

Transitioning Towards Digital and Data-Driven Decision Support System

The Case of Jal Jeevan Mission (JJM) in Maharashtra

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Introduction

Policy Briefs 1 and 2 established a comprehensive analytical framework for understanding digital governance transformations in India's rural water sector. Policy Brief 1 demonstrated how the Jal Jeevan Mission exemplifies "digital federalism," where Management Information Systems enable unprecedented coordination across government levels while creating tensions between implementation imperatives and sustainability requirements. Policy Brief 2 developed a multidimensional functionality assessment framework, revealing critical gaps between the JJM's digital governance capabilities and the indicators necessary for sustainable water service delivery evaluation.

These analyses identified a fundamental disconnect between the technical aspects of digital monitoring systems and their practical utility for evidence-based decision-making. While the JJM MIS represents a significant advancement in data granularity and financial integration, systematic gaps persist in operation and maintenance tracking, institutional capacity assessment, and service reliability monitoring. The elimination of slip-back tracking and weakened sustainability indicators constrains the system's capacity to support preventive intervention and adaptive management approaches essential for long-term service sustainability.

Policy Brief 3 addresses this implementation-utility gap through a systematic examination of ground-level data management processes in Maharashtra, selected as a strategic case study for its institutional complexities and advanced JJM implementation experience. Maharashtra's multi-tiered administrative structure and diverse geographical contexts provide critical insights into how digital governance systems function within complex federal arrangements where central standardization requirements must accommodate state-specific institutional capacities and local implementation contexts.

This analysis examines three interconnected dimensions identified as critical for understanding digital governance effectiveness: organizational structures that mediate between central guidelines and state implementation realities; data management processes that determine information quality and accessibility across administrative levels; and decision-making utility that translates monitoring capabilities into

responsive governance actions. Through systematic investigation of these dimensions, this brief develops an empirically grounded framework for understanding how digital governance systems can evolve from compliance-oriented monitoring platforms toward decision support tools that enable adaptive management and improved service delivery outcomes.

The study addresses persistent questions about the relationship between digital system sophistication and governance effectiveness, exploring how institutional capacity, data management processes, and decision-making requirements interact to determine practical utility for water service delivery improvement. These findings provide essential groundwork for subsequent analysis of source sustainability challenges and recommendations for enhancing digital governance systems to support sustainable rural water service delivery across India's diverse contexts.

Objectives and Methodology

Objectives

Building upon the digital federalism framework established in Policy Brief 1 and the functionality assessment developed in Policy Brief 2, this investigation addresses critical gaps in understanding how digital governance systems function within complex federal implementation contexts. The study examines Maharashtra's JJM experience to develop empirically grounded insights into data management processes and decision-making utility through the following research objectives:

- (i) To analyze the institutional arrangements mediating between central JJM guidelines and Maharashtra's state-specific administrative contexts, investigating how the four-tier governance model envisioned in operational guidelines translates into practical implementation structures that accommodate local administrative requirements and capacity constraints.
- (ii) To systematically document information management processes across village, block, district, and state administrative levels, examining how data moves through institutional hierarchies and identifying structural factors that determine information quality, accessibility, and utility for

governance purposes.

(iii) To establish empirically grounded frameworks for evaluating JJM MIS practical effectiveness and developing pathways for transforming monitoring platforms into active decision support tools that enable responsive management and evidence-based policy implementation.

Research Questions

The investigation addresses four interconnected questions that examine the relationship between digital system design and governance effectiveness:

What institutional processes govern data collection, collation, and entry across Maharashtra's administrative tiers, and how do these processes determine information quality and decision-making utility? What systematic challenges constrain JJM data management effectiveness, and how do these limitations affect the system's capacity to support comprehensive functionality assessment? How do current data management capabilities provide practical utility for decision-makers and implementing staff across different administrative levels? What modifications to data management processes and system architecture would enhance capacity for evidence-based governance and sustainable service delivery improvement?

Methodology

This study employs a qualitative methodology designed to capture complex institutional processes and stakeholder perspectives determining digital governance system effectiveness. The approach addresses limitations in quantitative administrative analysis, which may document formal procedures without revealing implementation dynamics or practical utility experiences. The research integrates government document analysis with semi-structured interviews targeting organizational leaders and data management functionaries across governmental and allied institutions. Interview design focused on institutional roles, data management responsibilities, system utility experiences, and improvement recommendations. Participants were selected through purposive sampling, ensuring representation of office heads at each administrative tier and functionaries with direct data management responsibilities, capturing both decision-making and operational perspectives across the institutional hierarchy.

Primary data analysis employs thematic analysis methodology (Figure 1), enabling systematic pattern identification within data management processes. The analytical approach references the functionality assessment framework from Policy Brief 2 for evaluating current system capabilities against service delivery requirements. Figure 2 presents the

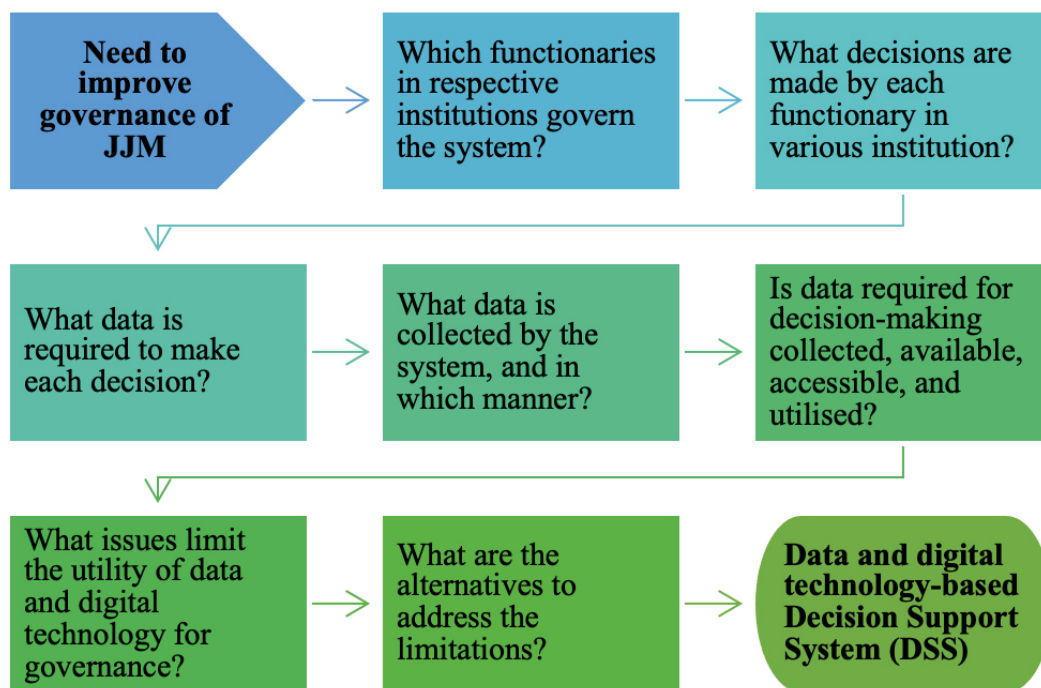


Figure 1 Logical framework for understanding the scheme data and decision-making

logical investigation flow whose systematic examination illuminates JJM governance mechanism requirements, assuming these questions will reveal system characteristics, gaps, improvement requirements, and Decision Support System development opportunities. Maharashtra's institutional complexity, advanced JJM implementation experience, and administrative complexity provide optimal conditions for analyzing digital governance functionality across diverse contexts while maintaining analytical utility for broader federal system understanding.

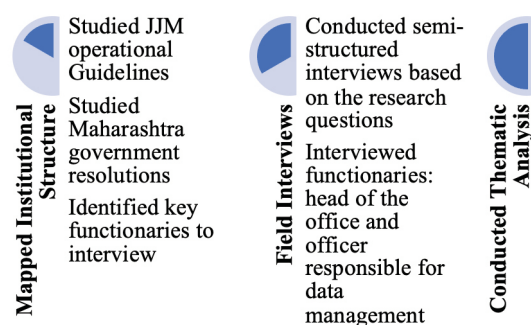


Figure 2 Graphical representation of methodology

This policy brief is categorized into the following sections, as mentioned in Figure 3:

Section 1: Institutional Structure and Federal Coordination Mechanism

The organizational structure governing JJM implementation establishes the institutional framework within which digital governance systems operate, determining how policy directives translate into administrative practice and information flows through multi-tiered governance arrangements. While JJM operational guidelines envision a four-tier institutional mechanism for decision-making and governance, systematic field investigation in Maharashtra reveals significant divergence

between prescribed arrangements and operational reality. This analysis integrates insights from field research with official documentation including JJM operational guidelines, Maharashtra Government Resolutions regarding workforce approval, State Level Scheme Sanctioning Committee (SLSSC) and District Water and Sanitation Mission (DWSM) composition guidelines, and organizational charts available through institutional websites. It operates through five administrative tiers rather than the prescribed four, incorporating subdivision or block-level administration as a critical intermediate layer. Figure 4 synthesizes these findings to represent Maharashtra's actual organizational structure, demonstrating institutional adaptations necessary for effective programme coordination.

This structural modification reflects practical coordination requirements where the Deputy Engineer of RDWS, heading subdivision offices, bears responsibility for scheme design and implementation while serving as the primary recipient of community grievances and design requests. The JJM institutional design does not formally assign decision-making roles to block-level administration, creating coordination challenges that affect data management processes and decision-making effectiveness. The JJM's status as a centrally sponsored programme requires states to adapt prescribed institutional structures to accommodate existing administrative arrangements through equivalent designation alignment and additional functionary incorporation. This federal adaptation process demonstrates the tension between standardization imperatives and contextual responsiveness identified in Policy Brief 1's digital federalism analysis, where states must balance adherence to central guidelines with practical implementation necessities.

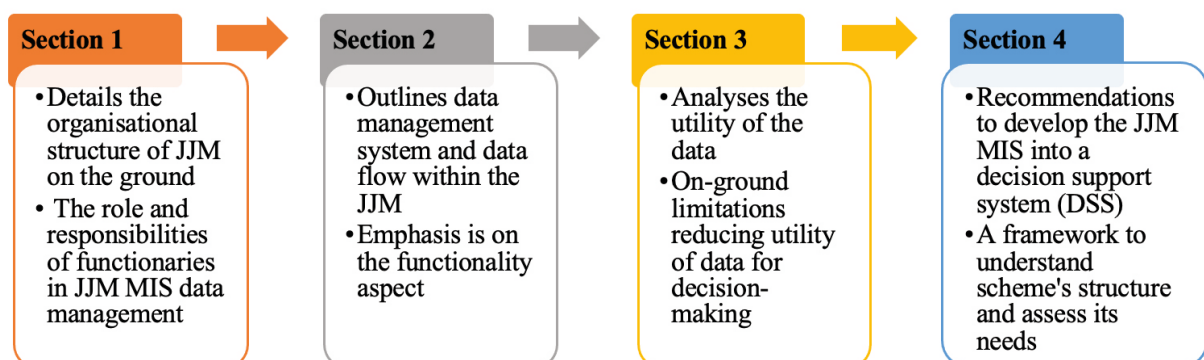


Figure 3 Structure of the policy brief

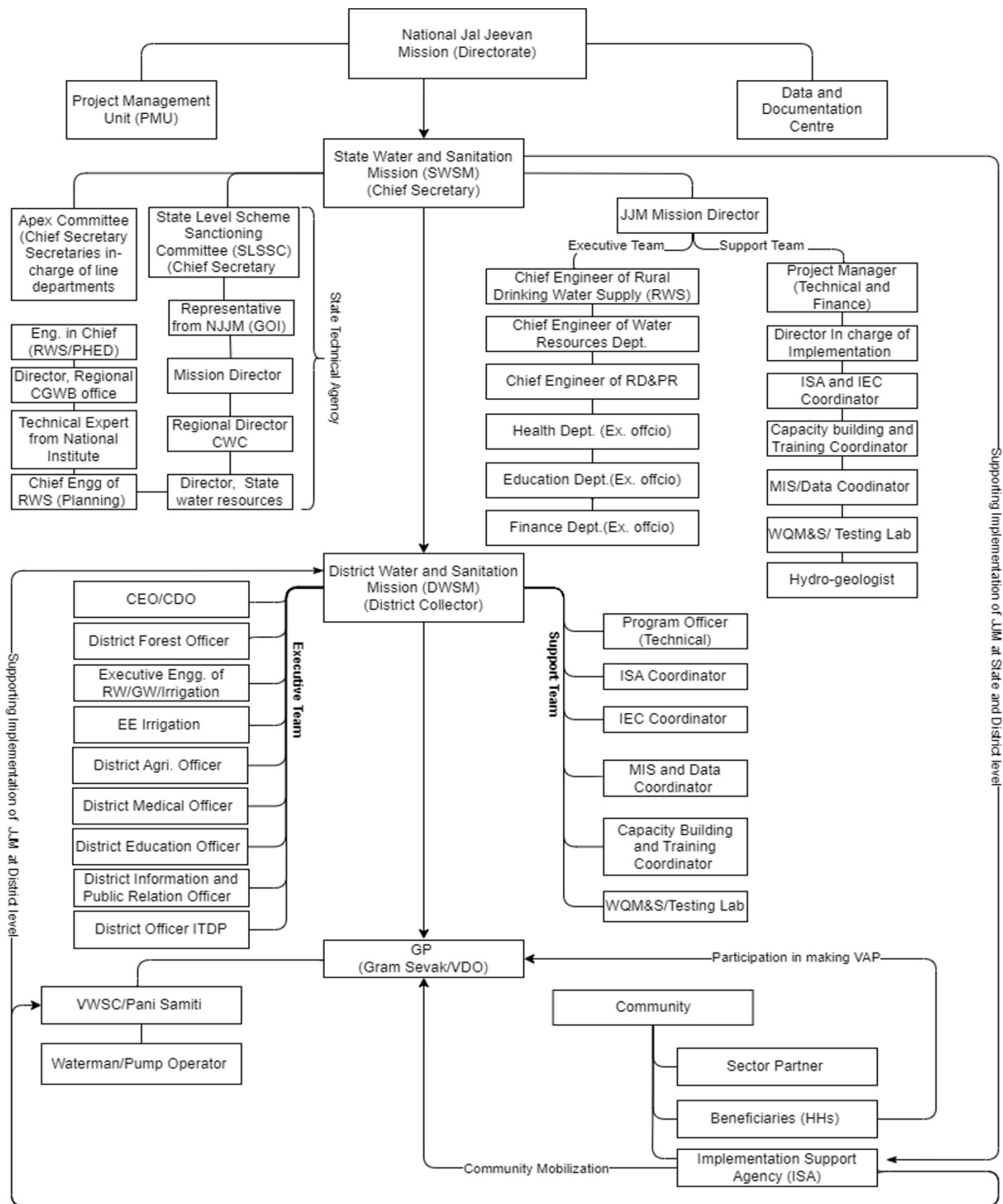


Figure 4 JJM institutional structure based on JJM guidelines and field implementation reality

Understanding these complex institutional arrangements guided systematic stakeholder engagement strategies, targeting office heads at each administrative tier and functionaries with direct data management responsibilities. This approach enabled investigation of both formal institutional arrangements and informal coordination mechanisms, revealing how digital governance systems must accommodate not only

organizational hierarchies but also adaptive arrangements that emerge from practical implementation requirements. These findings have significant implications for understanding data management processes and developing decision support systems that function effectively within complex federal implementation contexts.

Section 2: Data Management Systems and Information Architecture

Digital governance effectiveness depends fundamentally on how information flows through institutional hierarchies and the extent to which collected data serves decision-making requirements. In administrative systems, regularly collected data flows systematically through designated platforms and applications, with the central government retaining control over data architecture and access protocols. The JJM's data management system reflects this centralized approach, where selective portions of consolidated data appear on public dashboards while gamut datasets remain inaccessible to state and local decision-makers. When state-level and lower-tier decision-makers require specific information beyond JJM portal accessibility, they resort to alternative collection methods, including Google Sheets and Excel spreadsheets. This parallel data collection reflects systematic limitations in the official system's capacity to serve diverse decision-making requirements. Maharashtra's JJM implementation demonstrates these challenges through three distinct data collection streams managed by the Groundwater Surveys and Development Agency (GSDA), Zilla Parishad technical teams,

and Zilla Parishad non-technical teams.

Data Collection Activities

Data collection activities align with JJM service provision phases established in operational guidelines, creating systematic information gathering across planning, implementation, and post-implementation phases^{1,2} as shown in Figure 6. During planning phases, financial and project planning occur based on action plan data, providing details about Rural Drinking Water Supply situations and requirements across administrative tiers. Implementation phases focus on physical and financial progress reporting through various agencies involved in scheme deployment. Post-implementation activities encompass infrastructure verification, record-keeping, and regular water quality monitoring.

¹ Data collection of Syama Prasad Mookerjee National Institute of Water and Sanitation (SPM-NIWAS) pre-implementation, implementation, and post-implementation expert survey and the annual 'Jal Jeevan Survekshan' are

² JJM service provision phases are as per JJM operational guidelines; however, activity classification is done by the team.

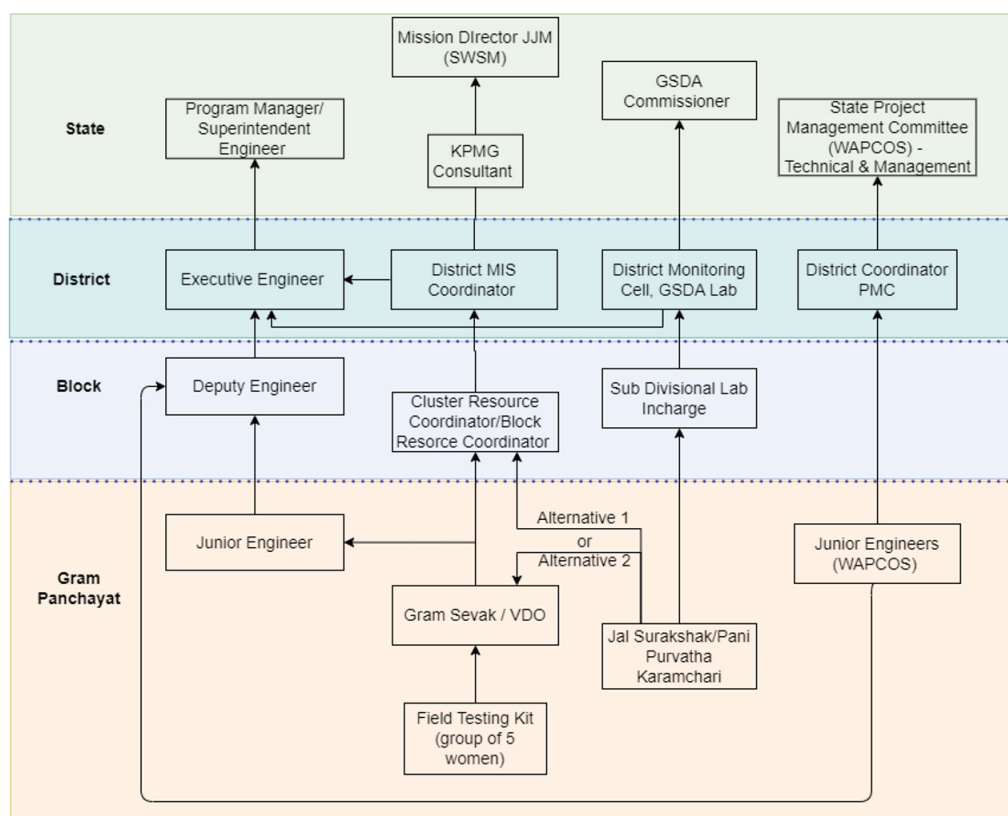


Figure 5 Data flow of the JJM in various tiers for Maharashtra

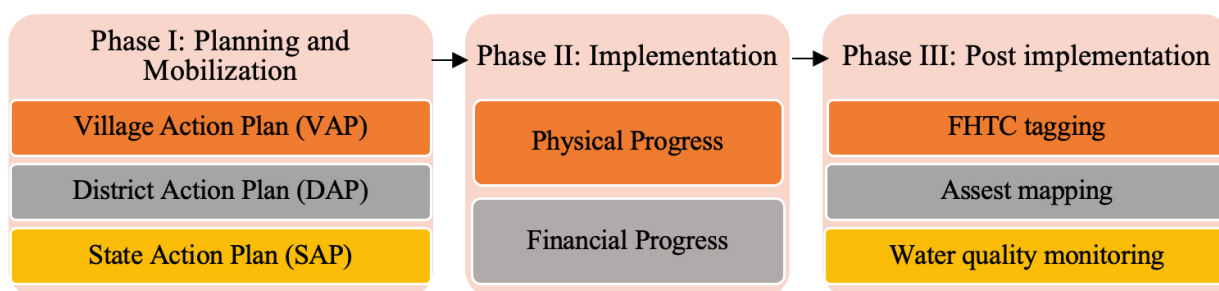


Figure 6 Data collection activity in three phases of JJM service provisioning

Data Entry

The complexity of data entry processes varies significantly across administrative levels and functional responsibilities, as shown in Table 1. Village-level activities centre on water sample registration for testing and beneficiary data provision in hard copy formats. Block and subdivision levels manage Aadhar linking of beneficiaries, village action plan development, asset geo-tagging, and water quality test result entry. District levels focus on physical and financial progress monitoring, verification of geo-tagging data, and water quality test result validation. These multi-tiered processes create substantial coordination requirements and multiple verification points that can either enhance data quality or create bottlenecks depending on institutional capacity and system design.³

³ We could not find the standard data collection procedure

Portal Dashboard and Reports

The central government accesses consolidated data through web portals and applications, with selective information displayed on the JJM-IMIS dashboard, organised into eight categories. The 'reports' category provides tabular data formats coded with letters and numbers, though not all reports are publicly accessible. Field investigation reveals that government functionaries typically access information similar to public users even after portal login, with no additional analytical features available for governmental decision-making within their jurisdictions. This accessibility limitation significantly constrains evidence-based decision-making capacity, as demonstrated by field experiences where block-level coordinators responsible for Functional Household Tap Connection verification could not access beneficiary lists showing completion status or pending verifications. Such systematic

Table 1 Data entry and tool use matrix for JJM

Tier Tool	Village	Block/sub-division	District	Users
Web-Portal	Registration of water sample for testing	Aadhar linking of the beneficiary	Physical and Financial progress of the scheme	VDO, CRC/BRC, MIS Coordinator (ZP, MJP, GSDA)
		Village Action plan	District Action Plan	
		Registration of water samples for water quality testing	Verification of the geo-tagging data updated by JEs and provides approval	
		Entry of the water quality test results by the sub-division lab	Verification and updates water quality test results and provides approval	
App	-	Geo-tagging of the assets Declaration of Har Ghar Jal village	-	Junior Engineer (Rural Drinking Water Supply, ZP)
Any Other tool than App and Web-Portal	GP provides the data required in hard copy, for example, Aadhar details	CRC-BRC sends data with a signed copy to the district office, even for the data uploaded on a portal	MIS coordinator provides data with a signed copy to state	All
	FTK provides a hard copy of the test results to VDO	Block officer provides data in Excel as and when required for special needs	District Office provides data in Excel as and when required for special needs	

information gaps prevent effective response to community inquiries and undermine local governance capacity, highlighting the need for differentiated access protocols that align data availability with decision-making responsibilities across administrative levels.

Field investigation confirms the absence of post-implementation data collection for critical functionality indicators, including water quantity supplied, tariff collection patterns, service

breakdown frequency, repair duration, operation and maintenance expenditure, and grievance details. While some information exists in gram panchayat records, it remains outside digital platforms and inaccessible for systematic analysis. This finding corroborates Policy Brief 2's identification of data gaps in sustainability and functionality monitoring, demonstrating that current data management systems prioritise implementation tracking over service delivery quality assessment (shown in Table 2).

Table 2 Data availability assessment for key functionality indicators

Indicator Category	Sub Indicator	Data Collection	Data Availability
Environmental	Source of water supply	JE (RWS, ZP)	JJM Dashboard – FUA2, FUA 3
	Quantity of Water Supply	Not available	Tap water supply in households (HHs) category village details section – “Service level/ quantity supplied”
	Quality of Water Supply	WQMIS and FTK	WQMIS dashboard
Institutional	ISA (Implementation support agency)	ZP (Deputy-CEO)	Not available
	VWSC Formation	VDO	Village details page in the coverage report
	Composition of members	VDO	Village details page in the coverage report
	Training of Members	CRC/BRC	JJM Dashboard – D30, D31
	Complaints Redressal	State-level portal	Not Available
Financial	Source of O&M Expenditure	GP (VDO)	Available in GP records
	Percentage of HH paying tariff	GP (VDO)	Available in GP records
	Total O&M fund available against expenditure	GP (VDO)	Available in GP records
	Source of payment to operators	GP (VDO)	Not available
Technical	Frequency of service breakdown	GP (VDO)	Available in GP records
	The average duration of repairing	GP (VDO)	Not Available
	Types of service breakdown	GP (VDO)	Not Available
Social	Category-wise Coverage	GP (VDO)	Not Available
	Community participation	GP (VDO)	Not Available

Section 3: Data Utility and Decision-Making Effectiveness

Understanding data collection processes and accessibility requirements provides the foundation for examining whether information systems achieve their intended governance objectives. The fundamental question concerns whether accumulated data contribute meaningfully to evidence-based decision-making and improved service delivery outcomes. While the JJM-IMIS represents one of the most extensive government programme datasets available in the public domain, systematic analysis reveals significant constraints that prevent this information from realizing its full potential for governance improvement.

The current data architecture presents information in either instantaneous or cumulative formats, limiting analytical utility to status monitoring rather than comprehensive performance assessment. These limitations constrain the system's capacity to support advanced analytical approaches that could inform strategic decision-making and policy refinement.

Field investigation confirms that the dashboard's primary function centers on implementation monitoring, specifically physical coverage and financial progress tracking. The systematic absence of post-implementation information including operation and maintenance patterns, tariff collection effectiveness, source sustainability indicators, and service level documentation reveals that dashboard design prioritized short-term implementation tracking over long-term

management and decision-making requirements. This design limitation reflects the implementation-sustainability tension identified in Policy Brief 1, where digital governance systems embed biases toward visible achievements rather than sustainable service delivery outcomes.

Government functionaries across organizational levels and administrative tiers consistently reported that JJM-IMIS utilization remains limited to performance monitoring and progress tracking activities. Many respondents emphasized that while dashboard data serves as reference information for initial decision-making processes, final decisions require integration with multiple locally available data sources to ensure alignment with field realities. The dashboard provides status information without revealing underlying causal factors or contextual conditions that determine performance outcomes, limiting its utility for diagnostic analysis and targeted intervention development.

Respondents frequently noted that JJM-IMIS demands substantial time and resource investments while providing limited practical utility for routine governance activities. The system's design assumptions appear misaligned with actual decision-making requirements, creating compliance burdens without corresponding analytical benefits. This finding highlights the need for systematic assessment of decision-making authority requirements to ensure data collection efforts serve genuine governance needs rather than creating administrative overhead.

The case analysis provided in Box 1 demon-

Box 1 A case of decision-making regarding water service level based on available data

Case – Households should receive the mandated service level of 55 LPCD, but a particular section is dissatisfied with the service level and claimed it to be lesser than 55 LPCD. A Junior Engineer or Deputy Engineer needs to address the issue.

- **Objective:** To resolve the complaint by ensuring a standard service level for every household.
- **Data required:** Cross-sectional and temporal data about service levels in each FHTC.
- **Data available:** General service level of village as per design, which is insufficient to be used as a proxy for service level at each FHTC.
- **Barrier/Limitations:** The unit-wise service data is unavailable as no water meters are placed. So, the engineer will have to conduct a fresh survey to gather the data, which need to be repeated for each complaint in every village.

strates that effective decision-making requires understanding fundamental constraints and causal relationships rather than simply implementing technical solutions. The water meter installation challenge exemplifies how apparent technical problems often reflect complex institutional, infrastructure, and capacity limitations that require systematic analysis before intervention design. Rushing implementation without addressing underlying constraints, including electricity availability, internet connectivity, and operator capacity, may result in intervention failure despite technical feasibility.

This complexity necessitates causal analysis approaches that examine relationships between different constraint categories, breaking down challenges into component issues until directly addressable root causes are identified. Such analytical approaches require decision support capabilities that extend beyond current MIS functionality toward more sophisticated diagnostic and planning tools.

The governance requirements for complex programmes like JJM demand platforms supporting scenario analysis, forecasting models, policy assessment, and response evaluation rather than simple status reporting. Decision Support Systems (DSS) can address these requirements by integrating data utilization with analytical tools that optimize limited resource deployment and enable targeted intervention strategies. Effective DSS development requires a systematic assessment of decision-making requirements, data integration capabilities, and user-friendly interfaces that match institutional capacity levels across different administrative tiers.

The transition from Management Information Systems focused on compliance reporting toward Decision Support Systems enabling evidence-based governance represents a fundamental shift in digital governance philosophy. This transformation requires careful attention to decision-maker requirements, institutional capacity constraints, and the complex causal relationships that determine service delivery outcomes in diverse implementation contexts.

Section 4: Strategic Recommendations for Digital Governance Enhancement

This investigation's systematic examination of Maharashtra's JJM data management processes reveals fundamental misalignment

between current information systems and decision-making requirements across administrative levels. The analysis demonstrates that data insufficiency and accessibility constraints significantly reduce MIS utility, resulting in sub-optimal decision-making effectiveness despite substantial data collection investments. These findings corroborate the digital governance challenges identified in Policy Briefs 1 and 2, where advanced technical capabilities fail to translate into improved governance outcomes due to design assumptions that prioritize compliance monitoring over decision support functionality.

The complexity of JJM governance requires integrated approaches that leverage data analytics and digital technologies to enhance decision-making efficiency and resource optimization. Current system limitations prevent realization of these potential benefits, necessitating strategic interventions that address fundamental architectural and process constraints while building institutional capacity for evidence-based governance.

Core System Enhancement Requirements

Decision-Centric Design Integration: The Data management system architecture must prioritise decision-making requirements rather than compliance reporting needs. This requires systematic assessment of governance decisions across administrative levels, identification of information requirements for each decision category, and system redesign that ensures data collection directly supports decision-making processes. The current disconnect between available information and practical utility reflects inadequate attention to user requirements during system design phases.

Resource-Optimized Data Collection: Data management processes require fundamental restructuring to ensure optimal resource utilization through systematic assessment of information utility and elimination of redundant collection activities. The investigation reveals substantial data collection efforts that provide minimal decision-making value, creating administrative burdens without corresponding analytical benefits. Effective systems must balance system information needs with institutional capacity constraints and practical utility requirements.

Comprehensive Decision Support System Development: The transition from Management

Information Systems toward Decision Support Systems represents an essential evolution for complex programme governance. DSS capabilities must address non-routine decision-making, scenario analysis, and crisis management through integrated data analytics and digital technology applications. Unlike current compliance-focused systems, DSS architecture should align with governance requirements and institutional capacity levels, enabling targeted interventions and resource optimization that accelerate programme outcome achievement.

Implementation Framework and Systematic Approach

The systematic methodology developed through this investigation provides a replicable framework for understanding governance requirements and developing appropriate decision support systems across diverse programme contexts (Figure 7). Government and allied institutions can utilize this process structure to assess decision-making design, capacity requirements, and institutional needs for evidence-based governance enhancement.

This framework synthesis enables pragmatic decision support system design that addresses specific governance challenges while accommodating institutional capacity realities. Continuous refinement through implementation experience will enhance framework effectiveness and enable adaptation to diverse programme requirements and administrative contexts.

The framework emphasizes iterative development approaches that begin with systematic governance requirement assessment, proceed through data architecture evaluation, and culminate in decision support tool development that directly addresses identified needs. This approach contrasts with technology-driven system design that may create advanced capabilities without corresponding utility for actual governance challenges.

Implications for Digital Governance Transformation

The Maharashtra case study demonstrates that effective digital governance requires alignment between technical system capabilities, institutional decision-making processes, and administrative capacity levels. Data collection and visualisation capabilities provide limited value without corresponding attention to how information translates into improved governance actions and service delivery outcomes.

These findings have broader implications for digital governance approaches across government programmes, suggesting that successful transformation requires systematic attention to decision-making requirements, institutional capacity development, and user-centred design principles that prioritize practical utility over technical sophistication. The evolution toward decision support systems capable of addressing complex governance challenges represents an essential advancement for achieving sustainable development outcomes through evidence-based policy implementation.

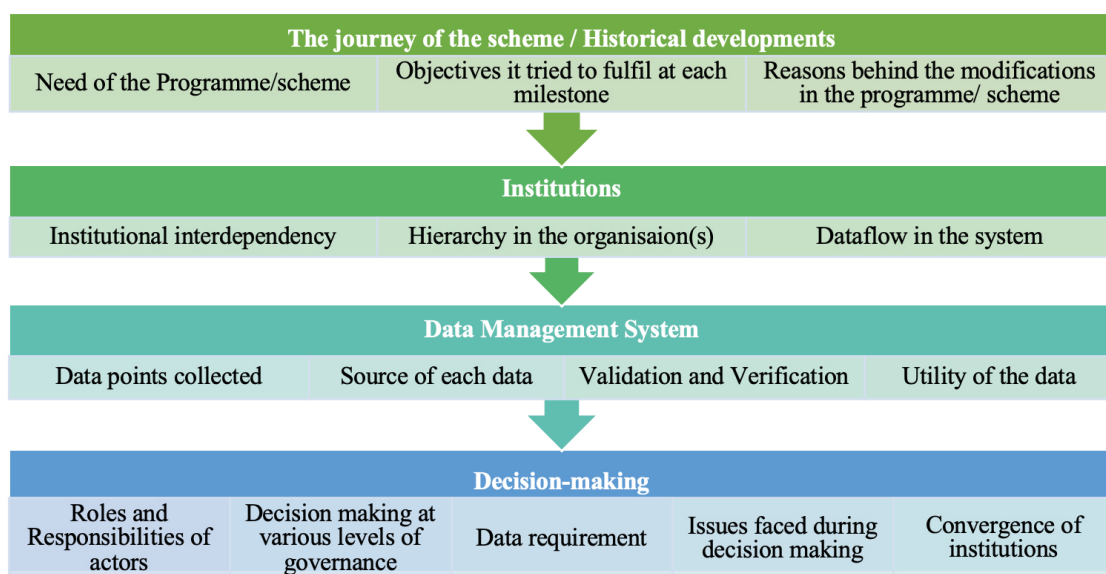


Figure 7 Framework to study and understand a scheme for developing a Decision support system (DSS)

Annexure

I. Data Collection Processes in Maharashtra's JJM Implementation

Initial Data Migration and System Setup: Primary beneficiary data was transferred from the Swachh Bharat Mission portal, with Maharashtra utilizing third-party organizations for data entry at the block level to reduce workload on regular staff. This streamlined approach enabled systematic identification of households requiring Functional Household Tap Connections before regular data entry processes commenced.

Action Plan Development: Village Action Plans originate from Gram-sevaks (Village Development Officers) and Sarpanchs, providing standardized data to Circle Resource Coordinators (CRC) or Block Resource Coordinators for portal entry. This provides essential baseline information for scheme planning and design, establishing FHTC targets for each village. District Action Plans aggregate village-level data, while State Action Plans synthesize district inputs for effective planning coordination.

Asset Documentation and Verification: Junior Engineers from Rural Water Supply departments and private firms like WAPCOS conduct scheme design, implementation, and asset geo-tagging using Field User Apps. Asset documentation requires photographing infrastructure with five people present to record geolocation data. District MIS coordinators review these submissions with approval or rejection authority, though the system lacks feedback mechanisms for rejection reasons, creating coordination inefficiencies and increased workload on the JE and MIS coordinators.

Water Quality Monitoring: Field Test Kits (FTKs) enable testing at delivery points and local sources with or without Jal-Surakshak assistance. Results flow from FTKs to Village Development Officers to Circle Resource Coordinators for portal entry. Jal-Surakshaks collect samples according to designated plans, register them through Gram Panchayats or CRCs, and deliver them to subdivisional laboratories where attendants enter results for district WQMIS coordinator verification and source safety classification.

Progress Reporting: Physical and financial progress enters the portal with each transaction, validated against Public Financial Management System data. Monthly Progress Reports are prepared by implementing agencies, including Maharashtra Jeevan Pradhikaran for Multi-village Schemes, Zilla Panchayats for Single Village Schemes, and GSDA for Groundwater Recharge Structures, with signed copies transmitted to state offices.

II. JJM Operational Guidelines Monitoring Elements

The operational guidelines specify 22 monitoring elements across technical, institutional, and governance dimensions including water quantity measurement, groundwater level tracking, storage tank overflow monitoring, basic water quality parameters through sensors, leakage detection, pressure monitoring, institutional activity tracking, geo-tagged asset documentation, financial progress monitoring, water quality surveillance, community sanitary inspections, laborat-

ory assessments, grievance documentation, and functionality assessments covering source sustainability, system sustainability, and scheme convergence.

III. Challenge Analysis Framework

Complex implementation challenges require systematic causal analysis that examines relationships between constraint categories, breaking down problems into component issues until directly addressable root causes are identified. This analytical approach prevents premature technical solutions that may fail due to unresolved fundamental constraints, including infrastructure limitations, institutional capacity gaps, or resource availability problems.



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