

Case Study

Mobile - Based Sanitation Monitoring System

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Governance Knowledge Centre

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
METHODOLOGY	3
BACKGROUND	3
OBJECTIVE	5
PROJECT DESIGN	5
KEY STAKEHOLDERS.....	5
TECHNOLOGY DESIGN	5
MOBILE APPLICATION	6
MANAGEMENT INFORMATION SYSTEM.....	8
GEO-TAGGED MAP	11
DATA COLLECTION.....	12
ACHIEVEMENTS	13
CHALLENGES IN IMPLEMENTATION	13

Executive Summary

Total Sanitation Campaign (TSC) is a comprehensive national scheme, implemented by the Government of India, to accelerate sanitation coverage in rural areas by 2012. The main objective is to eradicate the practice of open defecation, and bring about an improvement in the general quality of life in the rural areas. Since 1999, government made several attempts to improve the sanitation monitoring policy however it still lacks effective implementation of sanitation campaign in most rural areas and requires attention.

To ensure proper implementation, the government initiated an online monitoring system to keep track of the progress. However, the emphasis is to capture the financial and physical progress in form of input and output than the actual change in sanitation behavior. In such case, the number of toilets provides information only on toilet accessibility but not on the actual usage. Many households continue to defecate in the open irrespective of having toilets. Additionally, the manual process of collecting data on toilet construction and sanitation behaviour is cumbersome because development practitioners collect data manually at the village level and as a result; the data collected is not verified.

To address these two main challenges, Water and Sanitation Program (WSP), an international partnership to support the economically disadvantaged in enhancing their access to affordable, safe and sustainable water supply and sanitation services, collaborated with OneWorld Foundation India to design Information and Communication Technology (ICT) enabled sanitation monitoring strategy to strengthen TSC. The outcome of the project was an Android based mobile application that enabled door-to-door survey of sanitation behavior. Twelve surveyors were deployed in each Block to collect data from every household using mobile phones with GPS connectivity. The data collected were directly uploaded on the MIS in the form of individual reports, that were later compiled at village, panchayat, and block level. Towards the completion of the project, a total of 12,842 and 5,664 households were surveyed in Rajgir and Kandaghat, respectively. Despite few challenges, this pilot project was completed in six months and was successful in capturing information based on sanitation behaviour and toilet usage. Owing to its success, it is now ready to be scaled up in other states as well.

Methodology

The Governance Knowledge Centre (GKC) research team conducts extensive research to identify initiatives that contribute towards the betterment of public service delivery in India. The TSC monitoring application, with its focus on improving implementation of Total Sanitation Campaign was considered to be an important initiative to be documented. The mobile application builds upon the existing government procedures, and helps in strengthening the current online monitoring of Total Sanitation Campaign.

This case study is based on the primary research conducted for assessing the impact of the pilot project undertaken by WSP and OneWorld Foundation. Information from the field was gathered through extensive interviews with concerned officials at the state, district, block and panchayat level. The project team from OneWorld Foundation India visited Kandaghat and Rajgir in July 2011 and September 2011 to engage with the government representatives.

In addition, publications by Government of India, international organisations, NGOs and academic institutions were referred to comprehend the recent discussions on water and sanitation sector.

Background

Access to proper sanitation facility continues to be a challenge in India - while 59 percent of the urban population has toilet coverage as on 2004, in rural areas of India, 74 percent of the population still defecates in the open.¹ Apart from the obvious repercussions on health, lack of sanitation and hygiene facilities has other social consequences as well. Lack of separate toilets for girls in school has resulted in high rate of drop-out of girl children across the country. The government of India has been taking measures to address this concern however, due to supply-driven approach, with lack of community participation and awareness programmes, large-scale sanitation campaigns had to be restructured. Subsequently, in 1999, a people-centric Total Sanitation Campaign (TSC) was executed by the Government of India.

The basic objective of the TSC is to accelerate sanitation coverage in rural areas to eliminate open defecation. The strategy of this intervention is to design a demand-driven model focused

¹ Snehalatha, M. and V. Anitha. Total Sanitation Campaign - Progress and Issues: Situational Analysis of Andhra Pradesh with reference to Total Sanitation Campaign. Centre for Economic and Social Studies. May 2011.

on facilitating behavioural changes for improved sanitation and hygiene practices and meet people's sanitary hardware requirements in an affordable and accessible manner.² TSC gives strong emphasis on Information, Education and Communication (IEC), Capacity Building and Hygiene Education for effective behaviour change with involvement of PRIs, CBOs, and NGOs. In 2003, the Government of India also launched the *Nirmal Gram Puraskar* (NGP), a fiscal award program within TSC, to motivate Panchayats to achieve open defecation-free status at community-level.

To ensure effective implementation of the TSC and to keep track of its progress across the country, the government initiated an online monitoring system. As per the guidelines, all the districts are to submit physical and financial progress reports through online software. Despite the measures taken, the success achieved by the TSC is limited. From 2001-10, the target reached is below 56 percent for entire country.³ While the sanitation infrastructural facilities provided are increasing substantively in last year, it is not translating in sustainable change in sanitation behaviours of the intended beneficiaries.

Considering that the ultimate goal of all sanitation programmes is to end the practice of open defecation, the monitoring of these programs must focus on the usage of toilets. However, the access to improved sanitation facility globally continues to be measured by counting the number of toilets. This practice has recently been identified as being misrepresentative of reality. It is recognized that performance monitoring should also reflect the change from counting toilets to observing usage. Similar gaps exist in TSC monitoring mechanism where the data for analysing factors causing the gap between toilet building and actual usage. The lacuna in TSC's monitoring mechanism lies largely in its emphasis on collecting data based on output (number of toilets constructed), rather than on outcome (actual change in beneficiaries sanitation behaviour). Another major issue that has been affecting the monitoring system of TSC is its process of manual collection of data. Although there is an online monitoring system, data is collected manually from the village at the first level, leaving ample scope for inaccuracy and misplacement of data along with making it a cumbersome process.

To address these limitations, Water and Sanitation Program (WSP), an international partnership to support the economically disadvantaged in enhancing their access to affordable, safe and sustainable water supply and sanitation services, partnered with OneWorld

² Government of India. Ministry of Rural Development. Department of Drinking Water Supply. Total Sanitation Campaign Guidelines. India Sanitation Portal. Web on 16 April 2012.

<http://indiasanitationportal.org/sites/default/files/TSC%20-%20Guidelines.pdf/>.

³ Snehalatha, M. and V. Anitha. Total Sanitation Campaign - Progress and Issues: Situational Analysis of Andhra Pradesh with reference to Total Sanitation Campaign. Centre for Economic and Social Studies. May 2011.

Foundation India to design a more advanced and useful application. The partnership focused on piloting a mobile phone application to track robust data on progress and usage of toilets constructed and NGPs sustained by Gram Panchayats.

This application is expected to mitigate the earlier existing constraints in TSC monitoring mechanism by deploying an Android-based mobile application to enter data at a single point and by using an online MIS to consolidate data at multiple levels. This application also allows customization of monitoring data as the survey questionnaire can be modified as per the need. Rajgir block in Bihar and Kandaghat Block in Himachal were selected to test the Proof of Concept developed.

Objective

The two main objectives of doing this project was to develop a pilot Proof of Concept (PoC) on use of mobile phones to track verifiable data on progress and usage of toilets constructed and NGPs sustained by Gram Panchayats.

Project Design

Key Stakeholders

OneWorld Foundation India, a Delhi-based non-profit organisation, was responsible for developing and implementing the mobile technology used in the project.

Water and Sanitation Program, a multi-donor partnership administered by the World Bank to improve access to sanitation and water for poor people, commissioned this project to OneWorld Foundation India.

Total Sanitation Campaign beneficiaries

Technology Design

The design and implementation was carried out in a methodical manner to ensure that all the gaps in the existing monitoring systems are addressed. Therefore, prior to the implementation, a scoping study was conducted in Bihar and Himachal Pradesh to get a complete understanding of the monitoring mechanism executed by the government. The aim of the exercise was to understand the information flow, key stakeholders and the type of information gathered from people. For this purpose, OneWorld's research team engaged with the

government officials at state, district, block and *panchayat* level to gather information on the process flow under TSC

Upon completion of the study, technical architecture of the project was designed such that a surveyor will enter the data from the households into the mobile, and send it across to the MIS through use of GPRS. The prototype for the mobile application was finalised, including the survey questions.

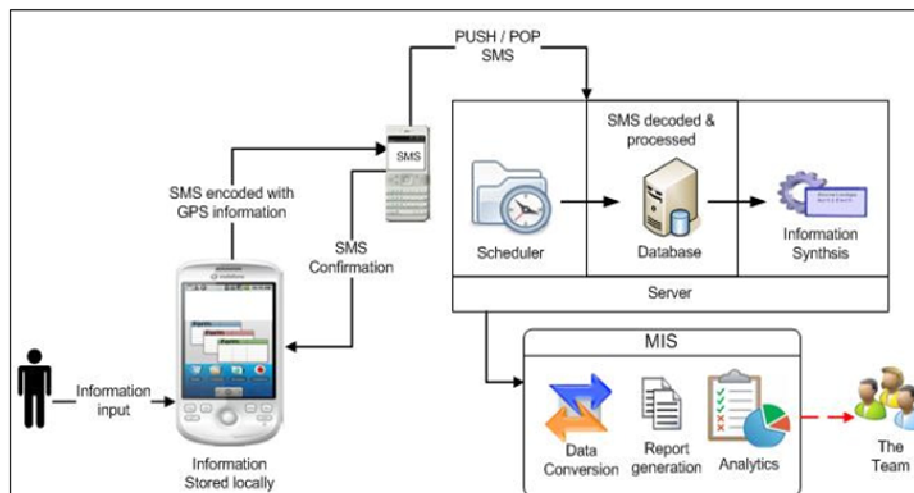


FIGURE 1: TECHNICAL ARCHITECTURE OF THE MONITORING SYSTEM

Mobile Application

Application Platform

The key component of this project is the mobile application that assists in collecting data from the households. The module was developed using Android 2.1 application programming interface (API) with a scope of getting it upgraded to any other up-coming versions. The application was developed in Hindi, the local language in selected region for pilot, using the Unicode character set. The use of Unicode presented a scalable solution as its adaption to other languages can be facilitated with minimal intervention by translating the message strings. The mobile set was also equipped with Global Positioning System (GPS) to address location-based validation and touch-screen interface for data input.

The design of the application is such that a survey questionnaire opens up through the application (Figure 2). During data collection, surveyors will ask questions, and feed relevant answers directly into the mobile through use of keypad or radio buttons.

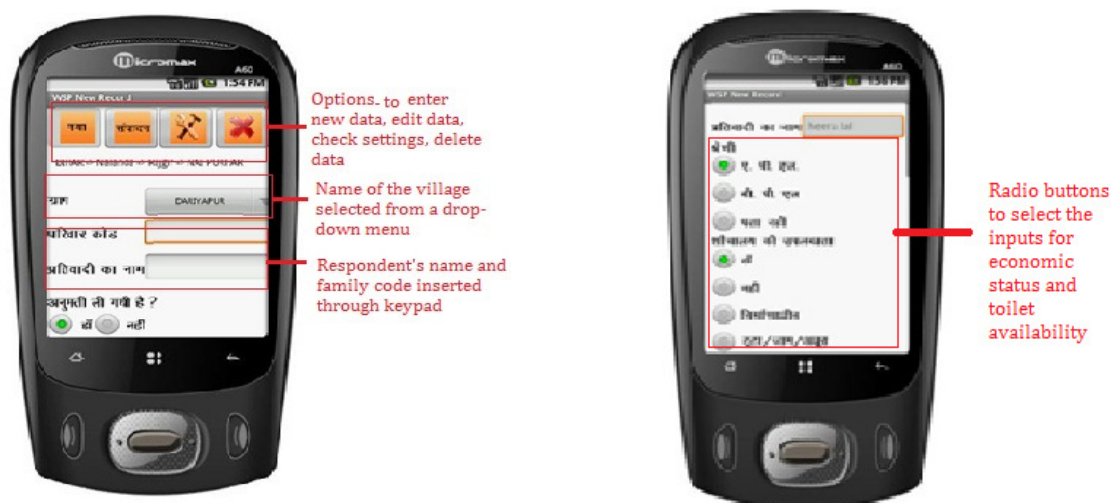


FIGURE 2: SCREEN SHOTS OF SURVEY APPLICATION

These questions capture the names of the beneficiaries, village, *panchayat*, their economic status, and whether they have toilets or not. In addition, the sanitation behavior is captured through a matrix of defecation practices, for example, whether the members of the households defecate in the open, in individual household toilet or in community toilets. The reason for collecting such data is to be able to understand the pattern of usage among community members, and correlate with other data sets to analyse the behaviour.

The survey data entered in the Android mobile is initially stored in the local database (SQLite) and upon availability of GPRS connectivity, bulk data is transferred to a central server and a confirmation flag is sent back to the mobile to acknowledge the receipt to ensure the proper data transfer. In the absence of GPRS, the application uses MMS service to send data to a predefined mobile number and uses the same acknowledgement procedure as under GPRS.

Coded data received through mobile is processed to be stored in the database server. The indexing and further processing is done by the Management Information System (MIS) which is available on the web interface. There is also a focused effort to develop similar application for a low-end mobile set to address the scalability issue for large scale deployment.

Integration of Global Positioning System

A GPS feature is integrated with application for two reasons:

- First, it acts as a check to ensure that survey was conducted at the assigned place instead of investigators entering data on their own.
- Second, the latitude and longitude recorded through GPS can be utilized to geo-tag households on a geographical map.

The GPS coordinates are detected automatically by the mobile application. Upon opening a new form, the longitude and latitude are recorded.

Monitoring module

To ensure quality data, verification module was developed. The data for verification were automatically flagged by the system, and the coordinator was responsible for verifying the records.

Management Information System

The survey data is accessed through a centralized MIS, developed in-house by OneWorld's Technology team. The MIS is accessible online to authorized users with a username and password. At present, apart from the access to all the data, three types of reports are available:

- Detailed individual report
- Cumulative report at panchayat /block level
- Summary report for all the blocks

Figure 3 presents an individual report of a household member from Rajgir block with sanitation details capturing all the above mentioned parameters. From this report, it is easier for authorities to analyse individual sanitation progress, toilet usage and monitor defecation status. It also includes a digital photograph of the individual, time of the survey conducted, name and contact details of the surveyor with GPS location of toilet to avoid manipulation or inaccuracy of data. In case data is found to be inaccurate; the surveyor can be contacted for further verification or the GPS coordinates can help to revisit the same household for verification.

Welcome : [REDACTED] Menu Logout

Statistics of Sanitation Behaviour and Usage

Respondent	[REDACTED] Devi
Family code	L2264
Location	Bihar -> Nalanda -> Rajgir -> Goraur
BPL Cardholder	No
Toilet	No
Use for hand wash	<ul style="list-style-type: none"> Water Ash
Total member in the house hold	5

Disposal of child feces

Not Applicable	<input checked="" type="checkbox"/>
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



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

FIGURE 3: DETAILED INDIVIDUAL REPORT ON MIS

Figure 4 displays a cumulative report comprising of all households surveyed. Information on their names, family code, category (APL/BPL), toilet availability, usage and; name of village, panchayat and state are available. In case of incorrect data found on MIS, authorities can track the surveyor through the IMEI number mentioned along with the household.

Statistics of Sanitation Behaviour and Usage

Total Record: 18507

Verification:

S.No	Respondent	Family code	Agreed	Category	Toilet	Village	Panchayat	State	Captured on	IMEI Number
1	Eandra [V]	R0215637	Yes	BPL	Yes	Dhiaula	Mumleeg	Himachal pradesh	2011-12-09 12:46:46	910556000458687
2	Baraduram	V033072	Yes	APL	Yes	Dhiaula	Mumleeg	Himachal pradesh	2011-12-09 12:39:21	910556000458687
3	Sunil	NA	Yes	APL	No	Tananji	Hinner	Himachal pradesh	2011-12-09 16:00:29	910556000458455
4	Ajay	NA	Yes	APL	No	Tananji	Hinner	Himachal pradesh	2011-12-09 15:58:32	910556000458455
5	Sadparkesh	NA	Yes	BPL	No	Tananji	Hinner	Himachal pradesh	2011-12-09 15:57:13	910556000458455
6	Madan	NA	Yes	APL	No	Tananji	Hinner	Himachal pradesh	2011-12-09 15:55:11	910556000458455
7	Kamalkessor	NA	Yes	BPL	No	Dhiaula	Mumleeg	Himachal pradesh	2011-12-08 11:46:38	910556000458687
8	Baraduram	NA	Yes	APL	Yes	Dhiaula	Mumleeg	Himachal pradesh	2011-12-08 11:42:32	910556000458687
9	Santram	R0184737	Yes	APL	Yes	Dhiaula	Mumleeg	Himachal pradesh	2011-12-08 11:40:08	910556000458687
10	Sewak ram	NA	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:44:17	910556000454520
11	Dharam das	NA	Yes	BPL	No	Badhel	Delgi	Himachal pradesh	2011-12-07 15:24:17	910556000448829
12	Ram lal	R0171354	Yes	BPL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:20:07	910556000454520
13	Kavel ram	R0364147	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:19:47	910556000448829
14	Vinod	R0364236	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:12:59	910556000448829
15	Umadutt	NA	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:11:53	910556000458679
16	Praveen	V0400085	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:11:30	910556000454520
17	Kuntaworameshchand	V021265	Yes	BPL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 15:05:20	910556000458679
18	Reena	R	Yes	BPL	Broken/choked/ incomplete	Rahana	Delgi	Himachal pradesh	2011-12-07 14:56:33	910556000458687
19	Ratansingh	R0364137	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 14:56:20	910556000458679
20	Kamlesh	R0556373	Yes	APL	Yes	Rahana	Delgi	Himachal pradesh	2011-12-07 14:51:22	910556000458687

1 2 3 4 5 6 7 8 9 10 || Next > || Last

FIGURE 4: CUMULATIVE REPORT OF ALL HOUSEHOLDS SURVEYED

Lastly, the Summary Page includes the cumulated sanitation data for Rajgir and Kandaghat on basis of economic status, household composition, age and gender. For example, the following screenshot of the page presents the Poverty Status, Toilet Coverage, Hand-The Summary Page includes the cumulated sanitation data for Rajgir and Kandaghat on basis of economic status, household composition, age and gender.

Poverty Status (Household)				
	RAJGIR		Kandaghat	
APL	2699	21.02%	3618	63.68%
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 & 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%

FIGURE 5: SUMMARY REPORT OF RAJGIR AND KANDAGHAT

Geo-Tagged Map

Another feature of MIS includes availability of the geo-tagged maps to reflect the sanitation patterns in select areas. Longitude and latitude gathered through the GPS was combined with Google Earth software to create a colour 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 the following maps, the results of the survey are evident for Rajgir and Kandghat.

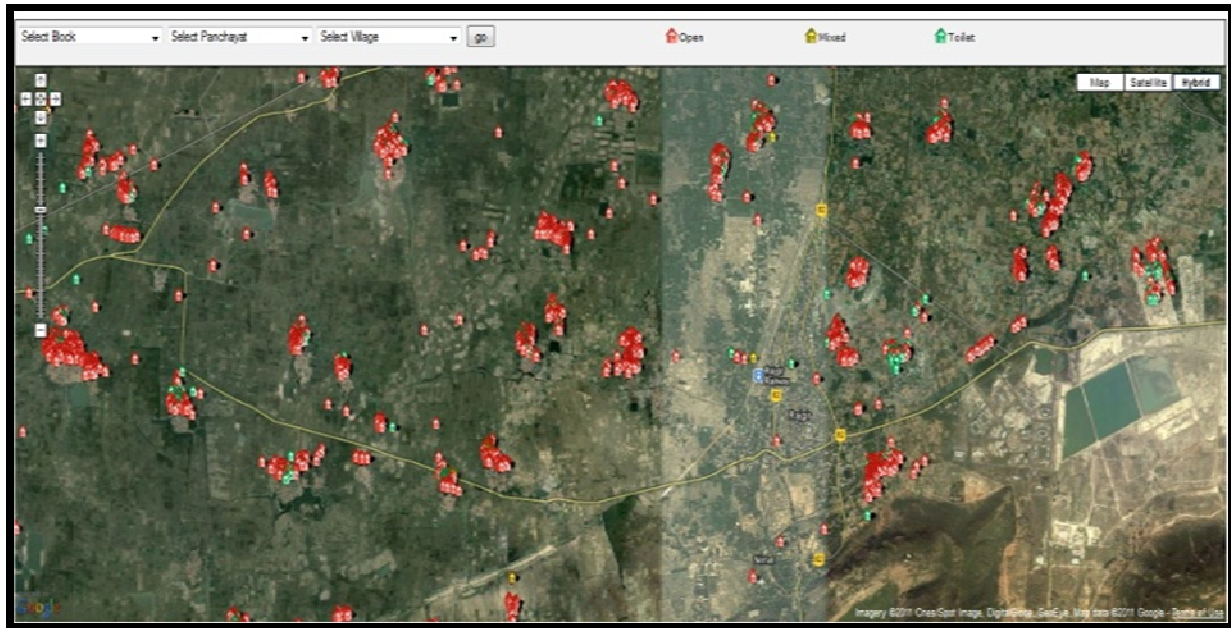


FIGURE 6: MAP OF KANDAGHAT BLOCK

Data Collection

While conducting the actual survey, the first step was to recruit local field investigators who had the appropriate level of education and familiarity with the use of mobile phone. Priority was given to local people, who were familiar with the *panchayats*. Also, it was ensured that people were not part of the NGOs or organizations involved in the Total Sanitation Campaign.

Prior to data collection, two-day training was provided to field investigators and coordinator in each block. The training was a joint effort between OWFI and WSP, and focused on project objectives, general sanitation knowledge, survey process and the use of mobile application. Sessions also included practice surveys to familiarize the investigators with the process and the mobile application.

Upon the completion of the training, the 12 surveyors were deployed in each block. The data was collected over a period of four months.

Achievements

In December 2011, small scale pilot conducted in Rajgir and Kandaghat blocks demonstrated the feasibility of using the mobile application to gather real-time sanitation data from rural areas in India. A total of 18, 506 households were successfully surveyed – 12,842 in Rajgir and 5,664 in Kandaghat – through the use of mobile phone.

The objective of the project was to strengthen the TSC monitoring by addressing the gaps identified during the scoping study. Specifically, establish linkage between toilet ownership and toilet usage to track the TSC outcome. Issues of credibility and standardization of reporting indicators were also covered.

In Rajgir, the final result indicates dismal progress in sanitation coverage in the Block and identifies the gaps. According to the data, 22 percent of the households have a toilet but out of that, 9.65 percent of the toilets are either broken/choked, hence, non-functional. Therefore, these households continue to practice open defecation.

It is also evident that through use of ICT traceable and verifiable data can be gathered to increase the transparency in the process. In the current process, the manual system increases the chance for errors as the administration calculates the data on paper and enters a final number online. The direct transfer of data from household to the server and MIS translates into automatic consolidation of the data with minimum human interaction. Moreover, integration of GPS feature allows tracking of households for verification in case there are errors in the data collection process.

Challenges in Implementation

While the project was implemented successfully, few challenges were encountered during the implementation process.

Socio-cultural concerns

The survey was conducted during the daytime when the male members of the family were unavailable. This gave rise to two problems – first, it was difficult to verify the name of the head of the household mentioned in the list provided by the government authorities, and second, the female members were hesitant to discuss sanitation openly with male investigators. Many respondents found it objectionable to be questioned on toilet usage, as

it is considered a private affair. Nevertheless, explaining the purpose of the survey usually encouraged people to provide information

Taking photographs was also a concern because some people consider toilet to be “impure” and standing close to toilet for a photo would require them to take a bath again.

Mobile Handsets

Initially, the low-end mobile phones used in the project did not efficiently support transfer of large data sets. It was noticed that various applications such as GPRS and GPS were consuming lot of energy therefore, the batteries did not last for long duration. On average, 10-15 houses survey was completed before the phones were required to be recharged again - the number was higher if the phone batteries were fully charged. The problem was exasperated in Rajgir due to limited power supply. The investigators could not fully charge the phone at night because of which they faced problems during the survey.

To address this concern, additional batteries were supplied to the investigators in later part of the project, when the problem became apparent.

GPRS Connectivity

The availability of GPRS is based on weather and network connectivity. Due to Monsoon, the GPRS connectivity was poor in several villages of Bihar. However, this problem was anticipated before the start of the project, therefore, offline information storage feature was added to the mobile application, where the data is locally stored and sent to the server upon availability of GPRS.

Research was carried out by the OneWorld Foundation India (OWFI), Governance Knowledge Centre (GKC) team.

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