

EVALUATING NATIONAL RURAL EMPLOYMENT GUARANTEE SCHEME IN INDIA: A DYNAMIC RURAL SURVEY METHOD USING MOBILE PHONES

Janani Rangarajan ^{*1}, Rajesh Kumar ^{*2}, Sriram Narayanamurthy ^{*3}, Dr. Ashok Jhunjunwala^{*4}, Suma Prashant^{*1},

^{*1} IITM's Rural Technology and Business Incubator (RTBI), ^{*2} Aaum Research and Analytics Pvt Ltd, ^{*3} Telecom Centre of Excellence (TCOE), IIT Madras, ^{*4} IIT Madras

AUTHOR DETAILS

Janani Rangarajan is an Assistant Professor of Mathematics in Kumararani Meena Muthiah College of Arts and Science and part-time researcher at RTBI, IIT Madras.

Rajesh Kumar is the founder and Managing Director of Aaum Research and Analytics Pvt Ltd. He has robust experience in quantitative and qualitative data analysis, business intelligence, project management and IT process consulting working for several clients in Finance, Information Technology, Marketing and Operations domain. Rajesh holds rich consulting experience with Fortune 100 organizations. He has B.Tech in Mechanical Engineering from IIT Madras and MBA from IIT Kanpur

Sriram Narayanamurthy is a MS Research Scholar at IIT Madras focusing on Energy Optimization Techniques for Telecom Applications. He has been working with IIT Madras's Reliance's Telecom Centres of excellence since 2008 and has vast experience in working with diverse mobile applications. He is currently working with RTBI as a Senior Project Officer working on the Energy Initiative under the guidance of Dr. Ashok Jhunjunwala.

Prof. Ashok Jhunjunwala is Professor of the Department of Electrical Engineering, Indian Institute of Technology, Madras, India. He received his B.Tech degree from IIT, Kanpur, and his MS and PhD degrees from the University of Maine. From 1979 to 1981, he was with Washington State University as Assistant Professor. Since 1981, he has been teaching at IIT, Madras. Dr. Jhunjunwala leads the Telecommunications and Computer Networks group (TeNeT) at IIT Madras which has incubated many companies with a focus on the development of rural India. Dr. Ashok Jhunjunwala has been awarded Padma Shri in the year 2002 apart from many other awards. He is also a board member for many companies in India.

Suma Prashant completed her Masters in Public Health in 2006 and her Masters in Environmental Engineering in 2002. Altogether she has experience of over 8 years of in ranging from engineering on building pilot-scale waste-water systems to experience in the field of public health research and outreach applications around health related issues, specifically on rural health issues over the last 4 years. She is currently the Vice President, Exploratory Initiatives, RTBI.

ABSTRACT

National Rural Employment Guarantee Act is a scheme formulated by the Government of India for the uplifting of the poorest of the poor in rural India. It has been implemented in all the states of India. The effectiveness of any scheme, especially one aimed at rural empowerment, can be measured only by studying the impact it has made in changing the lives of the beneficiaries. RTBI had evaluated the impact of NREGA in Tamilnadu by conducting a study. For this study, RTBI used a mobile phone based data gathering system instead of the regular paper based process. This paper will discuss how the questionnaire was developed, the data gathering method and the use of mobile phones as a reliable tool for conducting surveys.

INTRODUCTION

Poverty (India Poverty Indicators, International fund for Agricultural Development,2011)¹, especially in the rural areas, is one of the biggest challenges faced by India. The Government of India has come out with a plethora of schemes to alleviate poverty. National Rural Employment Guarantee ACT (NREGA)(<http://nrega.nic.in/Netnrega/home.aspx>) is one such scheme aimed at promoting rural empowerment by providing 100 days of guaranteed wage employment in every financial year to one member of every household whose adult members are willing to do unskilled manual labour. The implementation of NREGA began in 2005 and while NREGA has made an impact, there have been many a question about its implementation methods and the extent to which it has benefitted rural people and rural areas. RTBI (<http://www.rtbi.in/>) has conducted a UNDP sponsored study (“Evaluation of National Rural Employment Act 2009”, 2009)² in May 2008 and used a mobile based dynamic rural survey which is the focus of this paper.

BACKGROUND

Five districts out of the eight suggested by RTBI were mutually agreed between RTBI, the Commissioner, Rural Development (<http://rural.nic.in/>) and Panchayati Raj Institution. The districts were Cuddalore, Nagapattinam, Dindigal, Kanchipuram and Thiruvallur out of which the first three belonged to the category of well performing districts which had a high number of National Rural Employment Guarantee Scheme (NREGS) beneficiaries and the last two had a very low participation (“Evaluation of National Rural Employment Act 2009”, 2009)³ . For every district, 2 Blocks⁴ were selected and from every block 4 Gram Panchayats⁵ (works) were chosen. 15 NREGS workers were surveyed for every work which gave a sample size of 120 per district. The selection of sample was based on random sampling without replacement. Apart from the survey, Focused Group Discussions (<http://www.answers.com/topic/focus-group>) were also conducted in many villages to get direct feedback from the villagers about the various aspects of NREGS.

NREGS SURVEY EVOLUTION

Consultations were held between Non Government Organizations (NGOs), officers from the Ministry of Rural Development, NREGA field workers, RTBI researchers and Social Scientists in order to develop a survey for conducting the NREGA evaluation. The broad outline of the parameters based on which the questionnaire for the survey could be designed was laid down by the Ministry of Rural Development. Some of the key parameters based on which the mobile based questionnaire was designed is discussed below:

1. Socio Economic details: Questions about the monthly income, availability of electricity, landholdings, colour of the ration card⁶ etc were framed in the questionnaire in order to find out if the NREGS beneficiaries were from poor and below poverty line⁷ families.
2. Awareness about NREGS: The questionnaire consisted of questions on the awareness about minimum wages⁸, unemployment allowance, the steps undertaken by the beneficiaries to obtain the unemployment allowance, filling up the job card⁹ details etc.

3. Participation of the rural population in the Gram Sabha (GS) (the local governing body) meetings: Questions about the beneficiary's participation in the GS meetings, role played by the beneficiary in the decisions taken at the GS meetings and questions related to the deciding authority of the GS meetings were incorporated in the questionnaire in order to assess the efficacy of GS in promoting NREGS.
4. Procedures involved in NREGS: Questions like if job cards were available, if they were available throughout the year, job card updations, number of days of work done under NREGA etc were asked so as to study the beneficiaries' understanding of the procedures involved in NREGS.
5. Monitoring and supervision of the NREGS work that has been done: The answers to questions about the frequency of monitoring and supervision were intended to throw light on if the monitoring and supervisory authority¹⁰, namely if the Gram Sabha and Gram Panchayat was discharging its duties correctly.
6. Payment details, transparency about the NREGS work selected for the village : Questions were framed on these parameters in order to gain an insight into the actual transparency of NREGS implemented in Tamilnadu and also to see if NREGA has come up with some amount of financial inclusion¹¹ in rural India
7. Workplace facilities¹²: Questions related to the workplace facilities available at the site were added to check if the facilities mentioned in the act were provided at the workplace.
8. Impact of NREGS: This parameter was considered because it would aid in evaluating the extent to which NREGS had affected the rural households and if it has actually enhanced the livelihood of rural Indians.

The survey was administered in the local language, i.e. Tamil. The questionnaire consisted of a total of 72 questions.

CAN THE SURVEY BE DONE DIFFERENTLY TODAY?

Once the NREGS questionnaire was framed, its method of implementation was thought upon. The age old practice of using the pen and paper was the obvious option however with it came issues of higher consumption of paper, time latency in interpreting the data, if there was a revision in the questionnaire the correction of it was a cumbersome process. Hence the option of using the ubiquitous mobile phone for data collection was finalized upon as there was a requirement to collect large amount of meaningful data from many districts in a very short span of time and also be scalable to any number of districts in the future. The mobile application also allowed the flexibility in changing the questions even as the survey was being conducted.

A mobile based method of conducting the survey also has the advantage of providing live update at the back end which facilitates immediate analyses of the data gathered. (Schuster and Perez Brito, 2011)¹³. It is also very cost effective (Waidyanatha et al, 2010)¹⁴ when compared to the pen and paper method. The mobile phones used were ordinary and inexpensive costing only 50 USD. The data

obtained was immediately stored at the server end and so there was no loss of data (Tomlinson et al, 2009)¹⁵, whereas in a paper and pen method, there are chances of the survey answers getting misplaced or destroyed.

MINED TECHNOLOGY AND CHALLENGES

Data collection for the survey was done in all the villages by using an ordinary and inexpensive mobile phone connected over GPRS¹⁶ (General Packet Radio Service) to an enterprise data base for the aggregation of multimedia information, this unique interfacing technology called MINED (Mobile Interface to Enterprise Database) was developed by RTBI and TCOE

MINED WORKFLOW TECHNOLOGY



The MINED Questionnaire Creation and Data Collection Workflow is given below:

To enable ease of use, first the questionnaire was created in HTML¹⁷ by using an open source¹⁸ software namely phpform.org¹⁹. The Javascripts²⁰ were added to the HTML questionnaire in order to:

1. Enable offline storage of the data by storing the form fields in cookies

2. Enable validations like blank field validations, mandatory field validations and type validations.²¹ Mandatory field validations ensured that all the mandatory fields were filled up and no mandatory field was left blank. The type validations aided in error free data collection. For example, a question about the name of the NREGS beneficiary would not take in any numeric values for an answer.

Open source software tools were used to build the questionnaire and to store the data collected in the backend. Using open source tools such as php and MYSQL²² are easy to access, no cost involved, easy to edit and customize.

This downloaded questionnaire was stored in the mobile and was retrieved every time a survey was completed. Seven people were trained for half a day in order to help them understand the process of administering a questionnaire using a mobile phone. These people then went to the field to collect the required data. Whenever a questionnaire was completed, the field personnel administering the survey checked for GPRS connectivity and if available, he directly submitted the completed survey to the database at the server end, else in the case of No GPRS activity the answers were stored locally in the mobile phone's storage space, namely the Record Management System (RMS)²³ and submitted later when the GPRS connectivity was available. The time taken to complete a single questionnaire was around 15 minutes and one field person covered one village per day. The whole data collection process took around a month.

The application was built in such a way that it enabled the storage of the data obtained by the field worker into the server. The whole system was robust and could handle simultaneous form submissions from different villages. The Form tool provided an administrative console to view the submissions and export them in Comma Separated Values²⁴ (CSV), XLS²⁵ and other printer friendly views.

On the phone's screen 7 questions appeared and each question had many scroll down options. Hence a total of 10 snapshots of the questionnaire were used. The questionnaire was customized so that the field personnel conducting the survey could enter the data easily. This was done by replacing the text fields (allocated for the answers) with drop down options consisting of a set of most probable answers.

Questions were altered at the server end by people with knowledge of html. Javascript-programming was used in order to enable any alteration in the flow of questions. The flow of questions can be altered in real time based on certain conditions/criterion. For example, the questionnaire consisted of a question asking if the beneficiary had to wait for more than 14 days after applying for a job. If the answer to the question was 'Yes', then a preset condition was set so that the question asked immediately after the response was if the beneficiary had availed the unemployment allowance. If the answer was 'No', then the next question was asked. The flow of questions can also be altered based on the sum total of the answers received at the server end. Since type validations are enabled, the data obtained is error free. MINED does not just support text but it also supports voice samples recorded and images captured (using the phone's camera) at the field locations. Report generation in various formats was also supported.

The team which developed MINED had to surmount a few challenges in order to ensure that the survey collection was easy. Language was a major barrier because the mobile phones did not have scripts which supported Tamil (the local language in which the survey was administered). This was overcome by using Universal Text Format (UTF) 8 in all the mobile phones. UTF ensured that all the devices used for conducting the survey supported Tamil. The database was also converted to Unicode²⁶

in order to support Tamil. Optimal Storage (in the mobile phones used) was also another challenge faced and it was overcome by using Java Scripts. Another challenge faced was that the field size for the answers was set at the default 32 bytes which proved to be very less as Tamil font occupied more space. The field size was increased in order to ensure that the full answer to a question was accommodated.

The mode of conducting the survey was also initially a challenge. Since the field user conducting the survey had to constantly look at the mobile phone, it became a distraction because the field user could not maintain a constant eye contact with the NREGA beneficiary who was giving the survey. Some of the NREGA beneficiaries thought that the field worker was being inattentive and was messaging someone else. This challenge however did not prove to be much of a hindrance as all the answers had options. Further as the survey administrator became familiar with all the questions and answers, he could maintain eye contact and this particular challenge was thus overcome. As the answers to the questions were already provided in the drop down menu, descriptive answers could not be accommodated. This meant that the emotions of people could not be captured.

COST¹ COMPARISON BETWEEN THE PEN AND PAPER METHOD AND A MOBILE BASED SURVEY

The costs involved in conducting a survey for the National Rural Employment Guarantee Scheme covering 40 villages and 600 beneficiaries using the pen and paper are as follows:

1. Data entry costs of typing 63 questions in Tamil: Rs.140 (20 per page and 10 questions per page)
2. 600 photocopies of the questionnaire : Rs.4200 (Rs.1 per page and every questionnaire had roughly 7 pages)
3. Cost of administering the survey: Rs.30,000 (Rs.50 per interview)
4. Cost of data entry and translation of answers to English: Rs.1,05,000 (Rs.25 per page and 4200 pages for a sample size of 600)
5. Cost of couriering data from 40 villages: Rs.2000 (Rs.50 per village approx)

Total Cost: Rs.1,41,320

The costs involved in conducting a survey for the National Rural Employment Guarantee Scheme covering 40 villages and 600 beneficiaries using MINED are as follows:

1. Mobile Software Interface Developmental Cost (One time): Rs.50,000
2. Cost of administering the survey: Rs.30,000 (Rs.50 per interview)
3. Mobile phones recurring once in 5 years: Rs10,000
4. GPRS Package: Rs. 2500

¹ All costs are given in Indian Rupees. 1 USD= Rs.50 (approx)

Total Cost: Rs.92,500 out of which only Rs.42,500 is a recurring expense.

The recurring expense of using a mobile based technology for conducting a survey is just one third of the pen and paper survey method. The added benefits of using a mobile based survey method are the savings of time and the availability of error free data for immediate data analysis. These benefits, if quantified and added to the costs, make a tool like MINED extremely cost effective. A tool like MINED, when used to evaluate a National Scheme in a very vast country like India, results in saving many days in terms of time and a vast amount of money which can be used for the evaluation of other economic welfare schemes.

ADVANTAGES OF USING A MOBILE BASED SURVEY OVER THE REGULAR PEN AND PAPER METHOD:

A mobile based survey consumes lesser time (Schuster and Perez Brito,2010 p.3) when compared to the pen and paper method. In our case, the time taken to complete a questionnaire using a mobile phone only around 15 minutes and the whole data gathering covering 40 villages took just a month. The usual method would require atleast a day or two more because of the time taken to transport the completed questionnaire from the field to the back end.

A mobile based survey is also cost effective as it has been shown in the cost analysis. Further the design of MINED ensured error free data collection. The provision of drop down options and field validations ensured that the data collected was also accurate (Patnaik et al, 2009)²⁷ In the case of the traditional method of data gathering, data can be lost because of not being misinterpreting the handwriting or other non sampling errors like entering a numeric value for a question which requires textual answers. Data can also be lost in transit and there are chances of data being damaged too.

A mobile based survey also provides real-time data analysis and the provision of changing questions mid-way through the survey administration (P.Quinn et al 2003) ²⁸. This facility is not available in the conventional data gathering method.

Then findings of the survey conducted by using MINED covering 40 villages and 600 NREGS beneficiaries has been compiled as a report and the electronic version can be accessed online.

CONCLUSION

From our findings, we can conclude that a mobile based dynamic survey for evaluating a scheme like NREGA is the best suited method because it helps policy makers have a deeper and quicker understanding of the efficacy of the scheme by giving them flexibility in altering the questions, giving them access to error free data and providing them with a live update of the data gathered. A live update is extremely useful because it captures data and hence aids in the immediate understanding of the impact of the scheme. This method allows for easy alteration of the questionnaire midway through the process and doing so allows for gathering useful and pertinent information.

A mobile based dynamic survey for evaluating a scheme like NREGA has immense scope. It is easily scalable and can support any number of local languages. It can be used across all states in a country like India where languages are plenty. Any kind of data collection, especially in rural areas, will become easier if this method is used. The prospects of using this as a base for a voice based survey, where a user simply calls and answers questions which automatically gets uploaded in the database is already worked out(Jhunjhunwala et al,2009)²⁹.

REFERENCES

1. International Fund for Agricultural Development, India Poverty Indicators, retrieved on August 2011 at <http://www.ruralpovertyportal.org/web/guest/country/statistics/tags/india>
2. Evaluation of National Rural Employment Act 2009 by RTBI [Electronic Version], retrieved on August 2011 from http://www.nrega.net/pin/reports-and-resources/reports-submitted-to-the-ministry-of-rural-development/reports-28-jan-2010/copy_of_IIT%20Chennai.pdf
3. Evaluation of National Rural Employment Act 2009 by RTBI [Electronic Version], retrieved on August 2011 from http://www.nrega.net/pin/reports-and-resources/reports-submitted-to-the-ministry-of-rural-development/reports-28-jan-2010/copy_of_IIT%20Chennai.pdf, p.p16
4. Wikipedia, Panchayati Raj from http://en.wikipedia.org/wiki/Panchayati_raj
5. Wikipedia, Gram Panchayat from http://en.wikipedia.org/wiki/Gram_panchayat
6. Government of Tamilnadu, Public Distribution System retrieved on August 2011 from http://www.tn.gov.in/citizen/tds_ctr.htm
7. Wikipedia, Below Poverty line in India from [http://en.wikipedia.org/wiki/Below_Poverty_Line_\(India\)](http://en.wikipedia.org/wiki/Below_Poverty_Line_(India))
8. Government of India, National Rural Employment Guarantee Scheme FAQs, answer to question Number 19 retrieved on August 2011 from http://pib.nic.in/archieve/flagship/faq_nregaE.pdf
9. Government of India, National Rural Employment Guarantee Scheme FAQs, answers to question Numbers 5 and 6 retrieved on August 2011 from http://pib.nic.in/archieve/flagship/faq_nregaE.pdf
10. Government of India, National Rural Employment Guarantee Scheme FAQs, answer to question Number 22 retrieved on August 2011 from http://pib.nic.in/archieve/flagship/faq_nregaE.pdf
Piplantri Village website on NREGA retrieved on August 2011 from <http://www.piplantri.com/nrega.html>
11. Wikipedia, Financial Inclusion from http://en.wikipedia.org/wiki/Financial_inclusion
12. Government of India, retrieved on August 2011 from http://pib.nic.in/archieve/flagship/faq_nregaE.pdf
13. Schuster Christian and Perez Brito Carlos, Cutting costs, boosting quality and collecting data real-time – Lessons from a Cell Phone-Based Beneficiary Survey to Strengthen Guatemala's Conditional Cash Transfer Program, A regular series of notes highlighting recent lessons

emerging from the operational and analytical program of the *World Bank's Latin America and Caribbean Region (LAC)*. February 2011 Number 166

14. Waidyanatha, Nuwan, Sampath, Chamindu and M., Ganesan et al (2010), *Mhealth Revolutionizing Public Health: An Economic Study*, 5th Communication Policy Research South Conference (CPRsouth5), Xi'an, China.
<http://economictimes.indiatimes.com/opinion/guest-writer/mobile-phones-social-capital-shgs/articleshow/5678658.cms>), retrieved on 8/10/2011
15. Tomlinson et al, The use of mobile phones as a data collection tool: A report from a household survey in South Africa 2009 *BMC Medical Informatics and Decision Making* 2009, doi:10.1186/1472-6947-9-51
16. Webopedia, GPRS from <http://www.webopedia.com/TERM/G/GPRS.html>
17. Wikipedia, HTML from <http://en.wikipedia.org/wiki/HTML>
18. Search Enterprise, Open Source from <http://searchenterpriselinux.techtarget.com/definition/open-source>
19. Wikipedia, PHP from <http://en.wikipedia.org/wiki/PHP>
20. Wikipedia, JavaScript from <http://en.wikipedia.org/wiki/JavaScript>
21. W3schools, Java Script Form validation from http://www.w3schools.com/js/js_form_validation.asp
22. Wikipedia, MySQL from <http://en.wikipedia.org/wiki/MySQL>
23. Wikipedia, Record management System from http://www.en.wikipedia.org/wiki/Record_Management_System
24. Wikipedia, Comma-Separated Values from http://en.wikipedia.org/wiki/Comma-separated_values
25. Wikipedia, XLS from <http://en.wikipedia.org/wiki/XLS>
26. Wikipedia, Unicode from <http://en.wikipedia.org/wiki/Unicode>
27. Somani Patnaik, Emma Brunskill and William Thies (2009): 'Evaluating the Accuracy of Data Collection on Mobile Phones: A Study of Forms, SMS, and Voice' IEEE/ACM International Conference on Information and Communication Technologies and Development, April 2009

28. P. Quinn, J. Goka, H. Richardson, 2003 Assessment of an electronic daily diary in patients with overactive bladder, , *BJU International*, Volume 91, Issue 7, pages 647–652
29. Jhunjhunwala Ashok, Anandan Vasumathi, Prashant Suma and Sachdev Umesh. (2011). *Experiences with Voice Based Data Entry System over Mobile Phone in Rural India*, Proceedings of the 3rd International Workshop on Infrastructures for Healthcare: Global Healthcare, Denmark, pp 59 – 66.