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Scaling Up Rural Sanitation

You Manage What You Measure: Using Mobile Phones to Strengthen Outcome Monitoring in Rural Sanitation

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The Water and Sanitation Program is a multi-donor partnership administered by the World Bank to support poor people in obtaining affordable, safe, and sustainable access to water and sanitation services.



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You Manage What You Measure:¹ Using Mobile Phones to Strengthen Outcome Monitoring in Rural Sanitation

The monitoring of usage of sanitation facilities at scale in the rural areas is a continuing challenge. Usage of the facilities, as against construction, is a behavior which requires frequent cross checks over relatively shorter time spans; in addition, the costs involved are high in terms of money, effort, and time. Making information available in real time to feed back into policy and implementation decision making has been difficult.

The use of Information and Communication Technology (ICT), through the use of mobile phones, to collect data on sanitation behavior and make available almost real time data, offers potential at large scale. A proof of concept was piloted to test the viability of using mobile technology to strengthen monitoring in the rural sanitation sector in two blocks (sub districts) of varying socioeconomic characteristics. The pilot covered 23,000 households in a span of two to three months.

This proof of concept demonstrated that using smartphones can provide quick, credible information outcomes in near

real time, incorporate features such as geo-tagging and photographs to make results more credible and relevant, and make presentation of data as user-friendly maps to enable quick grasp of the status. The process can be replicated at large scale and at periodic intervals, to address the gaps in the monitoring of usage of sanitation facilities in rural areas.

INTRODUCTION

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 one in every 10 deaths in India is linked to poor sanitation and hygiene (Water and Sanitation Program [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). To address this sanitation challenge, the Government of India (GoI) has invested heavily in programs to achieve

LESSONS LEARNT FROM PILOTING THE PROOF OF CONCEPT

- Proof-of-concept pilot was able to gather data and present information on important parameters (less than 10) from about 23,000 households in two sample blocks (sub districts) in about three months;
- Photographs of the respondents, though met with hesitation from some respondents, and geo-tagging of household locations, ensured high level of quality control of information;
- Geo tags were also useful in showing results on maps at a glance; and
- Technological challenges included battery draining quickly, necessitating frequent recharge, poor general packet radio service (GPRS) connectivity in some areas.

¹ Klaasen P. and van Eeghen (2009).

universal sanitation coverage. However, despite two large national rural sanitation campaigns,² 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 Box 1), 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 tracked by surveys undertaken every few years (around 45 percent of rural households actually use toilets, International Institute for Population Sciences [IIPS] 2008) (see Figure 1).

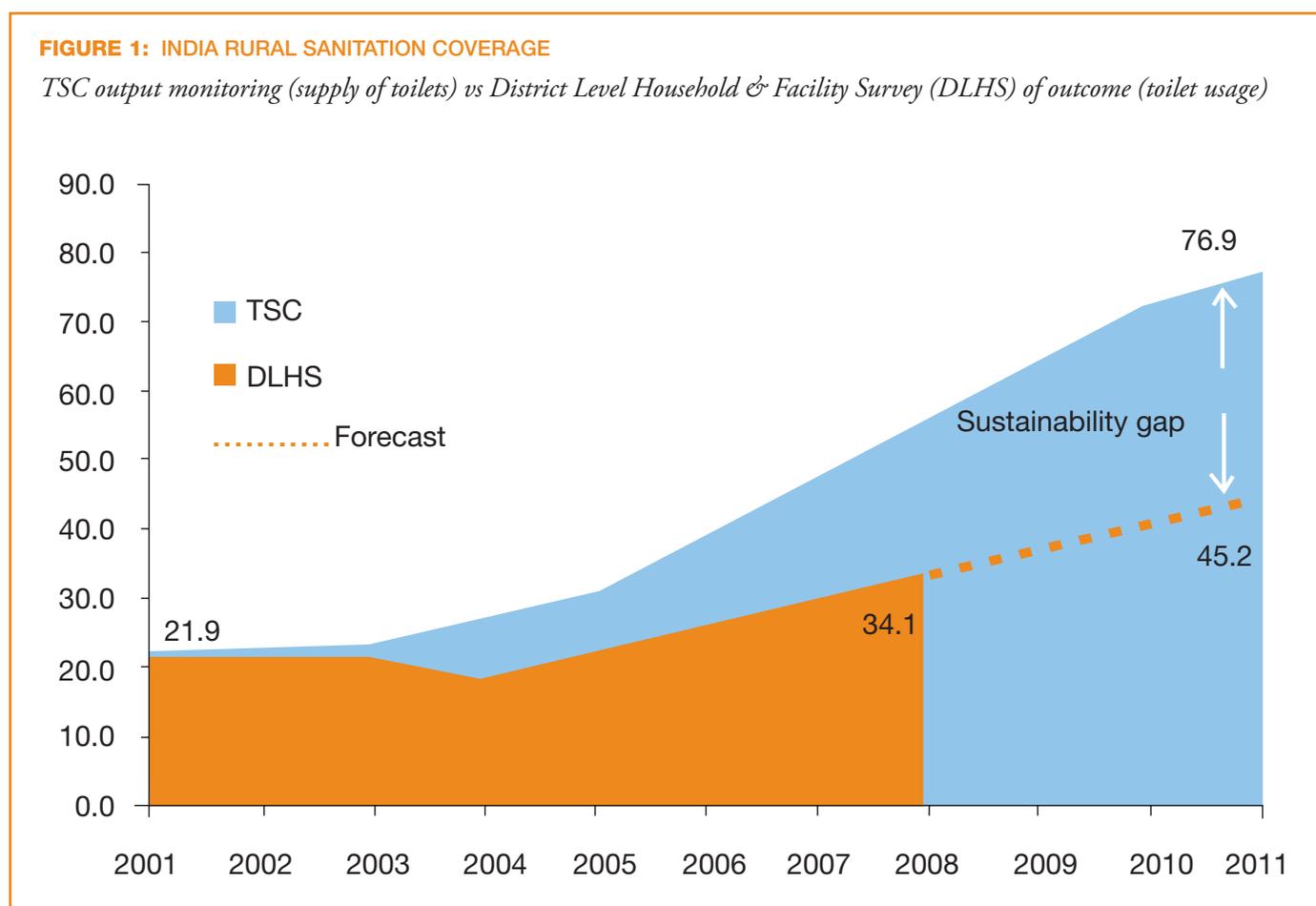
BOX 1: MONITORING IN THE INDIAN RURAL SANITATION SECTOR

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 (MIS) of the Total Sanitation Campaign (TSC), a 12-year program launched by 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:** GoI 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 percent 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 percent (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 three to four 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).

² Central Rural Sanitation Program (1986-1998) and Total Sanitation Campaign (1999-2012).



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

MONITORING OUTCOMES IN RURAL SANITATION

Recent trends in the rural sanitation sector in India, and across the world, have identified 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; and
- 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.

PROOF OF CONCEPT: USING MOBILE-TO-WEB MONITORING SYSTEM IN RURAL SANITATION

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. 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 redressal 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 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.

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 the 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;

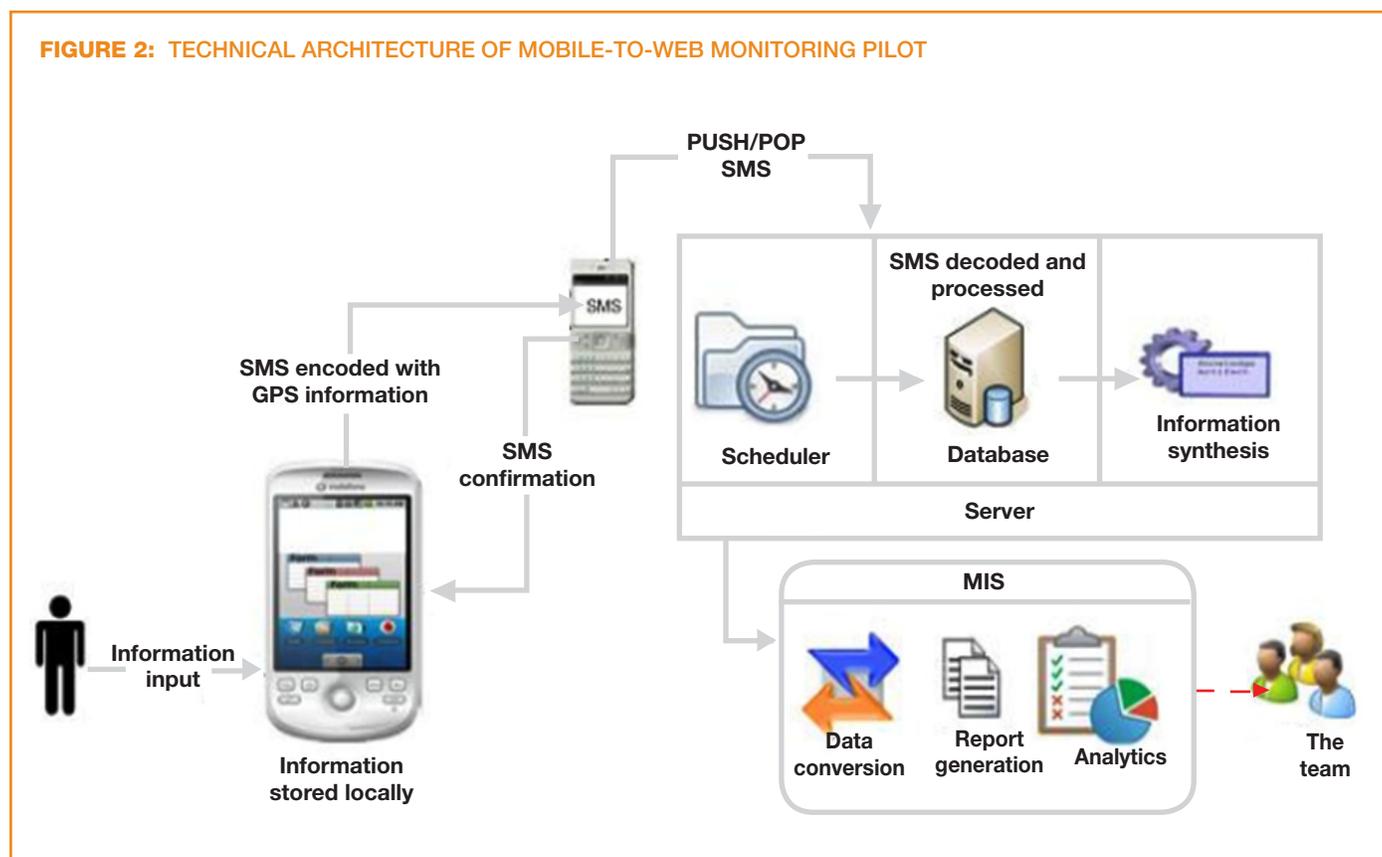
4. In case the household includes a child under three years, method of disposal of child feces; and
5. Material available for hand-washing (observation question).

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; and
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 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 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/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 which 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; and
- 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 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.

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 3: OPTIONS OF GENERATING REPORTS

Respondent	██████ Devi
Family code	L2264
Location	Bihar – Nalanda – Rajgir – Goraur
BPL cardholder	No
Toilet	No
Use for hand wash	● Water ● Ash
Total members in the household	5

Disposal of child feces

Not applicable	✓
Disposed in toilet	–
Dumped	–
Buried	–
Other	–
No. of children	0

Place for defecation

Gender	IHHL	Shared	Community	Open	Total
Elder man	–	–	–	–	–
Elder woman	–	–	–	–	–
Adult man	–	–	–	1	1
Adult woman	–	–	–	1	1
Boy	–	–	–	3	3
Girl	–	–	–	–	–
Total	–	–	–	5	5

Poverty status (household)

	Rajgir		Kandaghat	
APL	2699	21.02%	3618	63.55%
BPL	5512	42.92%	1914	33.79%
Not known	4602	35.84%	116	2.05%
Not agreed	29	0.23%	16	0.28%
Total	12842	–	5664	–

Toilet coverage and type of facility (household)

	Rajgir		Kandaghat	
Yes	1658	12.91%	4497	79.4%
No	9894	77.04%	826	14.58%
Under construction	25	0.19%	185	3.27%
Broken/choked/incomplete	1236	9.62%	140	2.47%
Not agreed	29	0.23%	16	0.28%
Total	12842	–	5664	–

Material available for hand-washing (household)

	Rajgir		Kandaghat	
Only soap	16	0.12%	8	0.14%
Only water	210	1.64%	20	0.35%
Only ash	262	2.04%	17	0.3%
Water and soap	963	7.5%	4167	73.57%
Water and ash	9913	77.19%	197	3.48%
Other	1284	10%	5	0.09%
Not found	40	0.31%	143	2.52%



Version	1
Collected by	██████ Kumari
GPS	25.04980000, 85.33600000
IMEI No.	██████ 454868
Captured on	2011-11-30 21:58:54
App version	1.2.2
Other info	

IHHL: Individual Household Latrine.

FIGURE 4: COLOR-CODED MAP OF THE HOUSEHOLDS



RESULTS

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 enhance 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.

APPLICATIONS OF CONCEPT

This approach of using mobile phones with a web interface to collect large amounts of data in short periods of time can have applications in the following, in the context of Indian rural sanitation:

- The existing TSC monitoring system which tracks inputs and outputs can be strengthened with such a system which tracks outcomes, that is, sustainability of usage. This can be done at periodic intervals, which contributes to the decisionmaking process at various levels. This can be undertaken using in-house resources of the Government or through third party contracts; and
- The Nirmal Gram Puraskar (NGP) assessments could use this approach to enhance the quality of the data collection process, which contributes to reduce doubts about the robustness of the process across the sector. The existing contracted out approach could use these technologies to improve their process.

LESSONS LEARNT AND NEXT STEPS

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

- 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; and
- Initially, the low-end mobile phones used in the project did not efficiently support transfer of large data records. 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.

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 Ministry of Drinking Water and Sanitation was involved to ensure replication beyond pilot stage. Following this, WSP has been requested by GoI to undertake a national assessment of sector outcomes using smartphones. Hence, the next step is to take this initiative to national scale, through a sample survey across the country. In addition, WSP is proposing to do a comparative analysis of the costs and other benefits of monitoring using ICT approaches vis-à-vis conventional approaches, using a systematic and scientific process.

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