

## Review Paper

# Data and monitoring in the Indian rural water and sanitation sector – a review of current status and proposed ways forward

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### ABSTRACT

This paper reviews progress on monitoring and evaluation on water, sanitation and hygiene (WASH) programmes in rural India, focusing on the Government programs and the related data and monitoring initiatives. The current state of the WASH sector is presented and discussed in terms of progress across geographical, wealth and social groupings. Though progress has been made, key challenges include data quality, reliability, standardization, availability, reach to all social groups and scaling up with quality services. Possible ways forward are proposed at various administrative levels (National, State, District and down to the individual) and discussed along with good sector practices. Efforts that advocate for increased public data becoming available on-line and then using this to improve the visualization of data are described. Recommendations are identified around increasing evidence-based policy and implementation and help support corrective management action via the linking of monitoring to intervention to results and stronger integration across the social, financial and technical issues.

**Key words** | auditing, India, monitoring, open data, sanitation, water

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### INTRODUCTION

India is at a critical time in terms of management of water resources, water supply and sanitation with unprecedented challenges from population growth, urbanization, agricultural and industrial demands (UNICEF, FAO, SACIWaters 2013); this is a complex and inter-linked sector and so solid data is required to facilitate evidence-based decision-making and program implementation (ADB 2013, Cronin *et al.* 2014a). The Government of India (GoI) recognizes 'sustainable water management has become a far more complex task (technically, socially and politically) than can be handled by traditional cost-benefit analysis ... and calls for ... comprehensive knowledge regarding the current and emerging situation' (Planning Commission 2011a, 2011b). However, serious gaps and inadequacies exist in the scope,

coverage and quality of data currently used for managing India's water (Upali *et al.* 2008; Shah 2013).

This paper reviews current progress on monitoring and evaluating water, sanitation and hygiene (WASH) programmes in rural India. The focus is on the two national programs: the National Rural Drinking Water Program (NRDWP) and the national sanitation campaign known as 'Nirmal Bharat Abhiyan' (NBA). The data collected as part of these programs helps to assess progress towards the planned outputs and, where required, should be used to improve the evaluated intervention or policy. We review these approaches and discuss possible recommendations that include better quality data, better availability to the public and better ways to integrate social, financial and

technical aspects of data for improved evidence-based interventions ultimately resulting in increased impact.

## BACKGROUND

In India, water and sanitation is overseen by two Central Ministries: the Ministry of Water Resources (MOWR) manages all water resource issues while rural drinking water supply and sanitation is handled by the Ministry of Drinking Water and Sanitation (MDWS). MDWS is a recently formed Ministry and formerly was a Department within Ministry of Rural Development. While this is a recognition of the growing importance of rural water and sanitation in India, such a move should also lead to increased capacity for implementation and monitoring of State implementation. Also, a similar culling of roles and responsibilities at State and sub-State levels has not happened and now rural water and sanitation is being implemented by a wide and diverse range of State Departments, from Rural Development to Panchayat Raj (Local Government) to Public Health and Engineering and other variants of these.

Therefore, two Ministries are responsible for the oversight of the entire water ecosystem from nature to services to people for rural India though often with little overlap across them. The monitoring and data collection is the responsibility of the District level officers. Since water is a State issue constitutionally, the Government of India provides guidelines and funding while the State Governments implement the schemes and also contribute State human and financial resources. Crucially, most monitoring should happen at State and District levels. Therefore, the State and Districts are mandated to collect data from the sub-district levels and feed this into a comprehensive National on-line system, the Integrated Management Information System. The other major source of data on drinking water and sanitation progress in India are national household surveys (from Census to National Family Household Survey and National Sampling Survey [NSS] Organisation surveys), and are used in the Joint Monitoring Program assessing progress towards the water and sanitation targets of MDG 7 (WHO/UNICEF 2013). These two data sources serve different purposes, the first being related to program implementation progress and

targets and the other direct feedback from citizens during household survey responses.

Water and sanitation data in India is consistently collected by Government and a great amount of it is also shared online or available for purchase. For instance, water supply schemes are monitored right up to habitation level (i.e. sub-village level) in relation to physical targets including number of households to be covered in a particular habitation along with the expenditure planned and incurred and this is all available on the MDWS website ([www.mdws.nic.in](http://www.mdws.nic.in)). Also the MDWS IMIS system contains information regarding water quality tests conducted at various laboratories of samples drawn from villages throughout the country. The IMIS also contains habitation-wise information on number of schemes handed over to the Gram Panchayats (the lowest level of elected local Government in India, this level has been mandated with Operation and Maintenance (O&M) of rural water and sanitation schemes while often lacking capacity to carry it out). Information on financial progress and achievement for O&M is also provided.

In addition to MDWS Census, NSS and National Family Health Survey (NFHS) data, other related datasets are available for accessing by purchasing the data or filing a Right to Information application. Researchers have used this data extensively (e.g. Meera & Mehta 2011; Ghosh & Cairncross 2014; Cronin *et al.* 2014b). While much of this data is disaggregated to a reasonable extent there are issues with methodology of data collection, timely availability, and poor quality of local level data have been found across the rural water and sanitation sector in India. This lack of standardization across datasets makes it difficult to undertake large-scale and detailed analysis that can be drilled down to sub-village (habitation) level for intervention; for example, it is not possible to determine the number of villages fully covered by water supply schemes that are not considered covered as they are supplying unsafe water. Data also is not consistent across government bodies; the 2011 Census had a different result for toilet coverage than the NBA, which may indicate serious issues with data collection practices (Mohanty 2012).

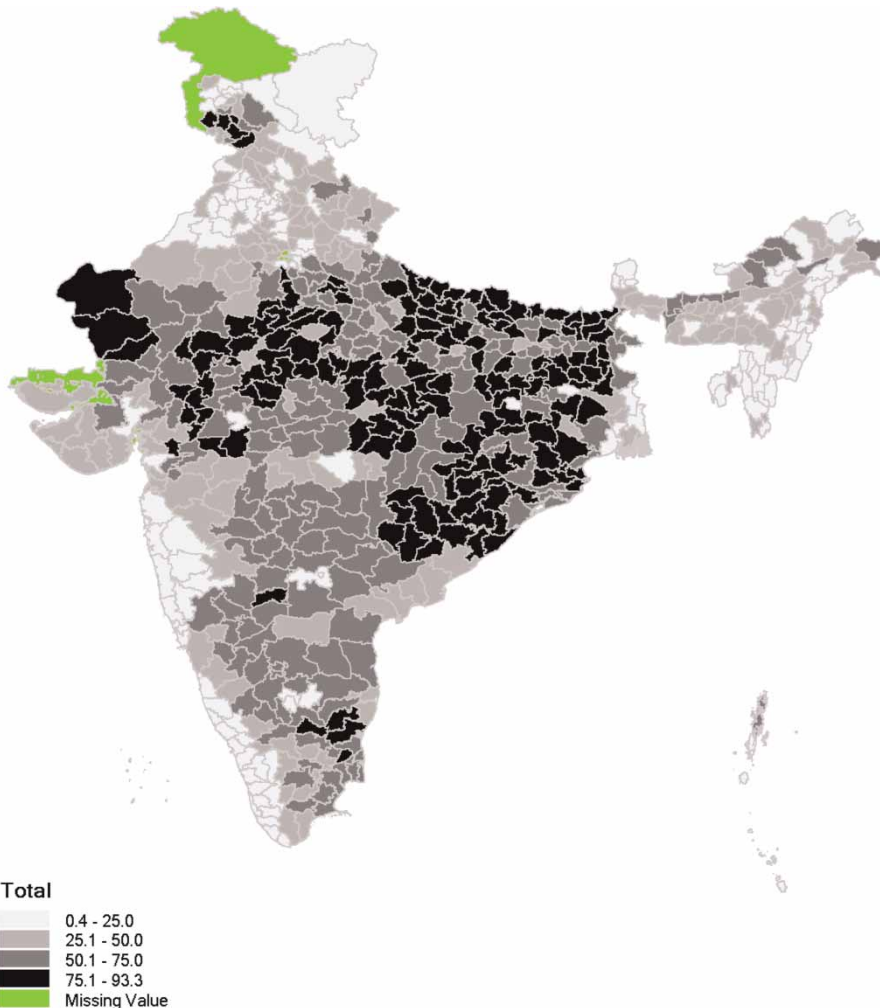
In summary, the water and sanitation problems of rural India require detailed data collection and analysis to determine appropriate policy, funding, program design that

allow for proper evaluation of those approaches. As water and sanitation are a State issue, it is currently difficult for a central body to rigorously monitor and standardize methodology for various parameters. This has resulted in a gap in the availability of consistent quality data across States.

## OVERVIEW OF PROGRESS IN THE INDIA RURAL WATER AND SANITATION SECTOR

To understand the data and monitoring gaps, the current situation of rural WASH service provision is presented.

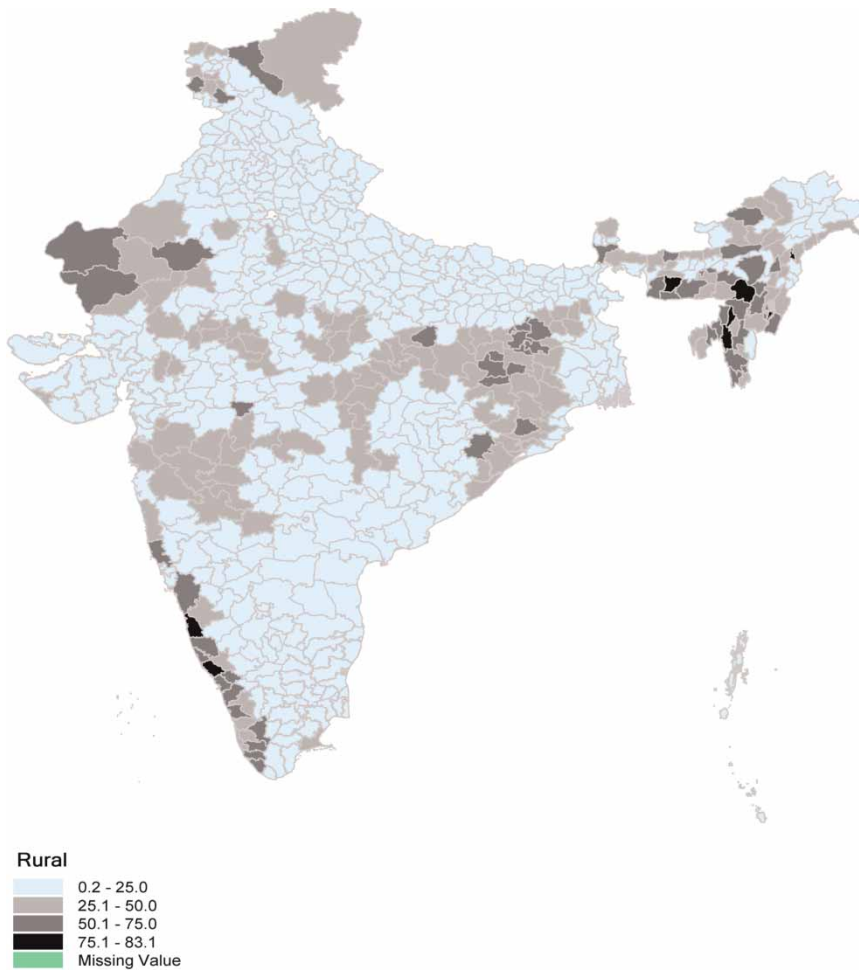
Census 2011 data has District-wise status of water and sanitation has been mapped (Figures 1 and 2) to this end. Open defecation (OD) rates (Figure 1) show both urban and rural but the progress in rural areas has been much slower – OD rates have dropped by 41% in urban areas over the period 2000–2011 compared to only 16% over the same period in rural areas (based on WHO/UNICEF 2013). Looking at OD rural rates only, less than one third of Indian Districts have rates under 50% (based on Census 2011). While water provision is better (Figure 2) data constraints mean water access and quality cannot be linked (discussed further below).



### Sources

Government of India\_Census\_2011

**Figure 1** | Percentage of population open defecating in Districts of India, based on analysis of Census 2011.



## Sources

Government of India\_Census\_2011

**Figure 2** | Percentage of population using unimproved water sources in Districts of India, based on analysis of Census 2011.

Significant differences are observed between the coverage values for sanitation obtained from the different data sources including the NSS, NFHS, District Level Health Survey and Census. The MDWS IMIS states progress of 81% cumulative total on sanitation up to April 2011 (using the 2001 Census population and hence a lower baseline) is much higher than the [Census 2011](#) report of 53% of all India not using a latrine. While the household surveys collect data on reported use, the IMIS data is based on assets created. Differences between these suggests that a significant proportion of assets – toilets, drinking water facilities created are not being used by households for various reasons ([Hueso & Bell 2013](#)) but the data does not give

reasons for this discrepancy. One of the reasons of discrepancy may be due to poor quality of assets, others may include definition of facilities, etc. Therefore, with the NBA data it is not possible to determine the proportion of households practicing OD as the data pertains to toilets built over a period of time against the targets set without consideration to their use. The IMIS also does not capture the type of toilets built – pour flush or pit. It also does not allow combining water access and sanitation progress to highlight which districts are doing well in both areas.

The gap between reported and actual coverage and reported use of toilets constructed is also evident from concurrent monitoring efforts of households in five GPs of UP

(GoUP & UNICEF 2011) where actual coverage is around 25% less than the reported coverage (as per NBA monitoring system), while the reported use in turn is 17–23% less than actual coverage, across household and institutional latrines. It is clear that there is a need for a mechanism, such as concurrent monitoring or third party checks, to assess, verify and certify the assets being built are being used.

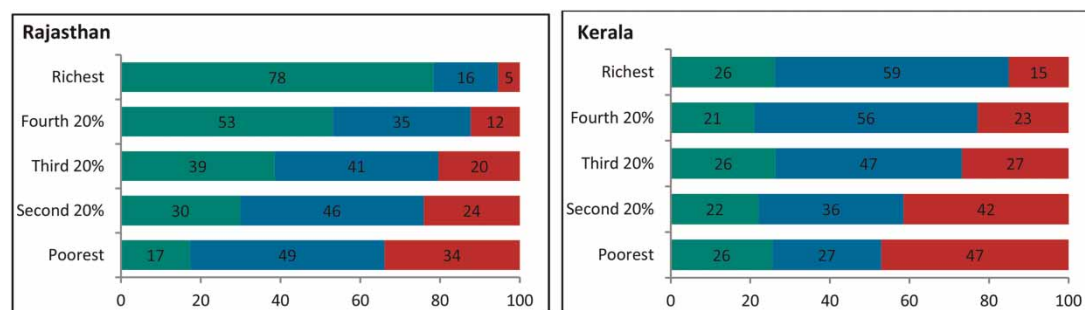
Similarly, in the case of rural drinking water supply it is not possible to assess the access to improved drinking water sources throughout the year; multiple sources are routinely used by households across India particularly during summer, all of which are not improved. The IMIS does not capture other improved sources of drinking water like protected wells, which account for about 10% of all sources in rural areas. However, the IMIS does provide information on water quality tests done throughout the country on a periodic basis though critical information on bacteriological contamination is not provided. The IMIS though does provide data on availability of field testing kits across districts throughout the country though this is not an impact indicator. Census and surveys do not capture any data on water quality at the moment. Census 2011 has included question on proportion of treated/untreated tap water though other countries have already coupled water testing to household questionnaires (Pathey 2009).

A key issue behind the service provision statistics is to determine who has access to improved service provision. Disparities in WASH service provision exist across States and Districts; rural–urban divides; religious and social grouping, including politically recognized excluded classes such as Scheduled Castes (SC) and Scheduled Tribes (ST)

(UNICEF 2012a). Currently 65% of the richest quintile of India have piped water on premises while it is only 2% of the poorest quintile; in rural areas 32% of the richest quintile have piped water on premises while it is 1% of the poorest quintile (based on analysis of NFHS-3 2006). State wealth quintile analyses have also been constructed (Figure 3). Other Household survey data available shows 15% of the poorest quintile of Indians has access to a toilet while it is 58% of the richest (NSSO 2010).

Caste and tribe-based inequity have resulted in deprivation due to social barriers in access and effective use – ST household access to piped water is lower than the Indian average (24% as opposed to 44%); the corresponding value for SCs is 41%. STs and SCs are also disproportionately disadvantaged with lower access to sanitation than the Indian average with 75% and 63% respectively as compared to the national average of 50% (Census 2011). The urban/rural divide is also evident 65 percent of rural India defecates in the open but only 11 percent in urban areas. Due to the environmental and societal needs, the urban areas appear to reflect better WASH coverage. However, the urban poor are a discriminated group within the urban segment (UNICEF FAO SaciWATERS 2013). Geographic inequities exist with richer States and Districts closer to State capitals in general being better served (UNICEF 2012a).

Though surveys capture these at National and State level, more detailed disaggregation is often not possible due to paucity of data given the sampling frame and design of these surveys. Indeed, for gender very little, if any, disaggregated data exists (Lala *et al.* in press). Without such data or local ability to better define inequitable access,



**Figure 3** | Examples of drinking water sources across wealth quintiles – taking the State of Rajasthan and Kerala as examples; based on NFHS-3 (2006). Dark gray (on left) is the % of that quintile population with access to other improved sources (e.g. protected wells and handpumps). Light gray (centre) is % of that quintile population with access to piped water. Medium gray (right hand side) is the % of that quintile population with access to unimproved sources.

corrective actions at grassroots level cannot be systematically initiated and linkages between survey data and program monitoring remain weak. The link between the IMIS data, changes in policy and the possibility for the Centre to work more with States to focus on particular populations and marginalized areas needs further examination. Possible future work could explore expanding possible use of the MDWS-IMIS for local level equity analysis.

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## DISCUSSION: EXPLORING POSSIBLE WAYS TO MOVE FORWARD AT EACH LEVEL

This Section examines issues at each administrative level in order to find possible and plausible ways forward in terms of strengthening the evidence base for rural WASH decision making in India.

### Open data

The India Water Portal (IWP) is a community of water and sanitation sector actors that largely concentrates on collating content, including case studies, reports, policy documents, manuals, news, opinions, and advice. The IWP Data Project aims to understand what water data exists and create a diverse and vibrant community who will use that data to enhance projects, advocacy, and impact around major water and sanitation sector indicators. The website ([www.indiawaterportal.org](http://www.indiawaterportal.org)) has had in excess of 34,000 hits over the past 3 years.

The IWP assessed the available datasets relating to water in India and found that over 300 datasets exist online but the water sector's use and understanding of this data is limited and there is significant space to expand content and its application. There are issues in terms of the formats used and its presentation. For example, while MDWS data is extensive and updated frequently, it does not allow easy visualization. More open platforms would encourage more use and users of the data and help to ground truth the information. Figures 1–3 all used open data but required considerable reworking to allow analysis and visualization. Freely available data in easily workable formats will help move the discourse away from anecdotal

to evidence-based decision making – for example, to what extent does lack of functioning toilets contribute to dropout rates among school children? More quality data that is easily available can begin to allow such correlations to influence policy and implementation.

Open government data (OGD) is gaining popularity. This relates to the concept that data collected using public funds and being used for development should be freely available to use it for projects and pursue policy change through evidence (OKFN [Open Knowledge Foundation, Definition of Open Government Data <http://opengovernmentdata.org/>]). The Govt. of India recognizes the potential of OGD and has approved the National Data Sharing and Accessibility Policy (NDSAP) requiring all departments to share and categorize the data they have in one common platform such as Data.Gov.in (DST 2012), which adopts a similar approach to data sharing platforms of the US and the UK. MDWS has also contributed rationalized datasets to this initiative ([http://data.gov.in/catalogs/?filter=catalog\\_type%3Acatalog\\_type\\_raw\\_data%2Bagency%3A1926&sort=updated%20desc](http://data.gov.in/catalogs/?filter=catalog_type%3Acatalog_type_raw_data%2Bagency%3A1926&sort=updated%20desc)).

The Planning Commission has also recognized the need to improve water data and its role in improved management and a series of recommendations made (Shah 2013). The Central Water Commission (CWC) has developed a GIS-based water data portal, the Water Resource Information System (WRIS) and is presenting water data on a mapped interface. The recent draft policy on data dissemination, which the CWC released, underlines the clear importance of the WRIS as a dissemination platform for water data in India (MOWR 2013).

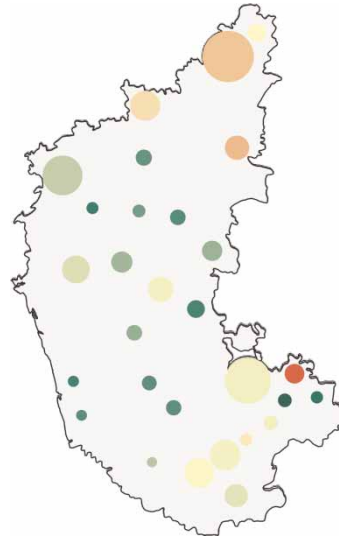
### National level

National level efforts on data standardization and quality assurance are essential. Water quality data illustrates this point well. A large database of water quality data exists on the MDWS IMIS but it is not clear if all States collect and analyze data in the same way and so uniformity and quality assurance are real issues. There is also a great deal of water quality data that sits in CGWB and CWC. It can be helpful to have a standard water quality testing procedures across Ministries and for the data to all be in place so that people can get a full idea of what the water quality is from various sources to allow for corrective action, as called for in the

Uniform Drinking Water Quality Monitoring Protocol (MDWS 2013). Provision for collection of data on water quality may be made in various household surveys to estimate access to safe water (see Bain *et al.* 2012). Linking financial progress with results, especially in disadvantaged communities, could help a variance analysis to be made and so would allow any discrepancies between the two to be spotted immediately. More analysis is needed of villages with decreasing access to safe water (from the IMIS) to assess the reasons and review the corrective action required. Also important is expanding and better capturing behaviors (reported and observed) in surveys.

To address equity, a comparative analysis of coverage in areas with high concentrations of minority groups may be made. Indeed, in the IMIS, the use of GIS may be further strengthened to identify problem areas and also to map process variables, for instance number of Block resource centres operational/number of meetings of local committees, etc. Furthermore, there is a need to look at water and sanitation programmes in an integrated manner as ease of access to water source is an important variable for sanitation (UNICEF 2012b). Mehrotra *et al.* (2013) argue that MIS, including for MDWS, is still in its infancy in most GoI flagship programmes, and yet to become an evidence-based tool for management and argue for improvements in this respect.

In 2012 Arghyam initiated the State of Sanitation Program (<http://www.indiawaterportal.org/topics/rural-sanitation>) with the goal of simple pattern analyses of NBA data. The work has involved examining spending and coverage data in the IMIS system and creating dynamic visualizations along with clear terminologies for a non-technical audience. For instance, it is not easy to answer questions such as: how one state is doing with respect to another; or one district vs another in a different state. Such simple visuals can aid in easy understanding of the state of rural sanitation. Figure 4 presents an example of an analysis done comparing financial progress and physical progress. Districts and states with best practices can be identified and lessons cross fertilized to areas that are struggling to achieve progress on rural sanitation. By changing how data is presented helps to improve monitoring and evaluation, in addition to increasing interaction with stakeholders.



**Figure 4** | Visualization of money spent on rural sanitation by NBA for Karnataka. Size of the circle is the total budget for the district and the grey scale reflects the extent of budget expenditure.

### State level

The ultimate goal is to move towards monitoring for results, i.e. the sustained use of safe drinking water and hygienic sanitation facilities by all. This means shifting traditional views on M&E from a reporting requirement to a management tool that can improve achieving results, including increased financial efficiency. Simple tools monitoring tools for effective management need to be available to decision makers at state level. Positive examples exist in the Sector of a strengthened evidence-based influencing decision making, e.g. a review of the initial NGP awardees highlighted slipping back of several NGPs in terms of their open defecation free status (UNICEF/TARU 2008). While this did expose limitations in the verification process, the findings were collaborated on a larger scale (MDWS 2011) leading eventually to process strengthening via third party verification of NGP applications.

There has been several initiatives to improve monitoring at State level. Assam's Public Health Engineering Department have introduced a Supervisory Control and Data Acquisition system to monitor water supply and quality from dams in the area (<https://www.facebook.com/media/set/?set=a.668614406544759.1073741932.410040242402178&type=1>). In 2012 MDWS launched a water security pilot

in 10 States, the aim is to integrate data collection and participatory monitoring of water as a resource. This pilot including several different departments working together like CGWB, MNREGS, IWMP, and NRWDP (MDWS 2012).

A clear understanding of the impediments to achieving results can be achieved through mapping of bottlenecks. Generally the focus of these approaches is on assessing inputs, processes, outputs and outcomes in order to be able to arrive at a situational analysis whereby key gaps, bottlenecks, become visible, along with the required interventions and finance to achieve the goals and from this an intervention priority mapping may be derived. These approaches may also take into account the inclusion aspects with particular indicators looking at the accessibility and affordability of marginalized sections. It has been used extensively in the Health Sector. The marginal budgeting for bottlenecks is an analytical costing and budgeting tool that helps countries develop their health plans by taking into account the most effective interventions, cost and budget marginal allocations of their implementation to health services and assess their potential impact on health coverage and outcomes. Bottleneck analyses have taken place for WASH in India at District level, for example in Maharashtra (UNICEF 2012c) and at State level, for example in MP, Orissa and Rajasthan (WSP 2013) and further developed tools are now available for comprehensive bottleneck approaches at States level (UNICEF 2012d); this will help identify what priority efforts can be made to unblock bottlenecks with the aid of strong monitoring.

Diarrhea among children is important indicator of quality of drinking water and sanitation provisioning. Linkage of drinking water and sanitation provisioning and diarrhea cases over time may provide one way of assessing the program outcomes. Appropriate linkage may be established with NRHM/ICDS programmes so that GP-wise number of monthly diarrhea cases among children could also be put on the website of MDWS in order to ascertain the impact over time. Such an approach is not easy to immediately gauge impact due to methodological challenges, cost and capacity and the complex multiple routes of the faecal-oral transmission route as well as the key role played by personal hygiene. However, such an initiative would help to raise awareness on the importance of convergence of monitoring

systems and linkages of WASH to health impacts. Longer term, the key issue of improved nutritional outcomes and reduced stunting may prove a strong indication of improved WASH service delivery over time.

### District and sub-District levels

The District, Block and village bodies are the key institutions responsible for the implementation and upkeep of drinking water and sanitation programmes in rural India. Each level has both enabling, implementation and reporting roles; each tier must act as an enabler for the tier below. Accordingly, in order to best understand action at community level, it is important to capture process indicators (e.g. Table 1) at various levels in addition to the overall output indicators like number of latrines constructed, number of water supply schemes completed, etc. It is, of course, essential that to have impact one must see the process of data collection and strengthen this (i.e. a system improvement plan) and then its analysis and usage to make mid-term implementation changes in the program (a performance improvement plan). Close inter-linkage across these plans is essential.

The extent of decentralization of funds, functions and functionaries varies across States and its impact on M&E must be better understood. One interesting recent initiative in this respect is the MDWS Management Devolution Index initiative trying to link fund allocation with process and outputs. There is a need for capturing gaps in execution that can be updated at local level. This will assist in putting in place an accountability mechanism with clear identification of bottlenecks and actions required. In terms of sustainability of structures built a record of expected life of assets is needed. Turn-around time for O&M activities may be recorded and compared with benchmarks as this is a critical gap at local level. Areas continuously missing targets may be prioritized for attention.

### Citizen level

A strong two-way interface between the citizens and the service provider is necessary for real-time feedback on quality of service provision. The service provider must consult users on plans and progress and citizens should have the



**Table 1** | Examples of possible indicators at District and sub-District level

Level/Institution	Potential process indicators
District (e.g. District Water & Sanitation Mission)	<ol style="list-style-type: none"> <li>1. No. of schemes for water supply and sanitation submitted by block panchayats/GPs approved</li> <li>2. No. of BRCs supported on water quality, safety, demand generation issues, etc.</li> <li>3. No. of capacity development and campaign programs organized</li> <li>4. No. of O&amp;M issues resolved at district level</li> <li>5. No. of meetings held with convergence programs like MGNREGA, NRHM, SSA, ICDS</li> <li>6. No. of field visits/monitoring trips with corrective action identified and followed-up conducted by officials</li> </ol>
Block (e.g. Block Resource Centre)	<ol style="list-style-type: none"> <li>1. No of GPs assisted in formation of VWSC</li> <li>2. No of demand generation events conducted focusing on sustainable behavior change outcomes</li> <li>3. Training courses conducted for GP and VWSC functionaries</li> <li>4. No of GPs assisted in drawing up of Village Action Plan on water and sanitation</li> <li>5. No. of GPs assisted in implementing Village Action Plan</li> <li>6. No. of GPs assisted on O&amp;M issues</li> <li>7. No. of trained workers assisted in water quality testing</li> <li>8. No of GPs assisted in conducting social audit</li> </ol>
Village and Panchyat level (Village water and sanitation committees)	<ol style="list-style-type: none"> <li>1. No of VWSC meetings held in the month (with gender and social grouping participation monitored)</li> <li>2. No. of households demanding sanitation facility identified</li> <li>3. No. of households demanding sanitation facility approved/supported</li> <li>4. No. of new water schemes proposed</li> <li>5. No. of O&amp;M issues addressed in existing water schemes</li> <li>6. No. of water quality samples collected and sent for testing/tested</li> </ol>

opportunity to report their complaints, O&M issues, water quality problems etc. in an accessible manner. Technology can now play a key role in facilitating this interaction. A web-based system could contain village-wise list of households planned for sanitation, water work with the list of completed households, slipped back sources and action planned; such a website can have two way access by users – for checking and updating e.g. through mobile phones. A call centre interface at district level could also be established in local language with interactive voice response system (IVRS). Such a website is possible to be updated also at GP level as the Common Service Centre Scheme of the Government of India, via the National e-Governance Plan (<http://negp.gov.in/>), has established a network of about 100,000 ICT kiosks all across the country in rural areas. Thus, an enabling environment has been created for updating and monitoring the data on water and sanitation on on-line basis from village settings. In order to strengthen validation and monitoring, mobile phones/low-cost smartphones with GPS facility can be readily used –

an image of the asset (water/sanitation) built may be put on a website with the GPS coordinates for verification and a date stamp (e.g. WSP 2012).

A summary of the various potential recommendations at National, State and District level is given in Table 2. These advocate for stronger linkages between the use of data and monitoring with policy and program oversight, ultimately leading to stronger evidence based decision making. These interventions have been prioritized and categorized into action in the short, medium and long term. Such a listing is not final and aims to help generate debate around the most pressing areas that are needed for improved rural WASH services in India.

#### Potential use of integrated audits

Financial auditing is in practice, overseen by the Auditor General of India, but cannot capture value for money or on quality of service delivery. It must be linked with a social audit to reflect on what has been delivered to the

**Table 2** | Potential recommendations at National, State and District level for rural WASH M&E in India to strengthen evidence-based planning and implementation.

	Medium Priority	High Priority
<b>National Level</b>		
Short-term	Standardization of water quality testing and reporting procedures Expand visualization tools in IMIS	Link financial progress with outputs and impact evaluation Standardized formats for data collection and dissemination
Medium-term	Service Level Benchmarking	Slip back of habitations – analysis of why and corrective action Undertake local formatives, baselines, mid-line corrections and end-line evaluations, including hygiene
Long-term	Village level data and maps available on website for download and use at grass-roots level	Sharp focus on collection of data on monitoring/marginalized groups with emphasis on data disaggregation (including gender)
<b>State Level</b>		
Short-term	New District integration into IMIS of all flagship programs	Bottleneck Analyses of programs; Higher focus on hygiene; Link financial progress with outputs
Medium-term	District data validation Technical Audits	Convergence of schemes and analysis Capacity building on M&E issues
Long-term	Service level benchmarks – O&M, availability, accessibility, durability of assets; monitoring of sustainability	Clear Accountability: Personnel policy adopted to outcome measures, additional allocation of funds to better performing GPs/ districts
<b>District Level</b>		
Short-term	Review of planned and actual implementation Institutional WASH reviews (AWCs, PHCs, schools)	Review of current process indicators and actions on gaps
Medium-term	District validation of GP/community progress (and use of new technology via mobile, GPS, etc.)	Capacity building of GPs and Communities; Engaging citizens and civil society for results-based monitoring and social audits
Long-term	Review of system sustainability and O&M v capital costs to take efficiency review	Outcome to Impact reporting

community and a technical audit for quality of service provided, a provision for social audit may be made as a built-in component in NRDWP and NBA programs (MDWS 2011). The social audit may be done by the community regularly and transparently and may consider some of the following activities:

- Recording the achievements made in number of toilets constructed and water supply issues resolved in previous month and who was reached/not reached
- Identifying individuals demanding sanitation facility and any need for O&M of water sources, need for new water source
- Projecting Month Plan for construction of toilets and water supply schemes in the GP
- Identifying slip-back cases and working out strategy for addressing the same

- Verifying expenditure made on various activities in the previous month including disbursement of incentive amount, construction and other works and activities.
- Works undertaken under IEC, HRD and SLWM, etc.
- Availability of human resources required for implementation, e.g. adequate number of motivators for sanitation

Regular technical audits (internal and/or external) of both water and sanitation projects are essential to optimize the benefits of costs incurred and to ensure sustainability. For sanitation, this may involve evaluating the type of toilets constructed with reference to the geological condition, type of soil, water table and distance to nearby water bodies. For hand pumps/tube wells it should be ensured that it is at a safe distance (from contaminating bodies, it should not be shallow and regular O&M activities are done and can check if a cement apron and subsurface seal is provided.



Figure 5 | Concept of combined auditing for improving WASH outputs and efficiency.

For the piped water supply schemes a technical audit should focus on capacity of the system to supply stipulated quantity of water, estimating losses in distribution pipe line network, assessing the downtime and O&M activities, study of power utilization to achieve savings in consumption of electricity, etc.

Such an innovative and integrated suite of auditing (Figure 5) would help to ensure efficiency of the systems and value for money. Indirectly, such a combination of financial, social and technical audits may help impact on corruption in the WASH Sector as it would impact on the three main types of corruption that can be found in the rural WASH sector. These are procurement irregularities (e.g. over-invoicing on official tenders), leakages from development budgets (i.e. payments to senior bureaucrats and politicians) and unviable distortions of planned schemes (reworking of schemes due to political or other pressures that may be against technical best practices and will eventually compromise the scheme functionality (James 2010). Some progress on addressing these issues have been made in the urban sector (e.g. MoUD 2007) and with recent initiatives on action research around service level benchmarking which have been motivated by the lack of reliable and updated information about operational and financial performance of urban water supply and sanitation services (For example, see Performance Assessment System Project, [www.pas.org.in](http://www.pas.org.in), aiming to develop appropriate methods and tools to measure, monitor and improve delivery of water and sanitation in cities and towns in India).

## INSTIGATING SECTOR GOOD PRACTICE AND ACCELERATING GOOD PRACTICE

The role of regulators is receiving increasing attention (Shah 2013). As part of the Twelfth Plan, a model bill for state water regulatory system has been drafted based on a thorough study of latest international thinking on regulation and the experience of the Maharashtra Water Resources Regulatory Authority (Planning Commission 2012). The draft bill proposes a separation of the authority to make 'political' or 'normative' decisions and the authority to make 'technical' or 'predominantly non-normative' decisions. Thus, the State Water Regulatory and Development Council (SC) is expected to ensure accountability by providing the policy framework for the techno-economic regulatory decisions of the State Independent Water Expert Authority (SIWEA). The SIWEA will, in turn, be accountable to technical experts through a mechanism of regular review.

In terms of a large country-wide standardization of water data collection methodology, the United States Geological Survey is a good example. All data must be collected and analyzed according to strict protocols even though the actual data collection is done at the state level (USGS 2013). By standardizing data collection methodology across the country the conflicting parties use the same high quality data sets instead of debating on differing data and their interpretation.

Benchmarking seeks to identify a minimum set of standard performance parameters that are commonly understood and used by all stakeholders. It seeks to define a common minimum framework for monitoring and reporting on these indicators. Service level benchmarks need to be developed for supply, availability and accessibility of water including O&M. Process benchmarking involves identifying and learning from the processes from those that are 'best in class', i.e. GPs/VWSCs can learn from other GPs/VWSCs that are doing well. Thus, processes in GPs already awarded *Nirmal Gram* status (now about 10% of all GPs) may be studied and compared with the prevalent practices and suitably adopted by other GPs. Here it may be mentioned that the linkage between processes and performance in the context of sanitation programme in India has been analyzed by WSP (2011) in 22

**Table 3** | Comparing water access in two Assembly Constituencies in Karnataka; the State average in comparison is over 60 litres per person per day

Parliamentary Constituency	Assembly Constituency	Year	Water Per Person Per Day (litres)	No of Piped Water Supply Schemes (In Use)	No of Latrines under Nirmala Grama Yojana
<i>Bangalore Rural</i>	Bangalore South	2003–04	27	59	1,840
<i>Bangalore Rural</i>	Channapatna	2006–07	24	179	3,408

India Governs (<http://www.indiagoverns.org/> last accessed May 2013).

districts across 21 states of the country using process indicators like strategy for implementation, institutional structure and capacity, approach to creating demand, promotion and supply chain, financing and incentives etc. and with performance indicators like % budget spent, % Individual Household Latrine target achieved, % sanitation target achieved, success rate of NGP applications, % of NGP Panchayats to total No. of PRIs, etc. with a strong correlation between performance indicators and process indicators ( $R^2$  of 0.635).

Bringing in non-State actors into monitoring and evaluation processes can help sharpen the impact focus and reduce irregularities also (Davis 2004). Organisations such as Accountability Initiative and Centre for Budget and Governance Accountability examine budget allocation and expenditure around water and sanitation to ensure the budget allocated are getting spent in the ways it was intended and are being used effectively (e.g. AI 2010). Such calls are also being made globally (e.g. Breslin 2010) and initiatives like concurrent monitoring can help in this respect (Solutions Exchange 2012; MoRD 2012).

Akvo (<http://www.akvo.org/>) is a non-profit organization that builds open source tools for monitoring and collecting data. It is specifically designed for WASH projects and has had extensive experience collecting data through mobile devices. They host the project Openaid which present aid-spend data online in easy to navigate ways so they can meet transparency obligations. This project has brought together a lot of information regarding foreign aid spending so that donors and individuals can track where money is going.

Transparent Chennai (<http://www.transparentchennai.com/>) uses a data-driven model (using volunteers, crowd sourcing techniques and the Right to Information Act) to assess service delivery. They have mapped public toilets in Chennai using government data along with volunteer validation and overlain criteria such as proximity to market

places and slums to show the gaps in toilet locations in relation to needs (<http://www.transparentchennai.com/research/public-toilets-and-sanitation/>).

India Governs (<http://www.indiagoverns.org/>) is a Bangalore NGO that works on correlating Govt. scheme outcomes to electoral districts instead of along the usual administrative boundaries. They generate reports and share them with elected officials on how their parliamentary district is doing on public schemes and so with this evidence-based advocacy aim to make program delivery a part of the election conversation (Table 3); attracting media attention (Kundu 2013; Navya 2013).

## CONCLUSIONS

Though progress is being made on WASH provision in rural India, significant data and monitoring challenges remain, including data quality, reliability, standardization, availability and reach to all social groups.

Recent positive developments include the increasing efforts to make public data available on-line as well as efforts to improve visualization of data, use of technology and efforts to ground-truth data. The Indian water and sanitation sector must strive towards a more reliable ground-based impact methodology using data as a backbone to decision-making. Even with current systems, by collecting data in one place and allowing for sharing of uniform methodologies more use can be made of data from the available sources. Other measures needed include increased emphasis on data quality, disaggregation, auditing and benchmarking and above all corrective management via the linking monitoring to results; one possibility discussed is of closer linkages across audit approaches (social, financial and technical) to support strengthening the system. Good sector

practices are also presented – future wider reviews can identify more of such lessons with potential for scale-up.

Significant efforts are required to put such recommendations in place in terms of orientation and approach, putting enabling systems in place including ICT tools at GP level, training and capacity building. This will have substantial cost implications, but it is argued that such systems are needed to facilitate in progress towards adoption of universal access to safe drinking water and sanitation for a vast population in rural areas of the country and safeguarding WASH investments.

It is ultimately important for all WASH actors to assess the cause of poor performance, including in terms of sustainability, quality and equity, and together share for learning; indeed learning from failure is very important for future program improvements.

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The views expressed herein are those of the authors and do not necessarily reflect the views of UNICEF, or the United Nations or Arghyam. The views expressed in this paper are entirely personal. The authors have no financial interests or benefits from the paper content.

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