

# You Manage What You Measure<sup>1</sup>: Using a Mobile to Web MIS to Strengthen Outcome Monitoring in Rural Sanitation

## Authors

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## Abstract

An effective and robust monitoring system is timely, cost-effective, and credible and tracks relevant indicators which feedback into program implementation. Monitoring rural sanitation outcomes needs to track both construction and behavior change, which is a challenge to measure at scale in the sector. The lack of robust and timely information on outcomes leads to investments made without a credible means to measure their achievement. The explosion of mobile technology has opened up opportunities to improve the monitoring of rural sanitation outcomes. The use of ICT to collect data on sanitation behavior and make this available almost in real time, offers potential, for large scale monitoring. A proof of concept undertaken by WSP used a mobile phone app (application) to track sanitation outputs (construction of toilets) and outcomes (behavior change). It used mobile phones to undertake a survey among households to ask critical questions about the above. Data was sent directly to a web based Management Information System (MIS), which made data available in real time. Additional features such as geo-tagging and photographs of each record created, improve credibility of the information collected. Results are presented through user-friendly charts and maps accessible through the online MIS, updated in real time as records are collected. This proof of concept tested an idea which links ICT with rural sanitation, to improve information available on service delivery outcomes. It demonstrated that: Using smartphones can provide quick, credible information on sector outcomes in near real time unlike that provided by conventional surveys; Features such as geo-tagging and photographs of respondents ensure results are more credible and relevant; and Presentation of data is user-friendly and maps enable a viewer to grasp the status of rural sanitation in a geographical unit at a glance.

This approach of using mobile phones with a web interface to collect large amounts of data in short periods of time can possibly be scaled up in the Indian rural sanitation context, with the existing Total Sanitation Campaign (TSC) monitoring system and Nirmal Gram Puraskar (NGP) assessments using this approach to enhance the quality of the data collection process. As pilots are often implemented in a controlled environment

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as pockets of excellence, taking this initiative to national scale, a sample survey needs to be undertaken across the country. In addition, a comparative analysis of the costs and other benefits of monitoring using ICT approach vis-à-vis conventional approaches, using a systematic and scientific process, are required to understand the efficacy of this approach in the long run.

## **Keywords**

ICT, MIS, Mobile, Monitoring, Sanitation, Rural.

## **Introduction and purpose**

Recent trends in the rural sanitation sector in India, and across the world, have identified that motivating sustainable behavior change rather than just creating infrastructure as the key outcome of a successful sanitation program. This trend is rooted in the failures of conventional approaches which were based on the assumption that once infrastructure is provided, behavior change will automatically ensue. Significant investments were made in constructing toilets in rural areas which ended up being put to various uses such as bathrooms, store rooms and so on.

That said, the focus on behavior change as the outcome of rural sanitation programs, poses specific challenges for monitoring sector progress, namely:

- While monitoring infrastructure is a one-time activity with cross checks over longer time periods, monitoring behavior is a constant activity that requires frequent cross checks over relatively shorter time spans.
- The cost of monitoring, in terms of effort, time and money, can be significant when done at scale and at high frequency. Even sample surveys make data available on program outcomes often after it is too late to make a mid-course correction.
- Quality control is also an issue when such monitoring is done at scale. Results, if they are controversial, can end up being challenged on methodological fronts.

## **Context**

Although India is now included in the front ranks of rapidly growing emerging economies, it is also paradoxically home to the majority of people defecating in the open in the world (Joint Monitoring Program 2010). It is estimated that 1 in every 10 deaths in India is linked to poor sanitation and hygiene (WSP 2011). Diarrhea, a preventable disease, is the largest killer and accounts for every 20th death (Ibid). Diarrhea is linked to malnutrition, especially in children, and India has one of the highest rates of child malnutrition in the world, nearly double that of sub-Saharan Africa (Gagnolati *et al* 2005).

*Box 1: Monitoring in the Indian Rural Sanitation Sector.*

There are three main sources of information on the rural sanitation sector in India:

1. Routine Data Collection: This refers to administrative data collected by the Management Information System of the Total Sanitation Campaign, a 12 year program launched by the GoI to achieve universal sanitation coverage by 2012. The focus of such routine data collection tends to be on inputs such as budget spent and outputs in terms of toilets constructed.
2. Incentive Program Monitoring: The Government of India and several state governments have introduced incentives or prizes to motivate local governments to achieve community-wide total sanitation. These are based on third party survey monitoring and focus on outcomes such as 100% household toilet usage and safe disposal of solid and liquid waste. State government incentive programs are typically designed as annual competitions between local governments and hence winners have to sustain total sanitation achievements in order to successfully compete the following year. The national incentive program however is a one-time prize, awarded once a year and winners are only ever verified once at the time of application. Field assessments show that prize winners do not necessarily sustain total sanitation achievements and one recent study found that access to toilets in prize winning local governments varied from 47% to 100% (GoI 2011)
3. Surveys and Census: These are the most reliable source of information on sector outcomes such as toilet usage. However, results of large scale surveys of rural households are available only every 3-4 years and the Census is undertaken once in a decade.

Between the extremes of input/output tracking through monthly routine monitoring and outcome tracking through annual/multi-year surveys, a mechanism is needed to provide policymakers with reliable and timely information on sector progress. The process that this note demonstrates can contribute to the existing data collection in point no. 1 (routine data collection), as well as strengthen point no. 2 (incentive program monitoring).

To address this sanitation challenge, the Government of India (GoI) has invested heavily in programs to achieve universal sanitation coverage. However, despite two large national rural sanitation campaigns<sup>4</sup>, the goal of an open defecation free India – a *Nirmal Bharat* - remains elusive. To ensure investments in sanitation lead to commensurate outcomes, the sector needs a reliable and timely monitoring system. The present monitoring system is geared towards tracking of inputs such as budget spent and outputs in terms of toilets constructed. The key outcome – usage of toilets – is tracked only for the assessment of the clean village prize (see Box1), which means that the usage of those villages that do not apply are not tracked at all. Subsequently, delivery systems adapt to what is measured, and there is a gap between the sanitation coverage figures provided by routine monitoring (around 76 percent of rural households have access to a toilet, GoI 2011) and the actual usage of these toilets

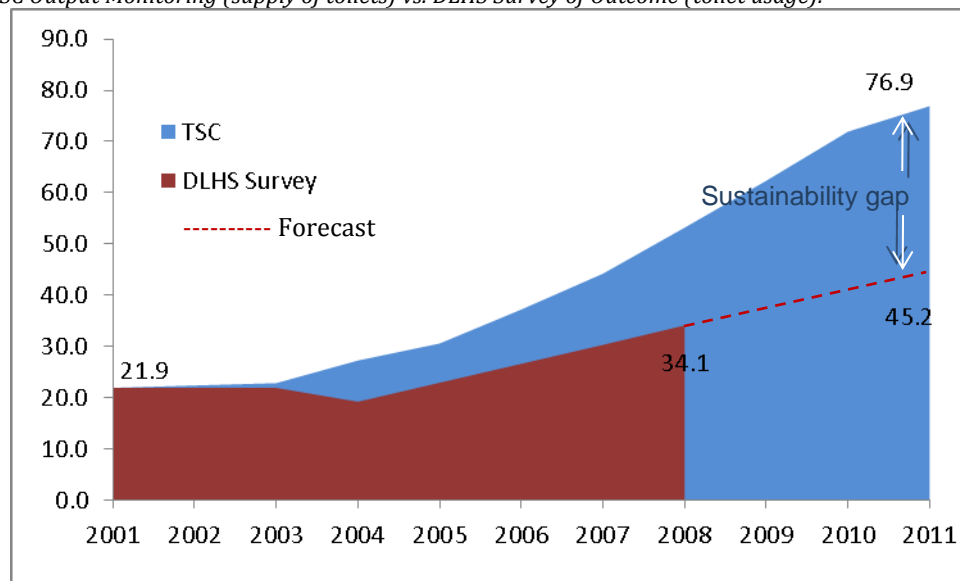
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<sup>4</sup> Central Rural Sanitation Program (1986-1998) and Total Sanitation Campaign (1999-2012).

tracked by surveys undertaken every few years (around 45 percent of rural households actually use toilets, IIPS 2008) (see Figure 1).

Figure 1: India Rural Sanitation Coverage.

TSC Output Monitoring (supply of toilets) vs. DLHS Survey of Outcome (toilet usage).



Source: GoI (2011) and IIPS (2008).

## Methodology

The proliferation of mobile phones in developing countries has outstripped the rate of improvements in basic service delivery in many cases, and India is no exception. Information and Communication Technology (ICT), especially mobile-to-web systems, have increasingly been used for improving service delivery. Some examples include motivating behavior change (advising pregnant women to take supplements) and customer interface (complaint redress systems for water supply).

To test the viability of using mobile technology to strengthen monitoring in the rural sanitation sector, a proof of concept was piloted by the Water and Sanitation Program (WSP), through a company involved in technology for development (Oneworld Foundation). A pilot was initiated in two blocks (sub districts) – Rajgir block in Nalanda district of Bihar, one of the poorest states in India, and in Kandaghat block in Solan district in Himachal Pradesh, a state which has traditionally performed well in terms of economic and human development indicators. The pilot covered the entire rural population of the two blocks which is around 23,000 households.

While this pilot was similar to conventional surveys in terms of instruments used (survey forms), sampling procedures, deployment of trained investigators, the major difference was the use of mobile phones to collect data, in place of pen and paper, which enabled transmission of the information gathered to the central MIS and its analysis, in real time. Additional advantages of the mobile-to-web approach included the inclusion

of photographs for each record collected, GPS tagging of each record which enhanced the quality of information collected.

The following steps were undertaken in piloting this proof of concept.

### Step 1: Development of Outcome Tracker Application

The development of a mobile application, **Outcome Tracker**, was the first stage in the process. Since the focus was on collecting information on key outcomes linked to behavior change and given that mobiles were used instead of conventional paper surveys, the number of indicators was deliberately kept to a minimum. A final list of five key indicators developed into the Outcome Tracker application included:

1. Economic status of the household (assessed through whether a household has an Above or Below Poverty Line ration card);
2. Whether the household has access to a toilet;
3. Sanitation behavior of each member of a household, starting with the eldest usual resident, and type of sanitation facility used or whether practicing open defecation;
4. In case the household includes a child under three years, method of disposal of child feces; and
5. Material available for hand-washing (observation question).



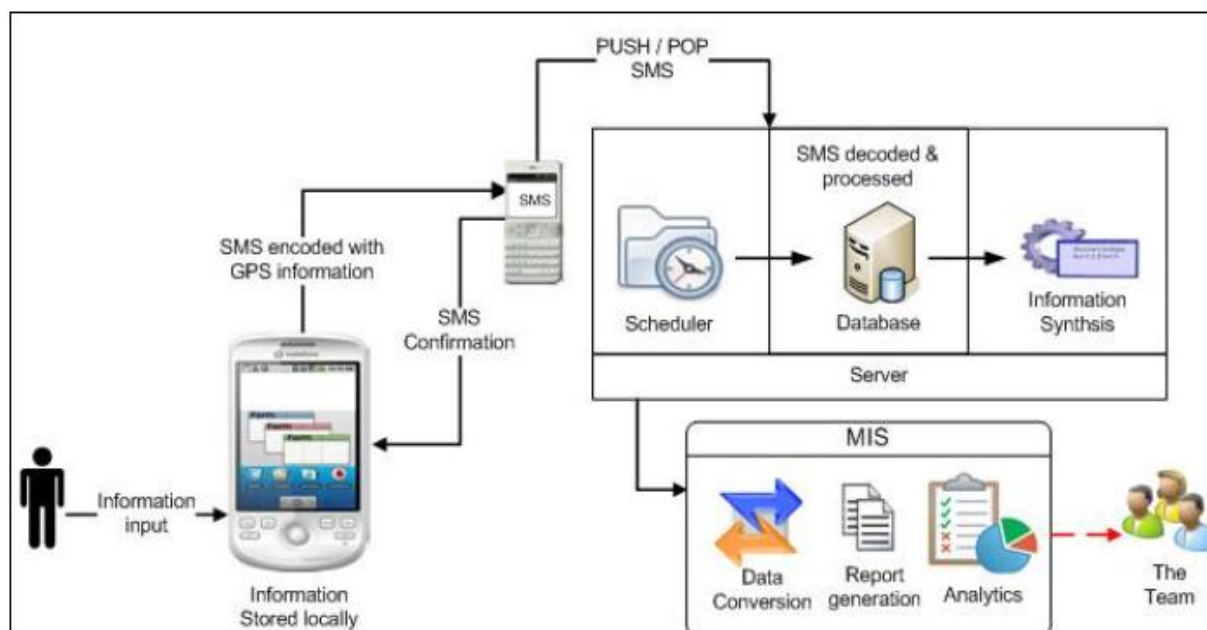
The application was designed to operate in the local language, Hindi, to collect information directly from rural households. The collection process, using smartphones, incorporated two features to ensure the quality of the data:

1. Photograph of the respondent, with the toilet, if available, or in front of the house.
2. Global Positioning System (GPS) coordinates of the location where the data are uploaded to the server.

This removed any doubts as to whether a sanitation facility did indeed exist in a particular household and also ensured that enumerators had to visit different households. Stringent quality controls included automatic flagging of records for back-check and also red flags on records that seemed to contain anomalous information, for example, the toilet is not available but the respondent reported use of a toilet.

A centralized management information system (MIS) was designed to manage large datasets and consolidate the village data at the Panchayat and block levels. This data would then be available to be consolidated and analyzed within a few minutes of its collection.

Figure 2: Technical architecture of mobile-to-web monitoring pilot



## Step 2: Survey of Households

The survey was preceded by recruitment of field investigators who were provided with classroom and field training. The two-day training program focused on nuances of sanitation monitoring and use of mobile phones and the **Outcome Tracker** application. The survey was started immediately after the training was completed in Kandaghat and Rajgir blocks in Himachal Pradesh and Bihar, respectively, and was undertaken over four months from August 2011. The process followed was: a listing of households/Total Sanitation Campaign (TSC) beneficiaries was procured from the local government authority and each field investigator was then assigned a couple of villages and a daily target rate – 30 households in Rajgir and 15 households in Kandaghat. The variance in target was due to the higher density of population in Rajgir compared to Kandaghat. Appropriate quality controls with back checks were also undertaken. These included scanning of data stored on the MIS by a team of researchers to identify outliers and were flagged for verification. In addition, an automatic verification application was incorporated in the MIS that flagged an entry if it fulfilled one of the following criteria:

- If it is the 30th record from Bihar and 40th record from Himachal Pradesh.
- If the toilet is not available but use of the individual household latrine is indicated.

The data gathered at the village level were sought to be transferred to the central server in real time. A dedicated team tracked the quality of incoming data and checked it for verification. A confirmation flag was sent back to the mobile to acknowledge the receipt. In the absence of a general packet radio service (GPRS), the data were stored locally in handsets until they could be sent to the server when the connectivity was restored.



### Step 3: Analysis of Data

The centralized MIS, accessible online to authorized users, presented various options of generating specific as well as customized reports (Figure 3). A user has the option of viewing:

- Detailed individual reports;
- Summary results including population, economic status, sanitation coverage, sanitation behavior; and
- Advanced search option to develop customized reports on different parameters.

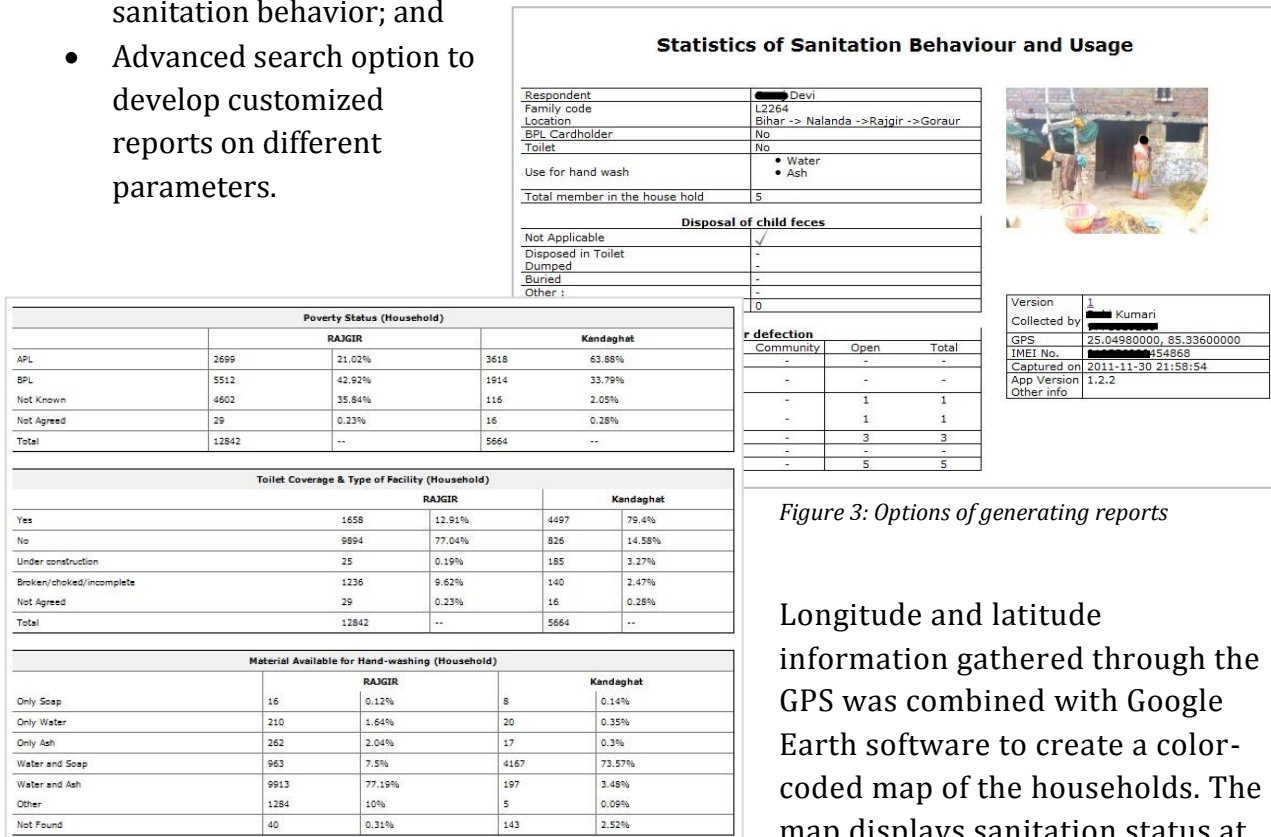
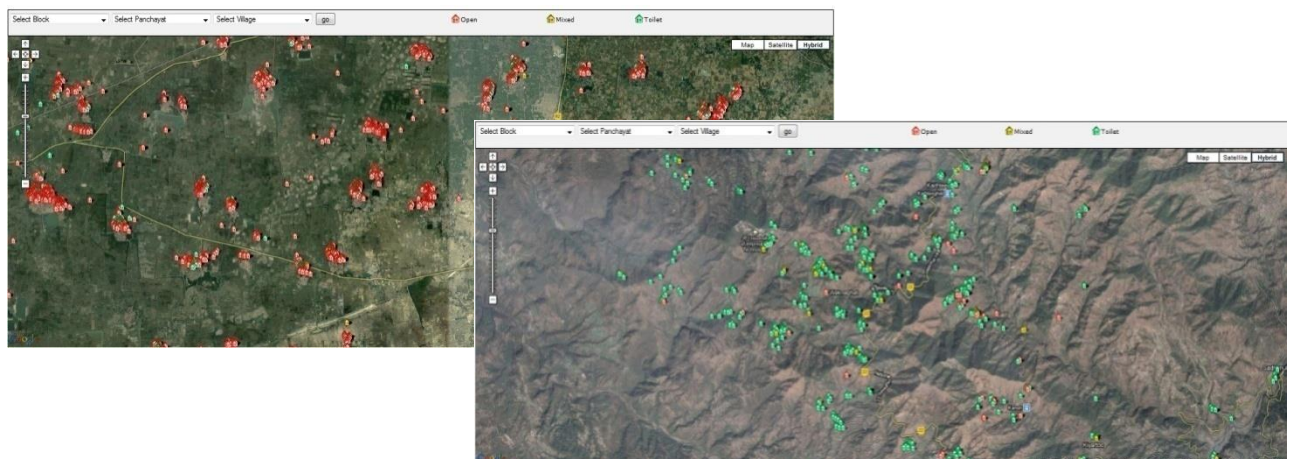


Figure 3: Options of generating reports

Longitude and latitude information gathered through the GPS was combined with Google Earth software to create a color-coded map of the households. The map displays sanitation status at

block, Panchayat and village levels. Three colors are used to represent the status: red indicates open defecation, green indicates toilet usage, and yellow indicates mixed behavior. In Figure 4, the results of the survey are evident for Rajgir and Kandaghat.

Figure 4: Color-coded map of the households.



## Findings and discussions

This proof of concept tested an idea which links ICT (a sector in which India is recognized as a global leader) with rural sanitation (a sector where India needs to improve considerably), to improve information available on service delivery outcomes. It demonstrated that:

- Using smartphones can provide quick, credible information on sector outcomes in near real time unlike that provided by conventional surveys.
- Features such as geo-tagging and photographs of respondents ensure results are more credible and relevant.
- Presentation of data is user-friendly and maps enable a viewer to grasp the status of rural sanitation in a geographical unit at a glance.

There were some specific challenges faced in implementing the pilot using mobile technology which went beyond the usual challenges facing household surveys:

1. Photographing of the respondent, especially near the toilet, although designed to ensure quality control and accountability of the survey, was met with hesitation from the respondents. There was a need to reassure the respondents about the need of photographing and that the information would be kept anonymous.
2. Initially, the low-end mobile phones used in the project did not efficiently support transfer of large datasets. It was noticed that various applications such as GPRS and GPS tended to drain the battery quickly. On average, the phones had to be recharged after completing the survey of 10-15 houses; the number was higher if the phone batteries were fully charged. The problem was exacerbated in Rajgir due to limited power supply. The investigators could not fully charge the phones at night because of which they faced problems during the survey. To address this concern, additional batteries were supplied to the investigators in the latter part of the project, when the problem became apparent. The availability of GPRS is based on weather and network connectivity. Due to the monsoon, GPRS connectivity was poor in several villages of Bihar. However, this problem was anticipated before the start of the project; therefore, an offline information storage feature was added to the mobile application, where the data were locally stored and sent to the server upon availability of GPRS.
3. The deployment of such technological approaches to improving the monitoring system would involve additional challenges in the form of training of investigators and other personnel involved in the survey. While conventional surveys also required training, they were more in the domain of canvassing information from respondents while this approach included technological training also – though this is not complex and simple enough to understand even for newcomers, this would involve time and costs when done at scale.



An overall comparison between monitoring surveys between conventional pen-and-paper based surveys and mobiles could include:

<b>Issues</b>	<b>Pen-and-paper</b>	<b>Mobile</b>
<b>Number of indicators to track</b>	Can include lots of indicators	Best for tracking limited indicators
<b>Type of entry</b>	Manual	Digital
<b>Frequency of updates</b>	Long	Short to medium
<b>Comfort level of respondents</b>	People are used to it	People may be wary of this approach
<b>Time taken</b>	Time consuming, takes long time from collection to collation to data processing to reporting	Very little time, straight from mobile to web MIS; results available in near real time
<b>Photographs</b>	Separate, has to be manually integrated	Automatically part of each record
<b>Locational data</b>	Not possible	GPS coordinates ensures tracking of location

### **Next Steps**

Pilots are often implemented in a controlled environment as pockets of excellence. In contrast, this initiative was deliberately tested in two very different states in terms of economic and human development indicators (Bihar and Himachal Pradesh). The next step is to take this initiative to national scale, through a sample survey across the country – this will enable the provision of data on sustainability of sanitation outcomes at more regular intervals, thereby enabling this to be fed back into program implementation, ultimately leading to overall improvement in quality of processes and outcomes. In addition, a comparative analysis of the costs and other benefits of monitoring using ICT approach vis-à-vis conventional approaches, using a systematic and scientific process, is also being undertaken.

## References

- Government of India, Ministry of Drinking Water and Sanitation, Total Sanitation Campaign (TSC) online monitoring [www.ddws.nic.in](http://www.ddws.nic.in).
- Government of India (2011) *Assessment Study of Impact and Sustainability of Nirmal Gram Puraskar* New Delhi: Ministry of Drinking Water and Sanitation.
- Gragnolati M, Shekar M, Gupta MD, Bredenkamp C and Lee Y (2005) *India's Under-nourished Children: A Call for Reform and Action*. Health, Nutrition and Population Discussion Paper. Washington DC: World Bank.
- International Institute of Population Sciences (2008) *District Level Household and Facility Survey III*. Mumbai: IIPS.
- Joint Monitoring Programme for Drinking Water Supply and Sanitation (2010) *Progress on Sanitation and Drinking Water: 2010 Update*. Geneva and New York: World Health Organization and United Nations Children's Fund.
- Klaasen P and van Eeghen I (2009) *Economic Capital: How it Works and What Every Manager Needs to Know*. Elsevier Inc, [www.elsevier.com](http://www.elsevier.com).
- WSP (2011) *Economic Impacts of Inadequate Sanitation in India* New Delhi: World Bank.