LoRaWAN for low-signal areas
- **Control**: AWS IoT Core + SCADA with central and district-level units

Functions & Benefits:

- Real-time alerts (e.g., pump/chlorine failure, low tank levels).
- Automated pump scheduling and energy optimization.
- Reduced manual tasks and improved service reliability

Integration Status:

- Standalone system, aligned with Jal Seva & SDPM for monitoring.
- The Jal Seva app supplements sensor data (currently inactive).

BOQ & DPR GENERATION TOOLS

No data is available.

PREDICTIVE MAINTENANCE & SCHEME RISK FORECASTING

No data is available.

SOURCE SUSTAINABILITY AND AUDIT

No data is available.

HYDRAULIC MODELING

No hydraulic modelling is being done currently.

REPORTING OF GRIEVANCES

SNK (Shikayat Niwaran Kendra) is a voice-based manual grievance redressal system. No integration exists with SCADA, Jal Seva, or MIS, and there is no digital public interface or automated routing system.

CAPACITY BUILDING

Internal dashboards are active under MIS; no publicly accessible dashboards are currently live.

ROLE-BASED DASHBOARDS AND REPORTS

No chatbot or automated conversational interface is deployed for consumers, operators, or engineers on any digital platform under DWSS (e.g., Jal Seva, SCADA, SNK, EPMS).

CONTEXTUAL CHATBOTS	No unified platform exists for managing the lifecycle of stakeholders (households, VWSCs, engineers) across schemes, training, billing, or grievances. Systems operate in silos (IoT, LIMS, HRMS, SNK, LMS).
STAKEHOLDER LIFECYCLE MANAGEMENT	Jal Seva app (for JEs) exists but is currently non-functional; there are no apps for WUCs, Gram Panchayats, or citizens.
ROLE-SPECIFIC MOBILE APPS	MIS & SDPM: Monitoring physical and financial progress of schemes • **LIMS:** End-to-end lab water quality tracking. • **EPMS:** Tracks engineering estimates and project implementation. • **HRMS:** Staff service lifecycle management. • **e-Office:** Department-wide file and communication workflow.
PURPOSE BUILT DIGITAL TOOLS	N/A

State Functionaries

INTER-DEPARTMENTAL DATA EXCHANGE	No API-based real-time integration exists yet.
JOINT PLANNING & APPROVAL WORKFLOWS	Integration across departments is limited to core DWSS functions; cross-departmental linkages remain manual.
GRIEVANCE & FEEDBACK LOOP INTEGRATION	Grievances are managed via Shikayat Niwaran Kendra (SNK), which operates through a centralized helpline and manual ticketing. Citizen feedback is collected but not fully digitized or integrated with mobile apps and dashboards. Plans for modernization exist but are yet to be rolled out.
JOINT TRAINING & KNOWLEDGE SHARING PLATFORM INTEGRATION	There is no dedicated digital platform for training, skill development, or inter-departmental knowledge sharing. Training is handled through physical workshops and circulars, with no centralized e-learning or collaboration portal.
CROSS-SECTORAL POLICY ALIGNMENT	There is no formal digital mechanism for aligning water policies with other sectors (like health, agriculture, or disaster management). Alignment occurs through manual coordination and inter-departmental meetings rather than a digital workflow.
CROSS-SECTOR ANALYTICS & DASHBOARDS	Cross-sectoral analytics (e.g., linking water data with health outcomes) are not yet implemented.
EMERGENCY RESPONSE & DISASTER MANAGEMENT INTEGRATION	There is no integrated digital framework for emergency response or disaster management linked with water supply operations. Emergency measures are largely manual, and are activated during crises through departmental instructions.

Technology Foundation

UNIFIED / INTEGRATED PLATFORM APPROACH	Current applications operate in silos without a unified architecture, leading to limited interoperability and fragmented data flows.
MODERN TECHNOLOGY STACK & CLOUD NATIVE ARCHITECTURE	Applications use mixed stacks (.NET, Java, PHP, Flutter, MS SQL) , which may cause maintenance and scalability challenges.
INTEROPERABILITY WITH CENTRE SYSTEMS	There is limited integration with IMIS and WQMIS; partial API-level integration between LIMS and WQMIS is hindered by technical and coordination issues. It also integrates with platforms like PM Gati Shakti to share geospatial infrastructure data (e.g., pipelines, reservoirs) for coordinated planning and uses PFMS for transparent financial management.
API INTEGRATIONS WITH EXTERNAL APPLICATIONS	Partial API integration has been attempted (LIMS–WQMIS) but progress is uneven; broader external API integration is minimal. JJM platforms aggregate data from IoT systems, mobile apps, and other mission portals, indicating some level of cross-system data sharing.
IDENTITY & ACCESS	No information is available.
USE OF ARTIFICIAL INTELLIGENCE	There is no evidence of AI use.
SECURITY AND COMPLIANCE	No information is available.

Infrastructure

HOSTING INFRASTRUCTURE	There is a mix of on-premises servers and state data centre services; there is no unified hosting setup.
STORAGE AND DATABASES	There are multiple local databases and no central data lake or standardized storage architecture.
HIGH AVAILABILITY & DISASTER RECOVERY	Data is not available.
MONITORING & OBSERVABILITY	Data is not available.
SCALABILITY (HORIZONTAL & VERTICAL)	Data is not available.
BACKUP AND RECOVERY MANAGEMENT	Data backup practices exist, but are inconsistent and not standardized.
NETWORKING AND CONNECTIVITY	Connectivity is inconsistent at field locations with respect to IoT devices; real-time data flow from the last mile is often affected.

JJM West Bengal

Introduction

West Bengal, with its diverse terrain—ranging from the Himalayan foothills in the north to coastal deltas in the south—faces unique challenges in delivering piped water supply.

These include:

- Water quality concerns, such as arsenic and iron contamination in groundwater;
- Flood-prone and cyclone-affected zones in southern districts;
- A high population density, which adds pressure on existing water infrastructure.

The Public Health Engineering Department (PHED), Government of West Bengal, is the nodal agency for implementing JJM in the state. The department has taken a phased and decentralized approach, leveraging digital solutions to improve planning, execution, and monitoring of rural water supply schemes.

Key Focus Areas of JJM in West Bengal:

- Adoption of surface water-based piped water supply schemes in arsenic-affected areas.
- Implementation of real-time monitoring dashboards to track coverage and scheme progress.
- Use of mobile-based applications by field staff for geotagging and household surveys.
- Strengthening village-level governance through capacity building of Gram Panchayats and Village Water & Sanitation Committees (VWSCs).
- Promotion of data-driven decision-making using Management Information Systems (MIS) and GIS platforms.

Highlights

1. Strong Digital Infrastructure Foundation

Diverse Mobile Ecosystem: West Bengal PHED has developed and deployed a range of mobile and web applications—Jal Swapna, Jal Mitra, Water Quality App, Mega Scheme, and Physical Progress App—covering the full lifecycle of service delivery, including household onboarding, scheme execution, and quality monitoring.

Resilient Data Centre Setup: All backend services are hosted on an on-premises data centre featuring 100% SAN redundancy, daily backups, 99.749% uptime, and secure leased-line connectivity (STPI 50 Mbps, BSNL 75 Mbps).

2. Effective Institutional Readiness

In-House IT Capability: The department boasts a dedicated internal development team and a well-funded IT budget, enabling agile and customized technological solutions.

Security-Minded Approach: With measures like daily backups, geo-blocking of foreign IPs, and ongoing planning for disaster recovery, PHED has demonstrated strong security and resilience protocols.

Innovative Mindset: The development of the Jal Saathi WhatsApp chatbot (via Twilio) showcases inventive in-house innovation and responsiveness to user needs—covering both staff and citizen interactions.

3. Coverage & Reach

Comprehensive FHTC Tracking: The combined use of Jal Swapna and Jal Mitra ensures scheme tracking across a wide network of villages.

Pilot Roll-Out of Unique IDs: Initiatives like UTID and QR code pilots demonstrate readiness to adopt household-level digital identity for future interoperability.

4. Water Quality Monitoring

Smart Water Quality Monitoring - A key achievement of PHED West Bengal is the Smart Water Quality Monitoring and Surveillance (WQMS) system, integrating a network of laboratories with mobile and web platforms. This system enables real-time tracking of water quality, laboratory performance, NABL accreditation, and treatment technology operations.

Dedicated Water Quality App – The app is used to record test results, upload lab data, and support facilitator entries—ensuring safe drinking water is delivered.

IEP/AIRP App – In the state, which faces an acute arsenic issue, the department responded with a dedicated digital tool to monitor operational status and water quality performance of Arsenic/Iron Removal Plants (AIRPs) and Iron Elimination Plants (IEPs).

5. Community Engagement

Active involvement of ISA groups in fieldwork, community awareness programs, school visits, and post-connection feedback gathering.

Encouragement of community-level monitoring and mobilization, aligned with the spirit of participatory governance.

6. Progress Transparency

Applications like the Mega Scheme App provide officials with real-time status updates on ongoing construction and physical progress.

7. Focus on Data Integration Pilots

There is an ongoing effort to implement a data lake for providing a unified source of truth for all data sets.

Strategic improvement areas

1. Lack of Integration with JJM-IMIS

- **Issue**: API integration with JJM-IMIS is currently non-functional; data entry is still manual.
- **Impact**: This causes reconciliation delays for over 38,000 villages and increases the risk of data mismatch.
- **Recommendation**: Revive and stabilize API integration with proper backend mapping and validation checks to ensure real-time data syncing with IMIS.

2. Fragmented Applications (Siloed Systems)

- **Issue**: Jal Swapna, Jal Mitra, Mega Scheme, and others operate in isolation without data exchange.
- **Impact**: Leads to duplicated entries, poor coordination, and fragmented scheme monitoring.
- **Recommendation**: Develop a middleware or shared services layer to enable data interoperability and task coordination across all apps.

3. Manual Water Quality Monitoring

- **Issue**: Water quality data is collected and entered manually by facilitators and lab staff.
- **Impact**: Delays in reporting, increased risk of errors, and poor integration with WQMIS.
- **Recommendation**: Digitize FTK test reporting, automate lab data upload, and ensure real-time linkage with WQMIS using unique household identifiers (UTIDs/QR codes).

4. Absence of a Formal Grievance Redressal System

- **Issue**: Grievances are reported through WhatsApp and logged manually in Excel.
- **Impact**: There is no escalation system, delays in resolution, and lack of accountability.
- **Recommendation**: Establish a structured grievance portal with ticketing, response tracking, and citizen feedback loops.

West Bengal IT Capabilities Mapping

Based on a two-day days onsite As-Is Study visit to PHED, this report attempts to map the capabilities of West Bengal's PHED IT systems on DMM scorecard as depicted in the figure below.

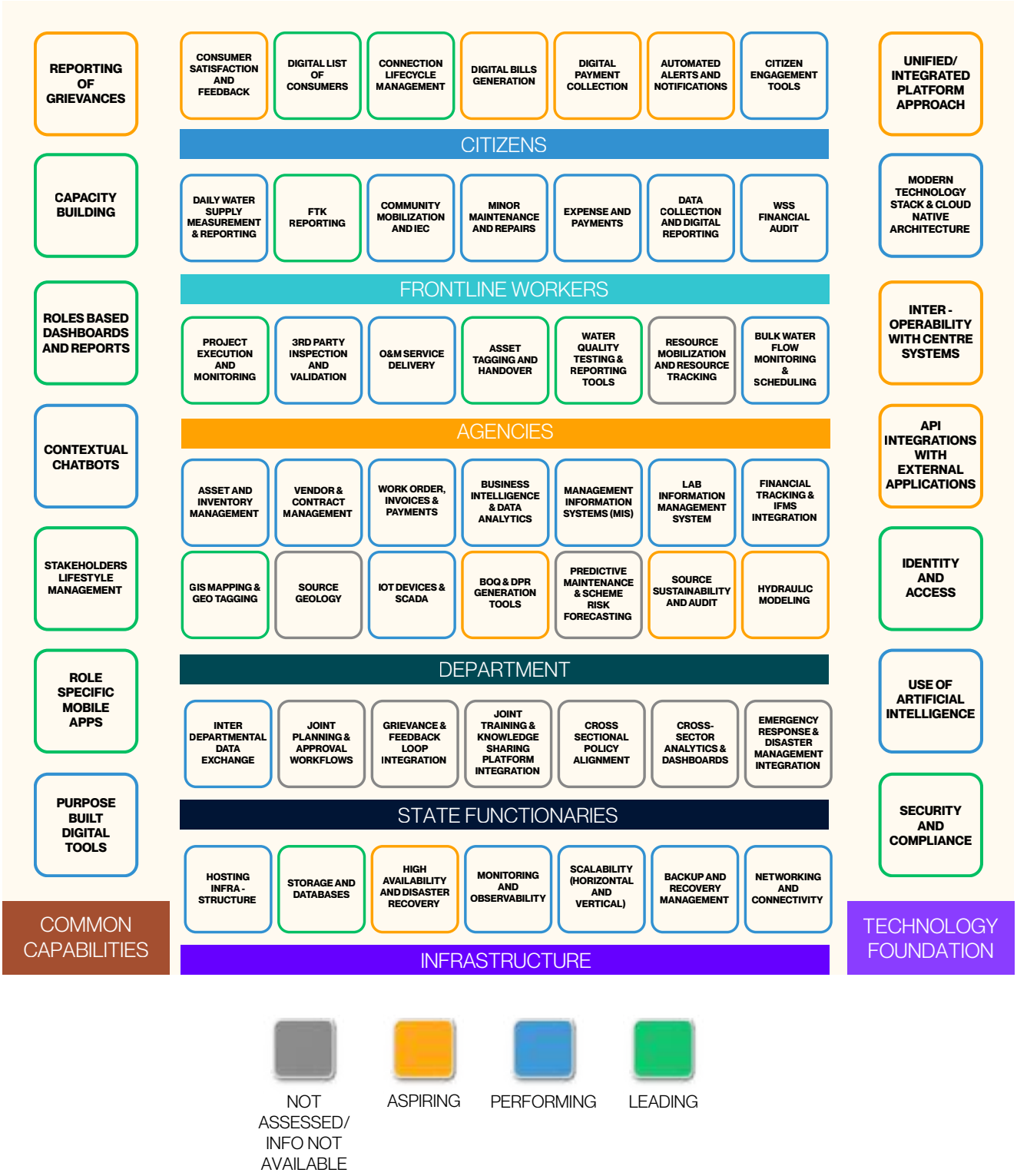


Figure 11: State IT Systems – West Bengal's PHED IT Capabilities Scorecard

Citizens Applications

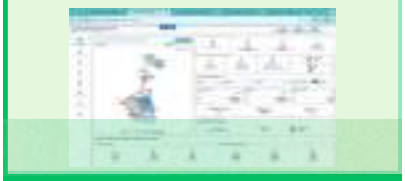
CONSUMER SATISFACTION AND FEEDBACK	At present, there are no established processes and digital tools to conduct proactive consumer satisfaction surveys.
 **DIGITAL LIST OF CONSUMERS**	The **digital list of consumers** is maintained using the Jal Swapna mobile app, which is integrated with the **Aadhaar and Swachh Bharat Mission-Gramin (SBM-G)** database. Consumer information is systematically collected at the FHTC level, with each connection assigned a **Unique Tap Water ID (UTID)** linked to scheme codes, ensuring accurate mapping, service tracking, and grievance redressal.
CONNECTION LIFECYCLE MANAGEMENT	There is a well defined process supported by digital tools like Jal Swapna mobile app to onboard new connections. 12-digit Unique Tap ID (UTID) is assigned to each connection, which is used in all consumer-related operations like grievance redressal, connection transfer, etc.
DIGITAL BILLS GENERATION	Digital billing is not currently implemented for rural consumers under JJM via PHED West Bengal.
DIGITAL PAYMENT COLLECTION	While local O&M contributions may exist in certain community-managed models, there is no standardized, state-level tariff system under PHED.
AUTOMATED ALERTS AND NOTIFICATIONS	Consumer-focused alerts (e.g., SMS/warnings for water disruptions or quality dips) are not part of the existing setup.
CITIZEN ENGAGEMENT TOOLS	A digital tool like Jal Kosh is under planning for better citizen engagement. UTID cards help engage citizens. Citizen-facing dashboards are powerful.
 **REPORTING OF GRIEVANCES**	There is no dedicated digital system to manage consumer grievances. Grievances are mainly reported through physical visits to the local offices or via the VWSCs , phone calls to departmental helplines, WhatApp channels, emails etc. Grievances are also reported via State-level grievance system and PHED-related grievances are notified to the department via emails or WhatsApp.

CAPACITY BUILDING

PHED West Bengal actively engages in mass awareness campaigns, especially leveraging festive and community events to reach a broad citizen base. These efforts extend to localized orientation, capacity building, and AV-based IEC, tailored in vernacular languages.

There is a coordinated institutional mechanism (the WSSO) for ongoing IEC/O&M awareness, which scales from community to disaster-response levels. Non-government partners (like UNICEF-supported groups and IMAGIN) have played a pivotal role in behavior change and grassroots planning.

However, digital platforms (like social media, mobile apps, or SMS campaigns) for IEC are not prominently evident in current documentation —indicating an opportunity for digital expansion.



ROLE-BASED DASHBOARDS AND REPORTS

PHED West Bengal has developed a very comprehensive and user-friendly citizen-facing dashboard, the WB-JJM Dashboard, available at the link https://jjm.wbphed.gov.in/dashboard/home. The dashboard provides detailed information on FHTC progress, scheme information, state PMU details and, for few schemes where IoT devices are deployed, real-time data like pump status, chlorine pump status, total 'on' time, water level, residual chlorine, water pressure in OHR, velocity etc. are displayed on the citizen dashboard, providing complete transparency.

CONTEXTUAL CHATBOTS

At present, no chatbots are available for citizens.

STAKEHOLDER LIFECYCLE MANAGEMENT

Robust consumer lifecycle management owing to a well-defined evidence-based consumer onboarding process using the Jal Swapna Mobile App and assignment of a 12-digit UTID.

ROLE-SPECIFIC MOBILE APPS

At present, there are no mobile apps available to citizens. There used to be an issue-tracker mobile app for grievance reporting, which has been discontinued due to certain operational reasons. The department is planning to build a new mobile app for grievance reporting and management.

PURPOSE BUILT DIGITAL TOOLS

There is no information on additional purpose-built digital tools for citizens.

Frontline Workers Applications

DAILY WATER SUPPLY MEASUREMENT & REPORTING	Captured through the Jal Swapna app by PHED staff; tracked via internal MIS and reflected partially on public dashboards.
FTK REPORTING (FIELD TEST KIT REPORTING)	Digitally reported via the Water Quality App; data is uploaded to centralized dashboards; includes photo/GPS- tagging.
COMMUNITY MOBILIZATION & IEC	Well digitized IEC processes and automation within the Jal Mitra application.
MINOR REPAIRS MANAGEMENT	Not centrally digitized; field-level interventions are handled offline; no structured digital interface is observed.
EXPENSE AND PAYMENT MANAGEMENT	Captured via MIS modules, reflected in Jal Swapna (project financials), and tracked through work orders and PFMS-linked dashboards.
DATA COLLECTION AND DIGITAL REPORTING	Implemented across Jal Mitra, Jal Swapna, and the Water Quality App; involves manual field-level data entry but ensures consistent backend aggregation and reporting.
WATER DISRUPTION AND REPORTING	Not separately reported or visualized publicly; no dedicated module or alert mechanism is currently available in Jal Mitra or Jal Swapna.
REPORTING OF GRIEVANCES	There is no separate channel for frontline workers' grievances.
ROLE-BASED DASHBOARDS AND REPORTS	Several dashboards are available for frontline workers, providing near real-time information.
CONTEXTUAL CHATBOTS	There is no chatbots interface for frontline workers at present.
STAKEHOLDER LIFECYCLE MANAGEMENT	Stakeholders like pump operators, etc., are properly onboarded in the systems.

CAPACITY BUILDING

Community-based water quality surveillance: The state programme emphasizes community-linked labs and FTK use; frontline workers and community volunteers are oriented to sample collection, safe storage, and reporting.

Routine training via WSSO: The WSSO conducts IEC & HRD activities year-round at the state/district/block levels, including sessions for field staff during normal times and emergencies.

Block-level mobilization through ISAs: Work orders show ISA teams running community sensitization on O&M, legal aspects (e.g., illegal connections), safe handling/storage, and WASH topics—frontline staff participate and reinforce messages in villages.

ROLE SPECIFIC MOBILE APPS

A Pump Operator App is in the initial stage of rollout for pump operators to record the on-off time of pump via the app, so that functionality monitoring can be done.

PURPOSE BUILT DIGITAL TOOLS

There is no information on any additional purpose-driven digital tools for frontline workers.

Agencies Applications

PROJECT EXECUTION & MONITORING	Agencies execute approved schemes by constructing water supply infrastructure, installing components, and coordinating with PHED and VWSCs. They also monitor work through inspections, geotagging, progress reporting, and quality checks, ensuring timely completion and compliance with standards.
THIRD-PARTY INSPECTION & VALIDATION	Digital tools available for third-party inspection and validation.
O & M SERVICE DELIVERY	The Gram Panchayat Water & Sanitation Committee (GPWSC) operates the system and collects a monthly tariff from each household, which fully covers O&M expenses. It also manages meter reading and grievance resolution.
ASSET TAGGING AND HANDOVER	The mission integrates with platforms like PM Gati Shakti to share geospatial infrastructure data (e.g., pipelines, reservoirs) for coordinated planning and asset tagging.
WATER QUALITY TESTING & REPORTING TOOLS	The state uses a Water Quality Management Information System (WQMIS) integrated with mobile apps for sample collection, verification, and approval. Around 217 water quality testing labs, including sub-district, district, and state-level facilities, carry out periodic testing—typically every six months for FHTCs.
RESOURCE MOBILIZATION AND RESOURCE TRACKING	No information is available.
BULK WATER FLOW MONITORING & SCHEDULING	Bulk metering is done in a few multi-village schemes.
REPORTING OF GRIEVANCES	There is no separate channel for reporting grievances of Agency-level stakeholders.
ROLE-BASED DASHBOARDS AND REPORTS	Decent dashboarding and reporting are available.

CAPACITY BUILDING

Formal engagement of ISAs for community mobilization & capacity building: Multiple districts engage ISAs to run sustained IEC and capacity-building cycles (e.g., Darjeeling & Kalimpong).

District Project Management Units (DPMUs): Engagements are recorded in PHED tracking for HRD/capacity work—these units help plan, supervise, and report IEC/CB activities.

Water-quality IEC embedded in lab operations: Ongoing work orders fund operational charges for PHED/NGO labs and NABL-related activities; agencies use these touchpoints for citizen messaging on testing and safe use.

CONTEXTUAL CHATBOTS

No chatbot or automated conversational interface is deployed for Agency-level stakeholders.

STAKEHOLDER LIFECYCLE MANAGEMENT

Information is not available.

ROLE - SPECIFIC MOBILE APPS

There is a rich suite of mobile apps for operators, contractors, and agencies to manage their field operations efficiently and effectively. Some of these apps include the Jal Swapna Mobile App, Jal Mitra Mobile App, Asset Management Mobile App, Water Quality Mobile App & ChlorStock Mobile App.

PURPOSE-BUILT DIGITAL TOOLS

There is no information on any additional purpose-driven digital tools for Agencies.

Department Applications

ASSET & INVENTORY MANAGEMENT	Assets are tracked through an asset management app, with division-level asset registries and integration plans for Gati Shakti. Each scheme has a unique code mapped to IMIS and state databases, aiding asset traceability.
VENDOR & CONTRACT MANAGEMENT	Vendor registration systems are in place, with around 10-12 vendors engaged. Source code is collected during procurement, and a mix of open-source and licensed technologies (Oracle, MS SQL, MongoDB) is used.
WORK ORDER, INVOICES & PAYMENTS	The e-Measurement Book (e-MB) system digitally records work measurements, generates bills, and processes fund requisitions, mainly handled by junior engineers. Pump operator payments are linked to motor readings.
BUSINESS INTELLIGENCE & DATA ANALYTICS	State dashboards and WQMIS enable monitoring of water quality, scheme progress, and grievance redressal.
MANAGEMENT INFORMATION SYSTEMS (MIS)	Multiple apps, including Jal Mitra and lab-testing tools, collect consumer, scheme, and operational data, feeding into the central MIS for scheme monitoring and reporting.
LAB INFORMATION MANAGEMENT SYSTEM	WQMIS manages data from 217 labs (district, sub-district, and state levels), enabling sample tracking, quality monitoring, NABL compliance, and integration with mobile/web apps for water testing cycles.
FINANCIAL TRACKING & IFMS INTEGRATION	IFMS exists.
GIS MAPPING & GEOTAGGING	**GIS mapping and geotagging** are used to digitally map all water supply assets, such as pipelines, reservoirs, treatment plants, and household connections. Each asset is geotagged with precise coordinates and linked to scheme data in IMIS and state databases, enabling better planning, monitoring, and integration with platforms like Gati Shakti for infrastructure coordination.
SOURCE GEOLOGY	No information is available.
STAKEHOLDER LIFECYCLE MANAGEMENT	With SSO in place, there is a well defined process for staff lifecycle management.

IOT DEVICES & SCADA	Over 250 IoT devices—mainly chemical, flow, and pressure sensors—are deployed to monitor parameters like residual chlorine and TDS. SCADA systems are operational at around five sites, with more planned, enabling remote monitoring and control of select schemes.
BOQ & DPR GENERATION TOOLS	No information is available.
PREDICTIVE MAINTENANCE & SCHEME RISK FORECASTING	No information is available.
SOURCE SUSTAINABILITY AND AUDIT	Such action is not taking place currently, but they have plans for this in the future.
HYDRAULIC MODELING	Hydraulic modelling is not happening in the department.
 **CAPACITY BUILDING**	**WSSO as a nodal unit for IEC/HRD:** The WSSO page explicitly assigns it responsibility to plan, organize, and implement IEC/HRD on safe water and sanitation—including during disasters—covering statewide coordination with districts and blocks. **State dashboards/work-order tracking to steer IEC:** PHED's JJM portals list scheme categories like **Support-IEC** and **Support-WQMSP**, with value, agency, timelines, and progress—used by department staff to monitor delivery and course-correct. **Convergence with partners:** Public records show collaboration with ISAs/NGOs (e.g., SIGMA Foundation pilots with UNICEF) that combine digital monitoring with citizen communication—state staff oversee and integrate such learnings.
REPORTING OF GRIEVANCES	No information is available on the grievance reporting system for employees.
ROLE-BASED DASHBOARDS AND REPORTS	MIS and dashboards are available for internal tracking of physical and financial progress, though access is primarily role-specific to officials. With dedicated initiatives like the data lake, this area will be further strengthened.
CONTEXTUAL CHATBOTS	WhatsApp based AI enabled chatbot named Jal Saathi has been rolled out, which connects with a centralized data lake and provides an intuitive interface to answer common questions on Scheme progress, financial tracking, water quality etc.

ROLE SPECIFIC MOBILE APPS	Jal Saathi is not a native mobile app, but it provides a user-friendly mobile interface.
PURPOSE-BUILT DIGITAL TOOLS	Mega Scheme app & IEP/AIRP apps are great examples of purpose-built digital tools.

State Functionaries

INTER DEPARTMENTAL DATA EXCHANGE	There is interfacing with the WB Electricity Board, where electric meter readings with latitude and longitude are collected at the site and entered in a central database, which is shared with the PHED. With this data, PHED analyzes various dimensions, such as whether there are any waste electric connections for which the department is paying unnecessary money and identifying outlier sites in electricity consumption. This helps in isolating problems with pump motors. The Jal Swapna app integrates with the SBM-G database to fetch the family ID at the time of onboarding a new consumer. There is integration with the Aadhaar platform for verifying and fetching consumer details at the time of issuing a new connection. PM Gati Shakti compliance is under planning through the Asset Management app, with integration of historical DPRs. It is still at an early stage and currently isolated to spatial validation only. Grievances are logged at the CMO grievance desk and also from CPGRAMS; however, at the PHED end, these grievances are received only via email.
JOINT PLANNING & APPROVAL WORKFLOWS	Not assessed; information is not available at present.
GRIEVANCE & FEEDBACK LOOP INTEGRATION	Not assessed; information is not available at present.
JOINT TRAINING & KNOWLEDGE SHARING PLATFORM INTEGRATION	Not assessed; information is not available at present.
CROSS-SECTORAL POLICY ALIGNMENT	Not assessed; information is not available at present.
CROSS-SECTOR ANALYTICS & DASHBOARDS	Not assessed; information is not available at present.
EMERGENCY RESPONSE & DISASTER MANAGEMENT INTEGRATION	Not assessed; information is not available at present.

Technology Foundation

UNIFIED / INTEGRATED PLATFORM APPROACH	PHED West Bengal employs a fragmented ecosystem of specialized applications rather than a unified platform. Real-time integration between apps is limited. However, a project is undertaken to build a data lake which will absorb data from multiple applications and will provide a unified data bed for analytics and insights.
MODERN TECHNOLOGY STACK & CLOUD NATIVE ARCHITECTURE	Owing to multiple applications, there is a large set of technologies being used; a majority of them belong to the open source category, such as Java, Android, PHP, Laravel, MongoDB, JSP, Spring, MySQL, and PostgreSQL. At the database level, proprietary solutions like Oracle and MS SQL are also heavily used.
INTEROPERABILITY WITH CENTRE SYSTEMS	There is zero to minimal interoperability with the Centre's IMIS application. No API integration exists; some data is taken from APIs and manually entered into the systems. There is a huge gap between Center and State data taxonomy, which results in duplicate data entry. In WQMIS, data is pushed via API, but it also requires manual validation. The department mentioned that APIs of the Centre's WQMIS are very slow.
API INTEGRATIONS WITH EXTERNAL APPLICATIONS	There is no API integrations with external applications.

IDENTITY & ACCESS	• SSO via Google SAML
	• Two-factor authentication + CAPTCHA for all systems.
	• Role-based access:
	  ◦ Junior engineers (e-MB)
	  ◦ ISAs (Jal Mitra)
	  ◦ Lab technicians (Water Quality Apps)

USE OF ARTIFICIAL INTELLIGENCE	The department has recently started using AI technologies in building digital tools. The Jal Saathi chatbot is a WhatsApp-based, AI-enabled application which connects with a data lake at the backend and provides an interface to the department staff responding to day-to-day queries, thereby increasing their efficiency. Also, the department is experimenting with OCR tools to extract and serve DPR content to engineers.
SECURITY AND COMPLIANCE	• Two-tier physical security • Next-generation firewall is being used • Intrusion Prevention System (IPS) is deployed • Zero-day attack mitigation is present • Login from new machine is detected automatically and accordingly extra security steps are mandated for the purpose of additional security • CAPTCHA is auto-enabled • Two-factor authentication

Infrastructure

HOSTING INFRASTRUCTURE	The department has its own data centre located within its own building. The department felt that there were too many bindings and regulations in using the State Data Centre or NIC hosting. Also, the level of confidence in public cloud service providers is low owing to frequent cyberattacks. The department does not want to compromise on security, therefore they chose to go with their own data centre. There is greater liberty with their own data centre. Google accounts are taken from the India Data Centre for emails.
 **STORAGE AND DATABASES**	Since there are multiple IT applications, there is a variety of databases used, primarily Oracle. **Managed MySQL** (DigitalOcean) for structured transactional data, with automated backups. **PostgreSQL with PostGIS** for geospatial data storage. **Redis** for caching and session storage. **Object storage** with versioning for document management. The volume of data is high. Everyday ~2GB data is added in various data stores. There are two SAN disks, one for primary purposes and a secondary one for de-duplication.
HIGH AVAILABILITY & DISASTER RECOVERY	At present, there is no disaster recovery (DR) site commissioned. A DR site was planned 4-5 years back. There was a major cyclone that damaged the DR site. There is planning in progress to set up another DR site in Bengaluru.
MONITORING & OBSERVABILITY	Monitoring and observability tools are in place to track system performance and service health.
SCALABILITY (HORIZONTAL & VERTICAL)	Scalability is currently vertical due to the monolithic architecture, but performance is enhanced through advanced indexing, optimized queries, and potential sharding for future growth. Horizontal scaling is constrained because of the monolithic architecture.
BACKUP AND RECOVERY MANAGEMENT	Backup strategies include daily and weekly automated database backups, Redis snapshotting, and version-controlled document recovery, ensuring data integrity and disaster recovery readiness.
NETWORKING AND CONNECTIVITY	There are two internet lines, STPI (50 Mbps) and BSNL (75 Mbps) connections at the data centre. Connectivity is quite consistent at field locations in terms of IoT devices; real-time data flow is working fine.

JJM Gujarat

The Water Supply Department, Gujarat, is responsible for delivering safe drinking water and sanitation services to over four crore people in the state through its three arms—Gujarat Water Infrastructure Limited (GWIL), Gujarat Water Supply and Sewerage Board (GWSSB), and Water and Sanitation Management Organisation (WASMO). The department undertakes bulk transmission, distribution, treatment, and source development projects, along with their operation and maintenance. The broader division of responsibilities of the three governing bodies is depicted in the figure below.

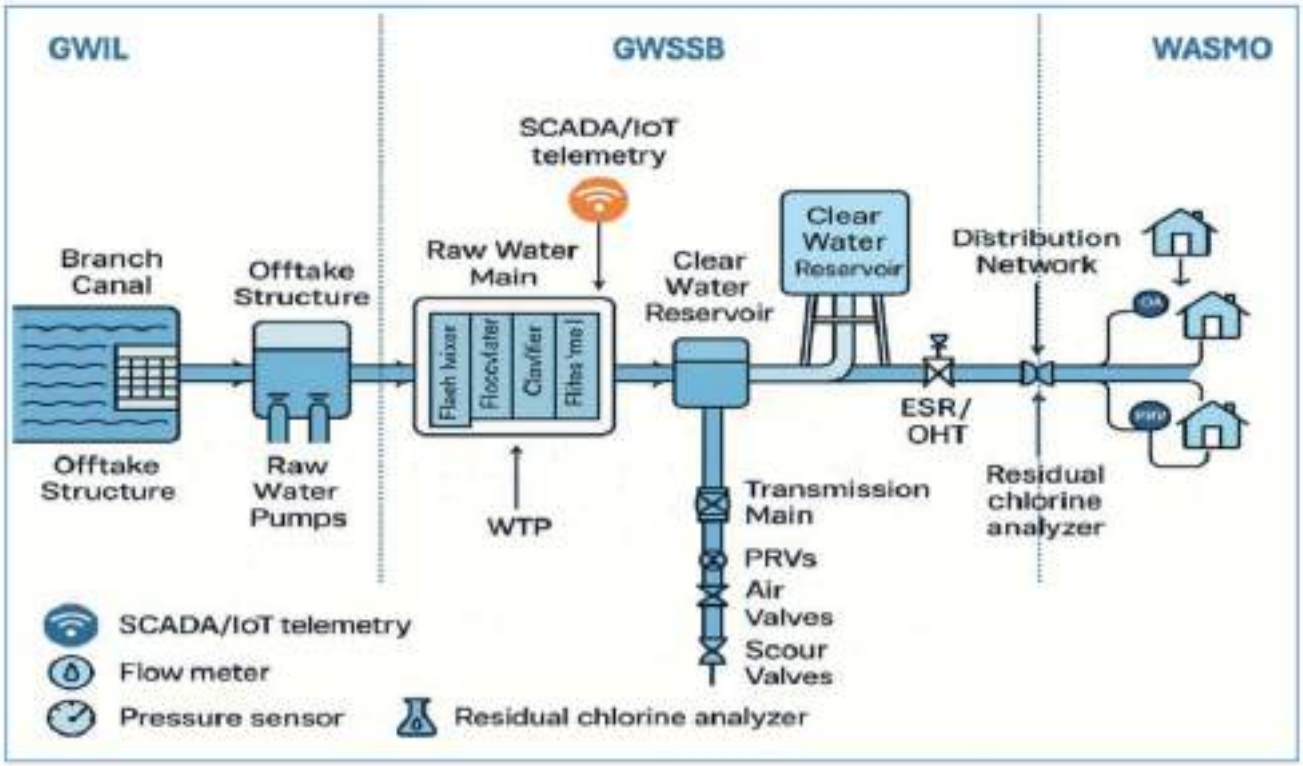


Figure 12: Block diagram of the water supply infrastructure

Highlights

1. Scheme Tracking System (STS)

The Scheme Tracking System (STS) under GWSSB provides a digital platform for end-to-end tracking of water supply schemes and projects. It monitors progress from conceptualization to execution, ensuring accountability, timely updates, and effective coverage monitoring. The system links data on WTPs, pumping stations, pipelines, and village-level connections, allowing engineers and administrators to track status at multiple levels.

2. Grievance Redressal Mechanism

Gujarat has established a robust grievance redressal mechanism for rural water supply. Citizens can raise complaints through the 1916 toll-free helpline and the Handpump Grievance App, with all complaints logged digitally, geotagged, and forwarded to the relevant division (Civil, Mechanical, WASMO) for resolution.

In parallel, the Jal Sampark application is used by engineers, pump operators, and frontline staff to inspect issues, mark attendance, and close tickets with photo and geotagged evidence. Together, these systems ensure responsive grievance handling, with over 99% of complaints successfully resolved.

3. Call Centre for Customer Feedback

A proactive call centre is operational for measuring citizen satisfaction, particularly in rural water supply schemes.

4. ERP & HR Modules

Since May 2020, the department's ERP system (developed by In2IT Technologies) has become the digital backbone for governance. It includes modules for project monitoring, O&M, procurement, finance, and HR.

HR modules manage leave, payroll, transfers, and postings, while integrated mobile apps, such as Jal Sampark, allow field-level updates. This has streamlined administrative workflows and enabled paperless governance.

5. GIS Mapping Initiatives

With support from BISAG and PM GatiShakti, GWSSB has mapped critical water infrastructure, such as pumping stations, reservoirs, pipelines, and ponds, using GIS. This enables accurate asset tracking, geotagging of IoT devices, and better planning of future schemes. GIS-based mapping also strengthens cross-sector planning, linking water schemes with other infrastructure such as roads and power lines.

6. Water Quality Monitoring

Water quality is monitored using a two-tier system: 80% through Field Test Kits (FTKs) and 20% through laboratories. Gujarat has 283 block-level labs, 33 district labs, and 1 state-level lab, all integrated through the Lab Information Management System (LIMS). Results are uploaded into WQMIS, ensuring transparency.

IoT-based sensors further monitor chlorine, turbidity, and TDS at pumping stations, linking quality assurance to real-time operations.

7. MIS & Reporting Dashboards (Internal)

The ERP and STS systems generate role-based dashboards for different administrative levels (HO, Zone, Circle, Division, Subdivision). These dashboards track scheme progress, fund utilization, grievance pendency, pumping station status, and water quality compliance. Engineers and administrators rely on these dashboards for real-time decision-making and performance monitoring.

8. Tendering & E-Procurement Integration

The department uses government e-procurement platforms to handle tenders, ensuring transparency, efficiency, and compliance with state digitalization initiatives. Through this system, vendors and contractors can access tender notices, submit bids, and track contract status online, minimizing manual intervention and reducing delays.

Strategic improvement areas

1. Citizen-Facing Dashboards

- Issue: No real-time dashboards are available for citizens to view water supply status, scheme coverage, or water quality.
- Impact: Limited transparency leads to reduced citizen trust and weaker accountability.
- Recommendation: Develop public-facing dashboards linked to ERP, WQMIS, and IoT data, displaying village-level supply status, quality reports, and grievance resolution progress.

2. Data Lake & Unified Information Store

- Issue: Information is fragmented across systems (STS, labs, grievance redressal, HR).
- Impact: Lack of integration prevents comprehensive analytics, slows decision-making, and duplicates effort.
- Recommendation: Establish a centralized data lake/unified virtual information store to consolidate datasets from all digital initiatives, enabling seamless analysis and cross-departmental use.

3. Advanced Analytics & AI

- Issue: Limited use of predictive analytics for demand forecasting, leak detection, or scheme performance monitoring.
- Impact: Reactive management continues, with missed opportunities for early intervention and optimization.
- Recommendation: Introduce AI/ML models for demand forecasting, anomaly detection, and predictive maintenance, integrated with ERP and IoT systems.

4. Water Quality Transparency

- Issue: While labs and FTKs test water, citizens cannot easily access real-time local water quality results.
- Impact: Communities remain unaware of water safety, reducing confidence in service delivery.
- Recommendation: Publish village-level water quality results on public dashboards and mobile apps, updated directly from LIMS/WQMIS.

5. Integration of Disparate Systems

- Issue: Systems like STS, ERP, grievance portals, IoT devices, and GIS mapping operate in silos.
- Impact: Duplication of work, inconsistent data, and weak flow of information across platforms.
- Recommendation: Create a unified digital platform with APIs ensuring interoperability and a single source of truth across all water sector applications.

6. Enhancing Mobile Applications

- Issue: Existing apps (e.g., Jal Sampark) are primarily staff-facing and limited in scope.
- Impact: Citizens, contractors, and many frontline workers lack mobile tools for reporting and engagement.
- Recommendation: Expand mobile application ecosystem with role-specific apps for citizens, contractors, pump operators, and supervisors, integrated with ERP and grievance systems.

7. Data-driven Decision Making

- Issue: Although data is collected, analytics and modeling are underutilized in decision-making.
- Impact: Resource allocation and supply chain management remain sub-optimal.
- Recommendation: Institutionalize data-driven governance, using analytics to predict demand, plan schemes, and optimize O&M, with insights fed into management dashboards and review processes.

Gujarat IT Capabilities Mapping

Based on a two-day onsite As-Is Study visit to GWSSB (Gujarat Water Supply and Sewerage Board), this report attempts to map the capabilities of Gujarat GWSSB IT systems using the DMM framework.

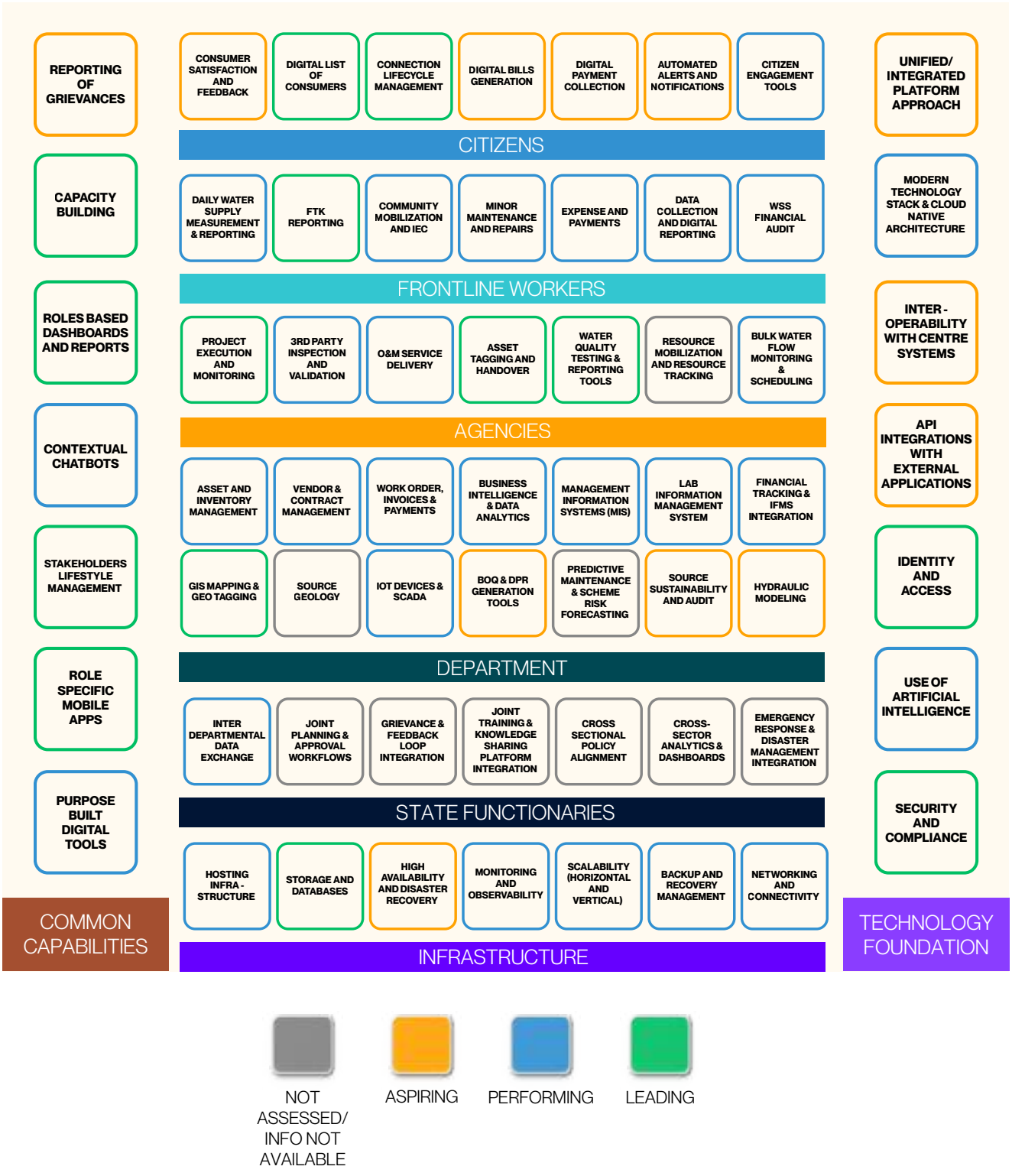


Figure 13: State IT Systems – Gujarat's GWSSB IT Capabilities Scorecard

Citizens Applications

CONSUMER SATISFACTION SURVEY/FEEDBACK	The Consumer Satisfaction Survey Call Center is housed at the WASMO building and is operated with technical support from BSNL. On average, 700 calls per day are made from this call centre. Approx. 4.5 lakh calls have been made till date from the call centre. The process is streamlined, but not integrated with other IT applications, therefore, there is human intervention in transferring the data back and forth.
DIGITAL LIST OF CONSUMERS	At present, there is no comprehensive process to manage and maintain the digital list of consumers. For purposes like the Consumer Satisfaction Call Centre, the consumer list is collected from multiple sources like ASHA workers, doctors, ration shops, etc.
CONNECTION LIFECYCLE MANAGEMENT	Such management is not happening yet; however the department plans to introduce a digital Connection Lifecycle Management system to streamline new connections, transfers, and closures, ensuring greater efficiency and transparency.
DIGITAL BILLS GENERATION	The bills are not generated digitally. However, the tariff is fixed at a rate of Rs. 2/1,000 liters.
DIGITAL PAYMENT COLLECTION	The collection happens manually.
AUTOMATED ALERTS AND NOTIFICATIONS	The department is exploring the implementation of automated alerts and notifications to further enhance responsiveness and citizen engagement.
CITIZEN ENGAGEMENT TOOLS	A minimum level of citizen engagement activity happens on the ground which is conducted by the Pani Samiti or VWSC. Also, Gujarat celebrates a Jal Utsav festival in order to promote water conservation, making citizens the medium for the same.
CAPACITY BUILDING	Citizen training includes community-led planning, water source mapping, and formulation of solutions for long-term water security. Committees are trained in WASH practices and scheme maintenance.

REPORTING OF GRIEVANCES	The GWSSB and WASMO have established effective grievance redressal mechanisms through the 1916 toll-free helpline, ensuring that citizens' water supply issues are addressed promptly and transparently. There is a Jal Sampark Mobile application, which performs evidence based tracking and closure of grievances. There is also a separate mobile app for raising handpump grievances. Overall, there is a conducive process adherence for grievance management, which includes raising suo-moto grievances via television news, print media, radio, and social media. Suo-moto grievances are also raised based on the customer satisfaction survey.
ROLE-BASED DASHBOARDS AND REPORTS	No consumer-facing dashboards are developed.
CONTEXTUAL CHATBOTS	No such chatbots are present in the system currently, but there is a plan to develop these.
STAKEHOLDER LIFECYCLE MANAGEMENT	There is no mechanism for end-to-end life cycle management. However, online water connection applications are supported.
ROLE-SPECIFIC MOBILE APPS	There are no citizens-facing mobile applications yet.
PURPOSE-BUILT DIGITAL TOOLS	No information is available on additional purpose-built digital tools.

Frontline Workers Applications

DAILY WATER SUPPLY MEASUREMENT & REPORTING	The pump operator records the on/off status of pumps on a daily basis, ensuring that operational data is consistently tracked. This information is then uploaded and reported on the ERP portal, providing real-time visibility of pumping operations to supervisory staff and enabling better monitoring of the rural water supply system.
FTK REPORTING (FIELD TEST KIT REPORTING)	80% of the water quality testing is done by FTK test kits.
COMMUNITY MOBILIZATION & IEC	WASMO is responsible for community mobilization through awareness campaigns. GWSSB has made the provision of IEC at a very broad level for the villagers.
MINOR MAINTENANCE & REPAIRS	It is primarily taken care of by the Gram Panchayat. There is no digital tool to manage this area.
EXPENSE AND PAYMENT MANAGEMENT	No information is available.
DATA COLLECTION AND DIGITAL REPORTING	Not much information could be gathered on the digital tools for field data collection.
WSS FINANCIAL AUDIT	No information is available.
REPORTING OF GRIEVANCES	There is no separate channel for frontline workers to raise grievances; however, they can make use of the 1916 helpline to report grievances.
CAPACITY BUILDING	WASMO has a dedicated, in-person training for frontline workers. For instance, in the tribal villages of Dahod, Pani Samitis successfully managed O&M after being trained by WASMO.

ROLE-BASED DASHBOARDS AND REPORTS	Not available.
CONTEXTUAL CHATBOTS	Not available currently.
STAKEHOLDER LIFECYCLE MANAGEMENT	Stakeholders like pump operators, etc. are properly onboarded in the ERP system.
ROLE-SPECIFIC MOBILE APPS	Applications like Jal Sampark and the handpump grievance redressal are developed and used by different frontline workers.
PURPOSE-BUILT DIGITAL TOOLS	No information is available on additional purpose-built digital tools.

Agencies Applications

PROJECT EXECUTION & MONITORING	**Projects are largely managed by vendors/contractors** under the supervision of GWSSB. Over 350 vendors are spread out across the schemes, taking care of execution and monitoring.
THIRD PARTY INSPECTION & VALIDATION	No such provision has been established yet.
O & M SERVICE DELIVERY	In-village Water Supply Schemes (IWSS) are typically operated and maintained by local Gram Panchayats or Pani Samitis, while Regional Water Supply Schemes (RWSS/MVS) may still have O&M support from GWSSB or contracted agencies.
ASSET TAGGING AND HANDOVER	The process is being implemented at scale, and once assets are tagged, the data is systematically uploaded onto the BISAG portal.
WATER QUALITY TESTING & REPORTING TOOLS	Water quality testing is carried out using FTKs and laboratories, and the results are reported through WQMIS.
RESOURCE MOBILIZATION AND RESOURCE TRACKING	No information is available.
BULK WATER FLOW MONITORING & SCHEDULING	The bulk water flow monitoring is happening with the help of smart monitoring sensors.
CAPACITY BUILDING	The field workers are getting employed with a common training portal GJTI.
REPORTING OF GRIEVANCES	No separate digital tool for agencies to report grievances.
ROLE-BASED DASHBOARDS AND REPORTS	ERP provides login access to the Agencies, using which the corresponding stakeholders can view and access the required information.

CONTEXTUAL CHATBOTS	Not available.
STAKEHOLDER LIFECYCLE MANAGEMENT	The ERP maintains the lifecycle of Agencies and contractors/vendors in the system. Login credentials are provided to them, with which they can login into the system.
ROLE SPECIFIC MOBILE APPS	Jal Sampark and handpump grievance apps exist but mainly for engineers, operators, and Pani Samitis.
PURPOSE BUILT DIGITAL TOOLS	Tools like Jal Sampark, 1916 Call Center, ERP portal, and asset mapping systems are in place for specific function.

Department Applications

ASSET & INVENTORY MANAGEMENT	All the assets are tagged and have an entry in the ERP.
VENDOR & CONTRACT MANAGEMENT	There are 350+ vendors assigned at the scheme-level for operation and maintenance purposes.
WORK ORDER, INVOICES & PAYMENTS	These are taken care of by the ERP.
BUSINESS INTELLIGENCE & DATA ANALYTICS	Data analytics is happening offline using the Power BI, after extracting data from the ERP portal in Excel format. Human intervention is required to extract, transform and load the data for analytics.
MANAGEMENT INFORMATION SYSTEMS (MIS)	The department has quite a comprehensive ERP system which is the backbone of the management information for the GWSSB/WASMO.
LAB INFORMATION MANAGEMENT SYSTEM	Gujarat has developed a **home-grown LIMS**, supported by NIC, specifically for **water quality testing and reporting**.
FINANCIAL TRACKING & IFMS INTEGRATION	No information is available.
GIS MAPPING & GEO-TAGGING	Asset tagging and reporting is carried out at the PM Gati Shakti portal.
SOURCE GEOLOGY	Data is stored in the dedicated department where they store ground strata data.
PURPOSE-BUILT DIGITAL TOOLS	There is no information on additional purpose-built digital tools.

IOT DEVICES & SCADA	The department has introduced **bulk water metering and IoT-enabled sensors** to improve real-time monitoring of the rural water supply network. Sensors record parameters such as **flow, pressure, residual chlorine, and Total Dissolved Solids (TDS)** at **five-minute intervals**.
BOQ & DPR GENERATION TOOLS	The ERP has a comprehensive e-procurement & e-measurement book modules which manages Bill of Quantities (BoQ) and Detailed Project Report (DPR)
PREDICTIVE MAINTENANCE & SCHEME RISK FORECASTING	Predictive analysis is not happening currently. However, in the future, it is easily doable, provided smart sensors are installed at major locations.
SOURCE SUSTAINABILITY AND AUDIT	There is no sustainability angle added to the source yet. However, the source and tubewell are the responsibility of the State or contractors.
HYDRAULIC MODELING	No hydraulic modeling is happening.
CAPACITY BUILDING	This is happening by means of the GJTI portal, developed by GWSSB.
REPORTING OF GRIEVANCES	No information is available on whether the department has a grievance system for its staff.
ROLE-BASED DASHBOARDS AND REPORTS	The ERP portal provides role-based dashboards and reporting features, ensuring that information is tailored according to users' level of responsibility.
CONTEXTUAL CHATBOTS	No chatbots have been built yet.
STAKEHOLDER LIFECYCLE MANAGEMENT	A well-defined lifecycle management system for department officials is managed via the ERP. With Single Sign-On (SSO) in place, no separate credentials are required for multiple applications.
ROLE-SPECIFIC MOBILE APPS	Jal Sampark mobile application is in use.

State Functionaries Applications

INTER DEPARTMENTAL DATA EXCHANGE	There is insufficient information available in this area.
JOINT PLANNING & APPROVAL WORKFLOWS	Scheme approvals and workflows follow the state-level committees (SLSSC/DWSM) with inputs from WASMO, and other agencies. There is a unified experience across all three arms of WSD—GWIL, GWSSB & WASMO via the ERP, where, from a single interface, workflow actions can be assigned across the three departments. However, no evidence could be found for cross-departmental grievances and feedback loops.
GRIEVANCE & FEEDBACK LOOP INTEGRATION	While feedback loops exist across the three departments of the WSD, no evidence could be found of grievance and feedback loops across other departments.
JOINT TRAINING & KNOWLEDGE SHARING PLATFORM INTEGRATION	The GJTI serves as the nodal training institute for water and sanitation, organizing workshops, exposure visits, and online resources. While training is strong, a cross-sectoral digital knowledge-sharing platform is not yet operational.
CROSS - SECTORAL POLICY ALIGNMENT	There is insufficient information available in this area.
CROSS-SECTOR ANALYTICS & DASHBOARDS	There is insufficient information available in this area.
EMERGENCY RESPONSE & DISASTER MANAGEMENT INTEGRATION	There is insufficient information available in this area.

Technology Foundation

UNIFIED / INTEGRATED PLATFORM APPROACH	Instead of maintaining fragmented systems for projects, operations, finance, and citizen services, GWSSB has developed the Enterprise Resource Planning (ERP) system. However, several applications still do not talk to each other, creating the need for human intervention. For example, there is no integration between the call centre application and the grievance application, and analytics is completely offline.
MODERN TECHNOLOGY STACK & CLOUD NATIVE ARCHITECTURE	Owing to multiple applications, there is a large set of technologies used; majority of them belong to open-source categories like Odoo, python, PostgreSQL. Core IT Stack • Frontend: JavaScript-based responsive design, optimized for both desktop and mobile browsers. • Backend: Python, XML, and HTML for business logic and API integration. • Database: PostgreSQL – chosen for scalability, reliability, and open-source flexibility.
INTEROPERABILITY WITH CENTRE'S SYSTEMS	Interoperability with the Centre systems is minimal.
API INTEGRATIONS WITH EXTERNAL APPLICATIONS	No API integrations with external applications exist.
IDENTITY & ACCESS	Gujarat operates its own **Single Sign-On (SSO)** portal, allowing state users (government officials and some citizens) to access multiple **state-level services through a single login.** Two-factor authentication + CAPTCHA is used for the ERP login.
USE OF ARTIFICIAL INTELLIGENCE	There is no use of AI in the department currently.
SECURITY AND COMPLIANCE	Role-based Access: Segmented as Viewer, Maker, Checker, and Admin to maintain accountability and data security.

Infrastructure

HOSTING INFRASTRUCTURE	The department uses the Gujarat State Data Centre (GSDC) for hosting all its major applications. The GSDC is a secure and centralized Information Technology (IT) infrastructure established to host applications and data related to e-Governance initiatives at the state level. This facilitates the efficient delivery of government services across various sectors. The GSDC holds the distinction of being the first State Data Center implemented in India under the National e-Governance Plan (NeGP). Established in 2010, it serves as a central repository for storing and managing all digital data, applications, and services pertaining to the Government of Gujarat.
STORAGE AND DATABASES	Not much specific information is available in this area.
HIGH AVAILABILITY & DISASTER RECOVERY	All applications are being hosted in the State Data Center; high availability and disaster recovery of applications are as per State guidelines.
MONITORING & OBSERVABILITY	Could not gather information on this specific aspect.
SCALABILITY (HORIZONTAL & VERTICAL)	The ERP, being a monolithic application, has provision for vertical scalability. However, there does not seem to be an opportunity to scale the application horizontally.
BACKUP AND RECOVERY MANAGEMENT	All applications are being hosted in the State data Center; backup and recovery are therefore as per State guidelines.
NETWORKING AND CONNECTIVITY	Being hosted in the State Data Centre, networking and connectivity guidelines are as per State policies.

JJM Rajasthan

Rajasthan State has a plethora of digital applications/tools in all three—G2C, G2E, and G2B segments, in line with the Government of India's Digital India initiatives. Some prominent sector agnostic applications include RajKaj, RajMail, Sampark, e-Mitra, IFMS 3.0, RajSIMS, RajSSO-AMS, SSO Raj, etc. The state has adopted an IT-first policy to improve efficiency, transparency, and citizen engagement. The figure below shows a partial snapshot of the State's SSO platform landing page, which contains 200+ SSO-enabled application links. PHED's IT evolution aligns with the broader e-governance goals of the Rajasthan government, such as the Rajasthan E-Governance IT & ITeS Policy, which promotes digital ecosystems for public utilities. Key objectives include real-time monitoring of water resources, streamlined service delivery, and data-driven decision-making. As of now, PHED's systems support over 9,766 sanctioned schemes under the Jal Jeevan Mission, with a focus on urban and rural water supply.

Figure 14: Snapshot of the SSO portal home page

In the initial phases of JJM, the Project Monitoring Information System (ProMIS) served as a core application for tracking both physical and financial progress, enabling site engineers to upload geotagged images; however, this system has since been discontinued. Asset and scheme management are partially digitized, with records of pipelines, overhead tanks, and other infrastructure available, but with limited GIS integration and varying data completeness across districts. Water quality monitoring relies on laboratory information systems, though manual data entry delays real-time reporting, and there is no citizen-facing access to results. SCADA systems are deployed in select large-scale projects, such as the Bisalpur Water Supply Project in Jaipur, enabling real-time monitoring of flow, chlorine levels, and system performance; however, their use is

largely restricted to major urban infrastructure, with limited integration into rural or IoT-based systems. Citizen grievance redressal is relatively robust, with a 24×7 toll-free helpline (181) and integration with the Rajasthan Sampark Portal, allowing complaint tracking and escalation. Financial and procurement processes are digitized through e-procurement systems and treasury integration, ensuring transparency. Additionally, standard MIS dashboards support internal monitoring, although reporting to higher authorities still involves periodic manual compilation.

Highlights

PHED's IT systems promote efficiency, with RajNeer reducing paperwork and enabling 24/7 access. SCADA enhances reliability in urban areas, and award-winning initiatives demonstrate strong digital maturity. A cloud-based architecture supports scalability, while SSO integration minimizes user friction.

Strategic improvement areas

1. Lack of Interoperability with Centre IT Systems

- Issue: API integration with JJM-IMIS and WQMIS is currently non-functional; data entry is still manual.
- Impact: Causes reconciliation delays for over 44,000 villages and increases the risk of data mismatch.
- Recommendation: Revive and stabilize API integration with proper backend mapping and validation checks to ensure real-time data syncing with IMIS..

2. Fragmented Applications (Siloed Systems)

- Issue: Grievance redressal, Jal Mitra, WIMS, and WMS applications function in silos.
- Impact: Leads to duplicated entries, poor coordination, and fragmented scheme monitoring.
- Recommendation: Develop a middleware or shared services layer to enable data interoperability and task coordination across all apps.

3. Manual Water Quality Monitoring

- Issue: Water quality data is collected and entered manually by facilitators and lab staff.
- Impact: Delays in reporting, increased risk of errors, and poor integration with WQMIS.
- Recommendation: Digitize FTK test reporting, automate lab data upload, and ensure real-time linkage with WQMIS using unique household identifiers (UTIDs/QR codes).

4. Advanced Analytics & AI

- Issue: Limited use of predictive analytics for demand forecasting, leak detection, or scheme performance monitoring.
- Impact: Reactive management continues, with missed opportunities for early intervention and optimization.
- Recommendation: Introduce AI/ML models for demand forecasting, anomaly detection, and predictive maintenance, integrated with ERP and IoT systems.

5. Water Quality Transparency

- Issue: While labs and FTKs test water, citizens cannot easily access real-time local water quality results.
- Impact: Communities remain unaware of water safety, reducing confidence in service delivery.
- Recommendation: Publish village-level water quality results on public dashboards and mobile apps, updated directly from LIMS/WQMIS.

6. Enhancing Mobile Applications

- Issue: Existing apps are primarily staff-facing and limited in scope.
- Impact: Citizens, contractors, and many frontline workers lack mobile tools for reporting and engagement.
- Recommendation: Expand the mobile application ecosystem with role-specific apps for citizens, contractors, pump operators, and supervisors, integrated with the ERP and grievance systems.

7. Data-driven Decision Making

- Issue: Although data is collected, analytics and modeling are underutilized in decision-making.
- Impact: Resource allocation and supply chain management remain sub-optimal.
- Recommendation: Institutionalize data-driven governance, using analytics to predict demand, plan schemes, and optimize O&M, with insights fed into management dashboards and review processes.

Rajasthan IT Capabilities Mapping

Based on a two-day onsite As-Is Study visit to PHED, this report attempts to map the capabilities of Rajasthan's PHED IT systems using the DMM framework.

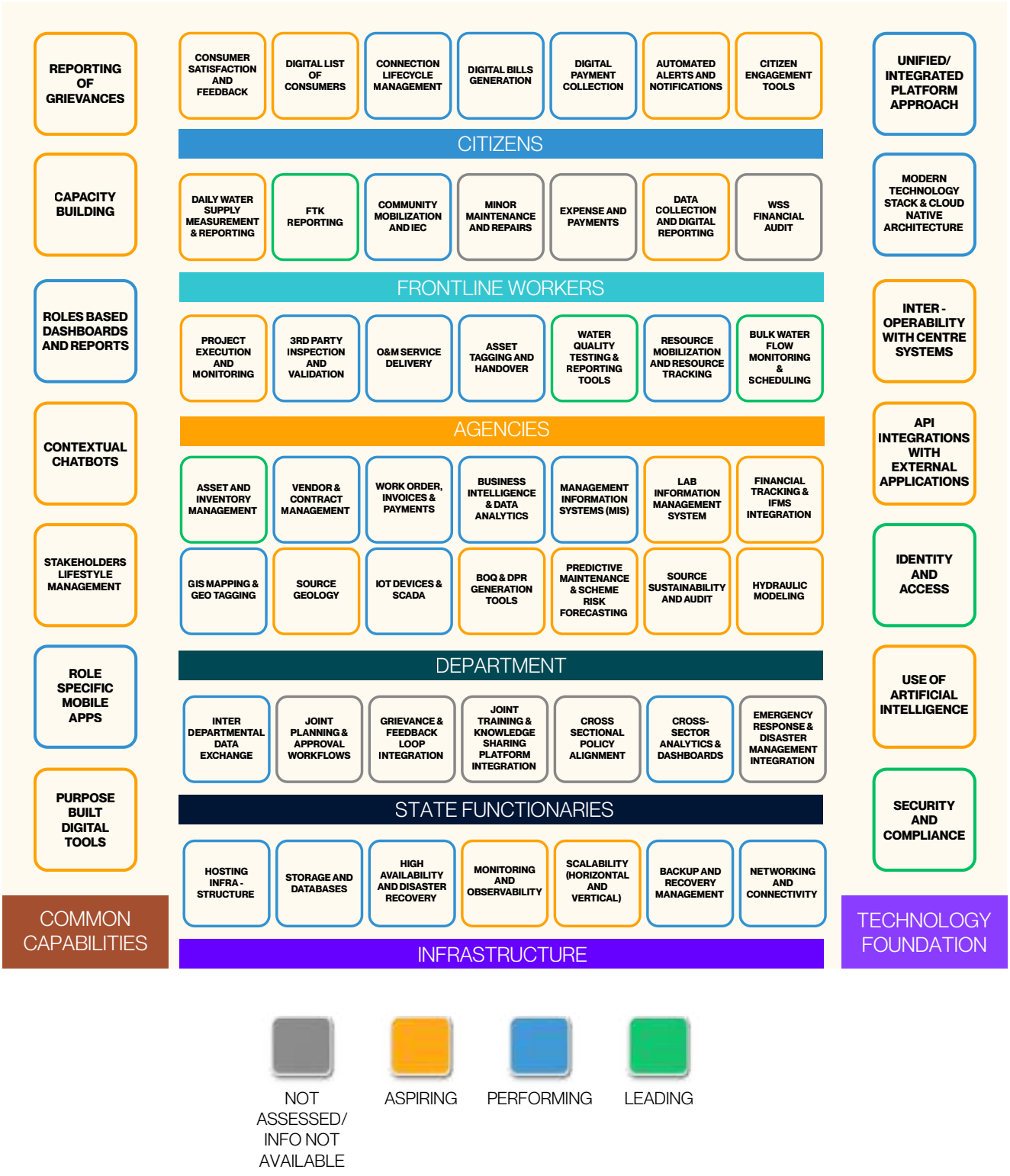


Figure 15: Rajasthan's PHED DMM Score Card

Citizens Application

CONSUMER SATISFACTION SURVEY/FEEDBACK	No structured consumer satisfaction surveys or digital feedback mechanisms are currently in place. Feedback remains informal and dependent on field officers.
DIGITAL LIST OF CONSUMERS	A comprehensive digital database of consumers does not exist at present.
CONNECTION LIFECYCLE MANAGEMENT	Digital capability to manage the lifecycle of water connections—from application to approval, activation, and closure—exists. However, usage and effectiveness of the same are not certain in rural areas.
DIGITAL BILLS GENERATION	While digital bill generation capability exists in the department's IT systems; however tariffs are waived off in most rural areas, therefore this is not being used by rural citizens.
DIGITAL PAYMENT COLLECTION	While digital payment collection capability exists in the department's IT systems; however tariffs are waived off in most rural areas, therefore this is not being used by rural citizens.
AUTOMATED ALERTS AND NOTIFICATIONS	There are no systematic digital channels for automated alerts and notifications. Pump and valve operators notify the community of any planned water supply disruptions on WhatsApp groups.
CITIZEN ENGAGEMENT TOOLS	No citizen-specific engagement tool is available.
REPORTING OF GRIEVANCES	There exists a multi-channel grievance reporting system–via a helpline number, WhatsApp, and the web. The State has established **Rajasthan Sampark** (also called "181") as a centralized platform for grievance redressal.
CAPACITY BUILDING	Insufficient information available in this area.
ROLE- BASED DASHBOARDS AND REPORTS	Citizens-facing **WMS dashboard** provides real-time insights into Rajasthan's Jal Jeevan Mission progress, showing district-wise household tap water coverage and Har Ghar Jal certification status. It tracks connections achieved since the mission's launch and highlights the remaining gaps to ensure universal coverage. However, local water quality data is not accessible to citizens.

CONTEXTUAL CHATBOTS	WhatsApp based chatbot is available for raising grievances.
STAKEHOLDER LIFECYCLE MANAGEMENT	In the context of citizens, there exists consumer lifecycle management via connection lifecycle management.
ROLE-SPECIFIC MOBILE APPS	Rajasthan Sampark mobile app is available to citizens to register complaints related to water supply, track the status of their grievances, and receive timely updates. The e-Mitra and water bill payment apps are also there.
PURPOSE-BUILT DIGITAL TOOLS	There is no information on additional purpose-built digital tools.

Frontline Workers Applications

DAILY WATER SUPPLY MEASUREMENT & REPORTING

The water supply is fixed for a certain number of hours, and the pump operator and valve operator keep track of it.

However, reporting of this information on any application or dashboard has not yet been implemented.

FTK REPORTING (FIELD TEST KIT REPORTING)	The FTK workers are adequately trained. When a consumer registers a complaint about bad taste or poor water quality, the water is first tested using an FTK kit. The sample is then sent to the district-level laboratory for verification of the results.
COMMUNITY MOBILIZATION & IEC	IEC activities are conducted through mass media, outdoor campaigns, and community engagement. They focus on promoting **Har Ghar Jal, the wise use of water, and water conservation** to drive lasting behavioral change in society.
MINOR MAINTENANCE & REPAIRS	No information is available.
EXPENSE AND PAYMENT MANAGEMENT	No information is available.
DATA COLLECTION AND DIGITAL REPORTING	Data is getting collected, but there is no digital reporting happening yet.
WSS FINANCIAL AUDIT	No information is available.
REPORTING OF GRIEVANCES	Rajasthan has established **Rajasthan Sampark** (accessible through the toll-free number 181) as a centralized platform for grievance redressal.

CAPACITY BUILDING	Capacity-building training is organized to equip FTK users with the necessary skills for effective water quality testing.
ROLE BASED DASHBOARDS AND REPORTS	Not available.
CONTEXTUAL CHATBOTS	Not present.
STAKEHOLDER LIFECYCLE MANAGEMENT	Not available.
ROLE SPECIFIC MOBILE APPS	There are no specific mobile apps for frontline workers.
PURPOSE BUILT DIGITAL TOOLS	Not available

Agencies Applications

PROJECT EXECUTION & MONITORING	While project execution and monitoring are not being carried out digitally at present, provisions have been made to enable these functions through future system development.
THIRD-PARTY INSPECTION & VALIDATION	Third-party inspection is taken care of by the State Water and Sanitation Mission (SWSM) department in Rajasthan.
O & M SERVICE DELIVERY	At most places, O&M services are being taken care of by the Gram Panchayat, or the PHED Junior Engineer/staff.
ASSET TAGGING AND HANDOVER	Asset geotagging is carried out through the Rajdharaa platform.
WATER QUALITY TESTING & REPORTING TOOLS	Water Quality Testing & Reporting Tools enable real-time monitoring of key parameters such as pH, TDS, turbidity, and fluoride through FTKs, IoT sensors, and laboratories. The results are geotagged, digitally reported, and consolidated into dashboards for timely decision-making and remedial action.
RESOURCE MOBILIZATION AND RESOURCE TRACKING	ISAs play a big role in mobilizing the community.
BULK WATER FLOW MONITORING & SCHEDULING	SCADA systems and IoT devices are being installed at the bulk meter line. IoT devices are used to measure the flowrate, pressure, and level. The data from the same can be seen in the WIMS application.
CAPACITY BUILDING	No information is available.
REPORTING OF GRIEVANCES	No grievance reporting application or portal for the agencies.
ROLE-BASED DASHBOARDS AND REPORTS	No agency-specific dashboards are available; however, agencies can access the WMS portal to view the FHTC status and the financial status of projects.

CONTEXTUAL CHATBOTS	No chatbot is available.
STAKEHOLDER LIFECYCLE MANAGEMENT	The ERP system is currently under development, and provisions have been made to include details of agency-specific stakeholders within the platform.
ROLE-SPECIFIC MOBILE APPS	Agencies can use WIMS to monitor the operational status of RO plants, DFUs, solar borewells, and SCADA sites in real time. The platform also helps track inspections, geotagged assets, and water quality data for improved oversight and decision-making.
PURPOSE-BUILT DIGITAL TOOLS	No information available.

Department Applications

ASSET & INVENTORY MANAGEMENT	Asset management currently happening at the Rajkaaj portal. It is considered to be the older version of PM Gati Shakti. Also, inventory management happens through e-procurement portals.
VENDOR & CONTRACT MANAGEMENT	E-procurement is being used for vendor selection; however, records of vendors and contracts are not yet being systematically maintained.
WORK ORDER, INVOICES & PAYMENTS	Work order management is currently being carried out through the ERP portal.
BUSINESS INTELLIGENCE & DATA ANALYTICS	No analytics is happening currently in terms of water supply data. However, analytics are happening in terms of electricity data. Electricity forecasting takes place through the ERP portal.
MANAGEMENT INFORMATION SYSTEMS (MIS)	The Water Information Hub (within the SCADA/WIMS ecosystem) provides MIS reporting for online monitoring, trends, historical reporting, daily/monthly aggregations, and exception reports.
LAB INFORMATION MANAGEMENT SYSTEM	The water quality data is not getting pushed to any of the state home-grown portals. The data is visible on the internal dashboards, prepared for departmental staff.
FINANCIAL TRACKING & IFMS INTEGRATION	Financial tracking is not in place currently. However, the Work Management System (WMS) will help in tracking the financial aspects of the project, including budget allocation, expenditure, and funding sources, in the future.
GIS MAPPING & GEO TAGGING	Urban and some rural assets have been geotagged using the RajKaj portal. There are plans to integrate this data with the PM Gati Shakti platform, while the geotagged assets are also visible through the WIMS application.
SOURCE GEOLOGY	No data is maintained for this.
CONTEXTUAL CHATBOTS	Not available.

IOT DEVICES & SCADA	SCADA systems and IoT devices are mainly deployed at bulk water supply points such as treatment plants, pumping stations, and transmission mains. These enable real-time monitoring of flow, pressure, and water quality parameters, though coverage in smaller distribution pipelines is still limited.
BOQ & DPR GENERATION TOOLS	No tools are available for BOQ and DPR generation.
PREDICTIVE MAINTENANCE & SCHEME RISK FORECASTING	This is not happening at the department level.
SOURCE SUSTAINABILITY AND AUDIT	There is no provision for source sustainability and audit.
HYDRAULIC MODELING	Hydraulic modeling is not in place right now, however there is a plan to establish it in the near future.
CAPACITY BUILDING	Training for department engineers happens from time to time.
REPORTING OF GRIEVANCES	Not available at the departmental level.
ROLE BASED DASHBOARDS AND REPORTS	Every PHED engineer has access to the departmental dashboard to monitor the system. It includes the flow and pressure data of the system, water quality, and other operational details.
STAKEHOLDER LIFECYCLE MANAGEMENT	The ERP has provisions to maintain data of engineers; however, the portal has not yet been made public. One such application is the **e-MB (electronic Master Book)**, which is built to record employee information digitally.
ROLE-SPECIFIC MOBILE APPS	There are several applications built for the department. Some are used by PHED engineers on a regular basis, while some others remain unused for several years. Applications such as WIMS for project monitoring, IFMS 3.0 for financial monitoring, and RajSSO-AMS for attendance are actively used.
PURPOSE-BUILT DIGITAL TOOLS	These are; • **SCADA systems** • **IoT-enabled sensors and telemetry** **WIMS mobile application** (for asset and quality monitoring).

State Functionaries Applications

INTER DEPARTMENTAL DATA EXCHANGE	PHED exchanges data with the state electricity board (DISCOM), which enables power demand forecasting and helps in planning energy requirements for water supply operations.
JOINT PLANNING & APPROVAL WORKFLOWS	Sufficient information is not available in this area.
GRIEVANCE & FEEDBACK LOOP INTEGRATION	Sufficient information is not available in this area.
JOINT TRAINING & KNOWLEDGE SHARING PLATFORM INTEGRATION	Sufficient information is not available in this area.
CROSS-SECTORAL POLICY ALIGNMENT	Sufficient information is not available in this area.
CROSS-SECTOR ANALYTICS & DASHBOARDS	Electricity consumption forecasting, carried out in coordination with DISCOM, is integrated into the ERP dashboard. This allows PHED to visualize future power demand and plan pumping schedules.
EMERGENCY RESPONSE & DISASTER MANAGEMENT INTEGRATION	Sufficient information is not available in this area.

Technology Foundation

UNIFIED / INTEGRATED PLATFORM APPROACH	ERP/WMS is an integrated platform that is being built by PHED Rajasthan. However, the portal is yet to be made public.
MODERN TECHNOLOGY STACK & CLOUD-NATIVE ARCHITECTURE	Java, PostgreSQL, Drools, Kafka.
INTEROPERABILITY WITH CENTRE SYSTEMS	There is limited interoperability with Centre systems via APIs.
API INTEGRATIONS WITH EXTERNAL APPLICATIONS	Limited integration with other States' applications via APIs. The ERP system is linked with the DISCOM for electricity tracking.
IDENTITY & ACCESS	PHED IT systems are SSO-enabled using the state-level SSO framework which provides a unified digital identity—known as the SSO ID—for accessing a wide spectrum of government services across the state. It supports various user categories, including citizens, businesses, employees, and e-Mitra kiosks.
USE OF ARTIFICIAL INTELLIGENCE	At present, AI is not used; however the department is planning extensively in this area for predictive analytics and forecasting.
SECURITY AND COMPLIANCE	The system employs robust security mechanisms including OTPs, Aadhaar authentication, and multi-factor options.

Infrastructure

HOSTING INFRASTRUCTURE	Since applications are hosted in the State Data Center, this is taken care of as per State Data Centre policies.
STORAGE AND DATABASES	Since applications are hosted in the State Data Center, this is taken care of as per State Data Centre policies.
HIGH AVAILABILITY & DISASTER RECOVERY	Since applications are hosted in the State Data Center, this is taken care of as per State Data Centre policies.
MONITORING & OBSERVABILITY	Being a fragmented IT ecosystem, centralized monitoring and observability are not available.
SCALABILITY (HORIZONTAL & VERTICAL)	Applications do not seem to be built using a cloud-native, microservices-based architecture and, therefore, have limited horizontal scalability. Applications should scale vertically by adding more hardware resources at the data centre.
BACKUP AND RECOVERY MANAGEMENT	Since applications are hosted in the State Data Center, this is taken care of as per State Data Centre policies.
NETWORKING AND CONNECTIVITY	Since applications are hosted in the State Data Center, this is taken care of as per State Data Centre policies.

CONCLUSION

The current IT landscape of the JJM reflects significant progress in digital enablement across planning, monitoring, and service delivery. However, several structural and technical limitations continue to constrain scalability, interoperability, user experience, and the effective use of data for decision-making. These challenges collectively limit the mission's ability to transition from digital monitoring systems to real-time, citizen-centric, and intelligent water service delivery.

A key concern lies in the prevalence of rigid and non-flexible system design, which restricts flexibility, scalability, and ease of integration with emerging technologies. The absence of reusable, plug-and-play components further limits the ability to replicate and scale successful solutions across states. In parallel, limited interoperability remains a critical bottleneck, as most systems are not designed with an API-first approach.

The lack of standardized data schemas and open APIs restricts seamless data exchange with external systems such as GIS platforms, IoT devices, and national registries, thereby hindering the development of unified dashboards and integrated decision-support systems.

From an infrastructure perspective, scalability and performance limitations persist, particularly in systems that are not cloud-native. The absence of elastic scaling mechanisms and robust disaster recovery frameworks creates vulnerabilities during peak usage periods and raises concerns regarding system resilience.

Additionally, weak data validation and quality control mechanisms—especially at the point of data entry—result in inconsistencies, duplication, and inaccuracies, further reducing the reliability of data for operational and strategic use.

Concerns around security and privacy also emerge, with inconsistent implementation of authentication protocols, role-based access controls, and encryption standards. Limited alignment with national cybersecurity guidelines and data protection frameworks highlights the need for stronger governance in this area.

Furthermore, the lack of offline functionality in many field applications creates operational challenges in rural and low-connectivity environments, affecting the timeliness and completeness of data capture.

Another critical gap is the absence of centralized monitoring and observability frameworks, including system-wide logging, performance tracking, and incident management. This limits visibility into system health, user behaviour, and operational bottlenecks, thereby affecting continuous improvement and system optimization.

From a data perspective, the ecosystem is characterized by fragmentation and inconsistency. Variations in data definitions, formats, and classifications across states lead to challenges in aggregation and comparative analysis. The presence of multiple standalone applications—often operating in silos—results in duplication of data, manual reconciliation efforts, and inconsistencies in reporting. At the field level, data quality issues such as incomplete entries, use of placeholder values, and manual errors further compromise data integrity, compounded by the absence of automated validation, anomaly detection, and audit mechanisms.

Overall, while substantial volumes of data are being generated, their potential remains underutilized due to the lack of a unified data architecture and interoperable ecosystem. Addressing these challenges requires the establishment of a robust data governance framework, standardized data models, and interoperable system design.

In this context, there is a clear and urgent need to transition towards a more modular, interoperable, and data-driven digital ecosystem. Strengthening system architecture, improving data quality and governance, enabling seamless integration, and enhancing user-centric design will be critical to unlocking the full potential of digital investments under the Jal Jeevan Mission. Such a transformation will not only improve operational efficiency but also enable proactive, evidence-based decision-making and significantly enhance the quality and reliability of water service delivery.

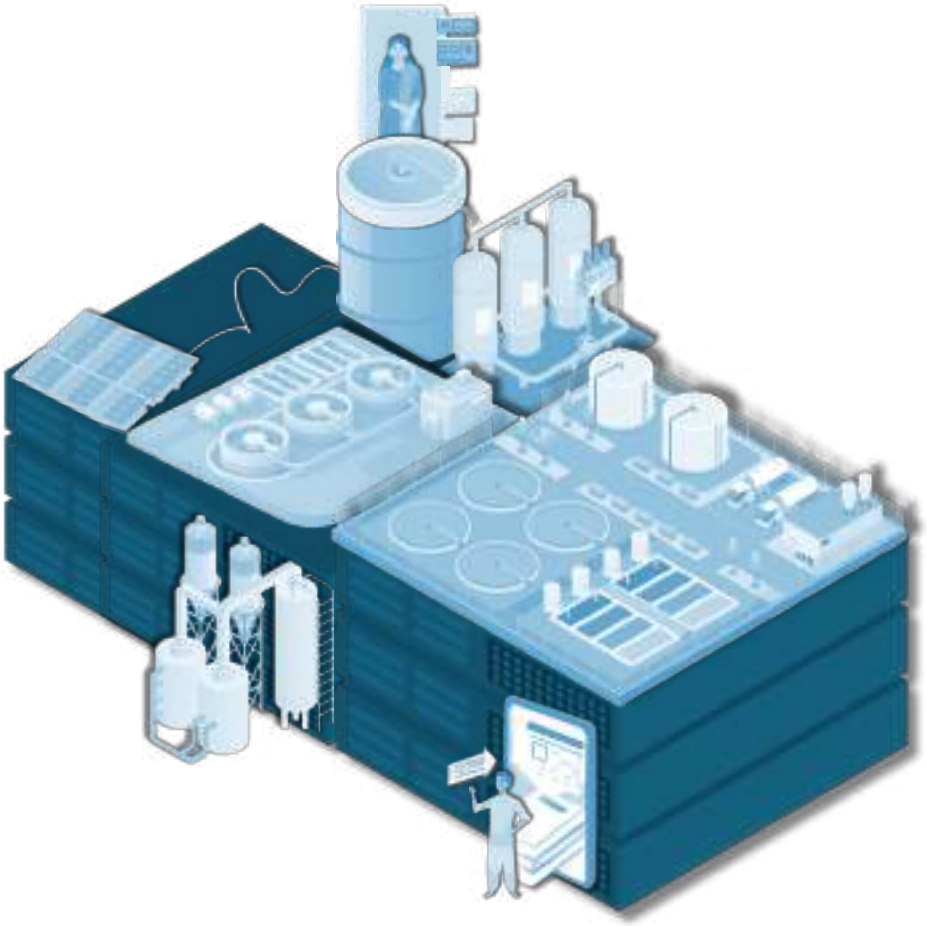
APPENDIX A:
As-Is Study Journey

Date	Activity	Remarks
03-Mar-2025	Project Kick-off	Project officially started with a kick-off meeting between SPM-NIWAS and Arghyam.
04-Mar-2025	Visit to DDWS, Delhi for developing an understanding of the NNJM IT systems	A meeting between Arghyam, SPM-NIWAS, and NIC team was held in DDWS, Delhi. Following officials attended the meeting: • **Priyatu Mandal**, Director, SPM-NIWAS (remote) • **Chayan Kumar Dhar**, Chief Technology Officer, SPM-NIWAS (remote) • **Seemantinee Sengupta**, Scientist-G, NIC & Deputy Director General, DDWS, Delhi **Surya Mohan Srivastav**, Scientist-D, NIC & Joint Director (IT), DDWS, Delhi
10-Mar-2025	As-Is Study methodology finalized	It was agreed that the As-Is study would be conducted with a multi-progged approach, which will include: 1. Collection of online responses from States against the standard questionnaire 2. Conducting VCs with States 3. In-person visits to 3-5 States
10-Mar-2025	two-day Assam State visit for As-Is Study	A two-day As-Is study was conducted on IT Systems of JJM Assam. Meetings were held with the following department officials: • **Kailash Karthik N, IAS** Secretary to the Govt. of Assam Public Health Engineering Department and Mission Director, Jal Jeevan Mission, Assam • **Smt. Preeti Kumari, IAS** Joint Secretary to the Govt. of Assam General Administration Department cum Addl. Mission Director, Jal Jeevan Mission, Assam • **Biraj Boruah, ACS** Deputy Mission Director, JJM Assam • **Arnav Kumar Baruah**, ALRS, Assistant Mission Director, JJM Assam • **Hemanta Kumar Sharma**, SPS-Monitoring, IMIS & Knowledge Management • **Sarangapani Sarma**, State Coordinator and Software Developer, JJM Assam • **Jyotishman Sarma**, Software Developer, JJM Assam • **Manoj Saharia**, Software Developer, JJM Assam • **Abdul Wahab Azad**, Software Developer, JJM Assam.

		A field visit was conducted to an SVS scheme in Rangia Block under Kamrup district.
17-Mar-2025	As-Is Questionnaire finalized	A 5-page document was finalized as the questionnaire for collecting the States' IT systems information.
21-Mar-2025	As-Is Questionnaire sent to States	The As-Is Questionnaire was sent to all 34 States/UTs with a follow-up on 09-Apr-2025.
.24-Apr-2025	VC with 9 states on As-Is Study Questionnaire response status	The following States participated in the VC: 1. **Uttarakhand,** M Mustafa, MD, JJM Uttarakhand 2. **Jharkhand,** Rahul Sinha, MD JJM Sanjay Gautham, IEC coordinator, Ranjit Mitra 3. **Maharashtra,** Mridul Kelkar, IT Divisional Officer 4. **Sikkim** Prakash Chetri, Additional Chief Engineer 5. **Ladakh,** Noor Mohammad Ishfaq 6. **Haryana**, Laxmi Kant Bhatia, State HRD & IEC Consultant Pratibha Choudhary, State consultant Ajith Kumar Debbrama 7. **Jammu & Kashmir,** Imtiyaz Ahmed, WASH Coordinator 8. **Andhra Pradesh,** Kolourur Venkateshwararoo 9. **Uttar Pradesh,** Nandini Krishna, Nodal Officer, Radha Krishna Tripathi, Senior Media Consultant
29-Apr-2025	Visit to SPM-NIWAS	Arghyam team visited SPM-NIWAS for discussions with C.K. Dhar, Chief Technical Officer, SPM-NIWAS on the structure and table of contents of the As-Is reports.
30-Apr-2025	States' IT Systems Digital Maturity Model (DMM) Framework	A consensus was formed on building a States' IT Systems Digital Maturity Model (DMM) to have a structured and comprehensive assessment of States' IT systems for rural drinking water sector.
07-May-2025	A two-day Punjab State Visit for As-Is Study	A two-day As-Is Study on IT Systems of DWSS Punjab was undertaken. Meetings were held with the following department officials and other personnel: • **Dr. Pallavi Kaur**, Head of Department, DWSS, Punjab • **Karanbir Singh**, Superintendent Engineer, Technical, DWSS, Punjab • **Rohit Kumar**, Executive Engineer, MIS & SNK,DWSS, Punjab • **Ms. Gurjot Kaur**, Executive Engineer, Water Quality, DWSS, Punjab • **Rajesh Bajaj**, Training Head,DWSS, Punjab

		• **Varun Kumar**, IT, DDWS Punjab • **Pankaj Kumar**, NIC Punjab • **Paramveer Singh**, Water Quality, DWSS, Punjab • **Harsh Goyal**, SDM-Inclusion, DWSS, Punjab • **Ms. Mamta Bakshi**, SDM-Inclusion, DWSS, Punjab • **Ms. Amrita & the Social Team**, DWSS, Punjab • **Tejpal Singh**, CIMCon (IoT Vendor) The following site visits were conducted: • SVS Water Scheme in Nagal Faizgarh • State Water Quality Lab
13-May-2025	Response received from Ladakh	The state JJM portal for Ladakh is available at https://jaljeevanladakh.in/ Ladakh JJM has implemented multi-channel grievance system using which stakeholders can register and track grievances through multiple channels: • Web portal accessible via desktops and smartphones. • WhatsApp messaging for quick grievance reporting. • Call centre/helpline for voice-based registration. The state uses the Centre's IMIS and WQMIS systems for reporting and tracking the progress of scheme implementation and water quality issues.
15-May-2025	A two-day West Bengal State Visit for As-Is Study	A two-day As-Is study on the IT Systems of PHED West Bengal was undertaken. Meetings were held with the following department officials and other personnel: • **Dr. Animesh Bhattacharya**, Engineer In Chief, PHED, West Bengal • **Aloke Saha**, Deputy SE, IT, PHED, West Bengal • **Subhasheesh Bhattacharya**, Head of Data Centre • **Monojit Saha**, Team Lead, IT • **Ms. Kalpana, Consultant,** E&Y, SPMU • **Ankur**, Consultant, E&Y, SPMU • **Manoj**, Consultant, E&Y, SPMU • **Ankush**, Consultant, E&Y, SPMU • **Rajib Kumar Sarkar**, Water Quality IT Head • **Ms. Soumyia Jit**, Water Quality, SMPU **Gautam Daftari,** Semaphore Computers Pvt. Ltd.

04-Jun-2025	Meeting with Madhya Pradesh JJM	A meeting was held with Ravindra Pare, Scheme Coordinator, JJM MP.
19-Jun-2025	State IT Systems DMM framework version 1 released	State IT Systems DMM framework version 1 released for review and feedback.
21-Jul-2025	A two-day Gujarat State Visit for As-Is Study	A two-day As-Is study on IT Systems of GWSSB Gujarat was undertaken. Meetings were held with the following department officials and other personnel: • Ms. Stuti Charan, IAS, Chief Executive Officer, WASMO , Gandhinagar • Hemant Rajput, Superintending Engineer, GWSSB Gujarat • Rahul Solanki, Supertending Engineer, GWSSB Gujarat • Manish Modi, Civil Engineer, GWSSB Gujarat. • Khant Shah, Senior Consultant, EY • Dhananjay Dwedi, Consumers Grievance Cell A visit was made to the Kudason MVS water supply scheme.
21-Jul-2025	A two-day Rajasthan State Visit for As-Is Study	A two-day As-Is study on IT Systems of PHED Rajasthan was undertaken. Meetings were held with the following department officials: 1. **Akhil Arora**, IAS, Additional Chief Secretary to the Government, PHED Rajasthan 2. **Dr. Ravindra Goswami**, IAS, Joint Secretary to the Government, PHED and Mission Director of Jal Jeevan Mission, Rajasthan. 3. **Dr. Suneet Sethi**, Sr. State Consultant, HRD & IEC, WSSO 4. **Himanshu Meel**, Superintending Engineer, PHED Rajasthan 5. **Sanjay Sharma**, Executive Engineer, PHED Rajasthan 6. **Ms. Poonam Rijwan**i, ACP, IT division, Jaipur, Rajasthan 7. **Dushyant**, IT division, Jaipur, Rajasthan



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