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WATER, SANITATION AND HYGIENE SERVICES BEYOND 2015:
IMPROVING ACCESS AND SUSTAINABILITY

'Technology matters' in ensuring drinking water supplies to rural households

U. S. Prasad & I. De (India)

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India's success towards ensuring safe drinking water to a sizeable proportion of its rural population can be largely attributed to planning and implementation of improved drinking water supply schemes. Among these, handpumps are common and are increasing in numbers, at the same time higher budgetary allocations on piped water supplies (PWS) can be seen as the reasons for increased access of tap water at the household level. However, there are discernable patterns in technology adaptions by the implementing agencies at the State levels. As a result, reporting covered population is possible with the handpumps, as shown in the paper, but PWS promises improved water security and safety. In Post 2015 years, drinking water security and safety should serve the criterion for benchmarking.

Introduction and purpose

Safe and sustainable drinking water accessible to the rural areas have been one of the prime concerns by the successive governments in India. Over the years, the policies and programmes were drawn that emphasized potability of water with development of sources in the vicinity of households while the Union Government played a major role in issuing necessary guidelines and the funding support. The States in India were capacitated to plan their own investments at the same time special considerations are given for the backwardness, development of desert and drought-prone districts (NRDWP 2011). Thus, the choice of technology depended upon the geographical conditions, urgency of situation and resources available. The detailed project planning and implementing the water supply schemes remained in the domains of the departments and agencies at state levels as a result influences of technology plays a major roles in defining access and drinking water safety.

Accelerated Rural Water Supply Programme (ARWSP) was the first major intervention undertaken during the early 1970s. A major fillip to this programme was given by Technology Mission approach in 1986 and in the year 2009 the current National Rural Drinking Water Programme (NRDWP), gave a contemporary approach emphasizing on equity, convenience to households and sustainability of source and system. As on April 2014, an availability of 40 liter of safe drinking water per person per day has been reported to more than 73 percent of the rural habitations (MDWS 2014) and the national aspiration "all rural households have access to piped water supply in adequate quantity with a metered tap connection" by the year 2022(Strategic Plan 2011-22, MDWS) can be a benchmark for the post 2015 years.

This paper examines the achievement of water supply coverage from the perspective of access, water security and safety in India. It also elaborates how technology can be the significant differentiator in influencing the national programmes when the local governments also have a stake in the programme.

Methodology

The paper also makes an assumption that presence of biological and chemical contaminants in water drawn from handpumps are more likely than water serviced at household levels with tap connection.

Reports of Census of India and online reports of Ministry of Drinking Water and Sanitation, Government of India have been the main sources of information on types of drinking water schemes and sources.in the rural areas. National Sample Survey (NSS) 69th round (July 2012-December 2012) provides useful information on condition of basic services of more than 95 thousand households spanning across all the states of India.

Background and trends in rural drinking water supplies

Census of India 2011 presents a marked shift towards the improved water sources and also opens-up new questions for the policy planners (Figure 1).

i. **Handpumps as the main source drinking water**: More than half of the rural households depend upon handpumps as the main source of drinking water. This number has increased over the last ten years as preferred source of drinking water. In terms of percentage there has been an increase of 3.0 percent of rural households using handpumps. Low cost and simple technology offers the potential for quick intervention under the public programmes. At same time these provide better water safety to the rural households, hence a substantial number of these have been funded from the private sources.

ii. **Decline in households using well water**: There is decline by 8.9 percentages of the rural households using wells as the main source of drinking water. The households dependent on wells in 2001 were 22.2 percent which declined to 13.3 percent in the year 2011.

iii. **Increasing access by the tap water:** The rural households which have access to tap water are increasing and there are additional 10.9 Million households (6.5 percent) in this category. During 2001, 24.3 percent of rural households reported tap water as the main drinking water source that has increased to 30.8 percent in the year 2011.

iv. **Decline in dependence on other sources**: Census 2011 also reports a decline in 0.5 percent of households dependent on the "Other" drinking water sources.

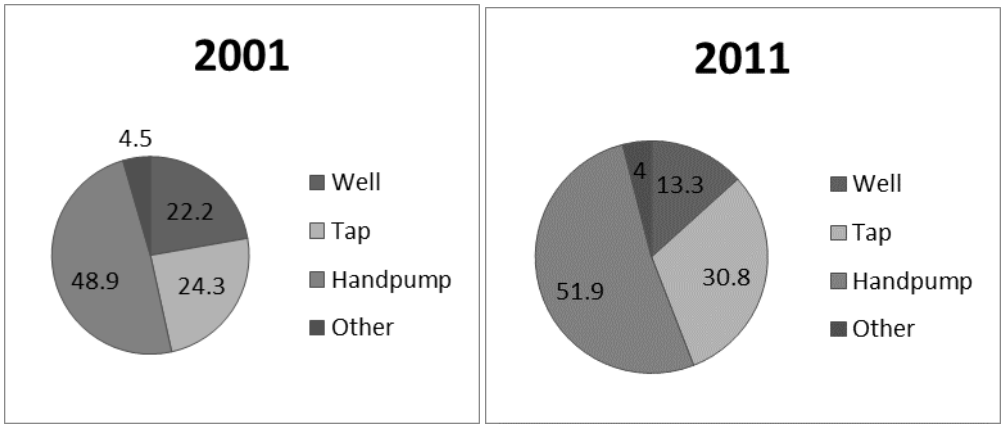

Figure 1. Main sources of drinking water in rural areas (India)

Source: Census of India 2011

Clearly wells and other sources have declined and there is increased acceptance of improved technology. Growing concern for safe and adequate drinking water has thrown up new issues on services provided by the implementing agency that not only should address availability but also ensure access with ease, quality free from contaminations and also sustainable over a period of time.

Data presentation and analysis

Though over the years wells have been the mainstay of the rural lives and as per the Census of India 2011 a substantial percentages of households in Jharkhand (42%), Madhya Pradesh (25%) and Maharashtra (24.3%) depended upon well water, theses have been not considered in this analysis. The reported number of covered well in the country being just 1.5 percent (2011).

i. Quantity of drinking water and types of schemes

The two technological options, handpump and the piped water supply, as the improved ways to providing drinking water supplies have gained acceptance by the States. Under the national flagship National Rural Drinking Programme (NRDWP) a majority of habitations fulfill the criterion of supplying adequate quantity of safe drinking water.

Table 1. Coverage of habitations (percentage) under NRDWP

	Partial coverage of habitations with <40lpcd and No Quality	Full coverage of habitations with =>40lpcd and No Quality
2012	19.84	73.91
2013	24.45	68.58
2014	21.72	73.66

Source: MDWS, 2014

However, there have been varying approach on promotion of schemes. For example, Jharkhand (98.23%), Madhya Pradesh (97.83%),Chhattisgarh (82.45%) and Orissa(58.99%), have reported a good progress with Handpumps, but on the other hands several States like Andhra Pradesh, Karnataka, Tamil Nadu may regard this as an obsolete way to provide drinking water supplies and may not choose to report coverage. Criticality of selecting schemes are protection against seasonal variability in supplies, distance of the households , water free from contaminants among others, there is a noticeable decline in share of investments in the Handpumps as shown in the table below.

Table 2. Cost of projects* in million rupees under NRDWP

	Piped water supply	Hand-pumps	Total
2012	476567(96)	18469(4)	495036
2013	542678 (95)	27100(5)	569778
2014	917087(98)	22272(2)	939360

Source: MDWS, 2014. *The figures in parentheses are the percentage of total project cost.

The emphasis on piped water supplies by the States like Gujarat, Maharashtra and Karnataka also reflect in their reported coverage that stands at 63, 33 and 23 percentages of the rural households with access to tap water. On the bottom of ladder are the States Bihar, Jharkhand and West Bengal where respectively only 0.02,0.38 and 0.63 percentage of rural household reported piped water supplies as main source of drinking water. Source: MDWS, 2014

ii. Quality of drinking water

Quality of water depends on source of water supply. We have made an attempt to explore the determinants of quality of water. Water quality has been examined on the basis of contamination by fluoride, arsenic, iron, salinity and nitrate. The following regression has been considered to explain the variation in number of people affected by contamination (affect_people) across states. The independent variables of these models are number of people covered by ground piped water supply (pws_gw), surface piped water supply (pws_sw), open well (ow), handpump (handpump), other tubewell (other_tubewell), surface water (surface_water) including canal, spring, treated surface water etc., rain water (rain), traditional sources such as Khadins, Nadis etc (traditional) and non-conventional sources (non_conventional).

Model I

$$\text{affect\_people} = a_0 + a_1\ \text{pws\_gw} + a_2\ \text{ow} + a_3\ \text{handpump} + a_4\ \text{other\_tubewell} + a_5\ \text{surface\_water} + a_6\ \text{rain} + a_7\ \text{traditional} + a_8\ \text{non\_conventional}$$

Model II

affect_people = a_0 + a_1 pws_sw + a_2 ow + a_3 handpump + a_4 other_tubewell + a_5 surface_water+ a_6 rain + a_7 traditional + a_8 non_conventional

We have constructed two different models to get rid of multi-collinearity problem arising out of high correlation between pws_gw and pws_sw. The regression results are presented in Table 3.

Results

The regression results demonstrate that pws_gw, pws_sw and non_conventional has negative impact on affect_people. These variables are significant in both the models Furthermore, ow, handpump, other_tubewell and traditional have positive impact on affect_ people. The variable traditional is highly significant at 1% level in both the model. The variable non_conventional also appears to be significant in both the models. Hence, these two variables are robust as they are found significant in both the models. Variables surface_water and rain are insignificant in both the models.

The results suggest that piped water supply delivered utilising ground water or surface water reduces contamination of water. Usage of non-conventional water supply sources also reduces contamination. On the contrary, contamination increases with traditional sources, open well, handpump and other tubewells.

Table 3. Determinants of number of people affected by water contamination

Dependent variable	**affect_people**	
	Model I	**Model II**
	Coefficient	**Coefficient**
pws_gw	-0.00015*** (-3.51)	
pws_sw		-0.00012* (-1.71)
ow	0.00053** (2.55)	0.000404 (1.72)
handpump	0.00007** (2.81)	0.000041 (1.5)
other_tubewell	0.00030** (2.75)	0.000135 (1.25)
surface_water	0.00059 (0.76)	5.18E-05 (0.06)
rain	0.00069 (0.38)	0.001165 (0.56)
traditional	0.03889*** (4.21)	0.042498*** (3.97)
non_conventional	-0.01615*** (-2.9)	-0.011136* (-1.82)
constant	430.16 (0.99)	490.7935 (0.94)
Number of observations	34	34
F	26.88	19.3
Prob>F	0.00	0.00
R-square	0.89	0.86
Adj R-square	0.86	0.82

Note: numbers in the parentheses are t value
* Significant at 10% level
** Significant at 5 % level
*** Significant at 1% level

Though we realize the above contaminations are geogenic and hence establishing any causality with technology of water supplies system may be incidental, it has been found there has been marginal decline in number of habitations affected with water quality problems (Table 4).

Table 4. Habitations (percentage) with Water Quality Contamination

	Quality affected habitations
2012	6.25
2013	4.89
2014	4.63

Source: MDWS,2104

Tale of two states: Jharkhand and Karnataka

The number of Districts in Jharkhand and Karnataka are 24 and 30 respectively and the reported rural populations respectively are approximately 27 Million and 39 Million. Jharkhand receives a higher rainfalls of 1400 mm as compared to Karnataka that receives as average 1248 mm but the State is in further disadvantageous position for its north interior parts receiving an average rainfall as low as 731 mm. However, an interesting comparison appears in their reported households (percentage) with water supply schemes that puts the two States stand at different poles.

During the year 2014-14, Karnataka has transferred over 8% of funds for operation and maintenance (O&M) of drinking water facilities while in Jharkhand this is barely 0.3 percent.

Source: MDWS 2014

Table 6. Input system

	Water supply	Jharkhand	Karnataka
Households by Schemes of Water Supply (%)	Bottled water	0	1
	Piped water into dwelling	0	5
	Piped water to yard/plot	1	20
	Public tap/standpipe	0	52
	Tube well/borehole	65	12
	Well: Protected	1	5
	Well: Unprotected	28	2
	Surface water: tank/pond	2	0
	Other surface water (river, dam, canal, lake etc.)	3	0
	Others (tanker, truck, cart with small tank or drum etc)	0	3
	Total	**100**	**100**

Table 7. Output system			
Table cell heading	**1**	**2**	**3**
	Months	**Jharkhand**	**Karnataka**
Households by Number of months insufficient supply of water (Percentage Distribution)	0 months	71	76
	1 months	3	0
	2-3 months	25	15
	>3 months	2	9
	Total	**100**	**100**
Households by perceived quality of drinking water (Percentage Distribution)	**Physical quality**		
	Bad in Taste	3	3
	Bad in Smell	0	0
	Bad in Taste and Smell	3	1
	Bad due to Other Reasons	4	3
	No Defect	90	93
	Total	**100**	**100**
Households by distance to major water supply (Percentage Distribution)	**Distance**		
	Within Dwelling	**4**	**6**
	Outside Dwelling but within Premises	**18**	**26**
	Outside Premises: within 0.2 KM	49	59
	Outside Premise : 0.2KM to 0.5 KM	**24**	**9**
	Outside Premise: 0.5KM to 1.00KM	**4**	**1**
	Outside Premise: 1KM to 1.5 KM	**0**	**0**
	Outside Premise: 1.5 KM or more	**1**	**0**
	Total	**100**	**100**
Average time (Minutes) spent to fetch water	**Collection time**		
	Time Taken to Reach Source	**40**	**17**
	Waiting Time	**22**	**16**

Source: NSSO, 69th Round

Conclusion

Delivery of drinking water supply in the rural India has taken different shapes in different States, primarily due to choice of technology taken by the respective State governments. While some have emphasized on hand pump/tubewell, others have taken measures in setting-up piped water supplies. Under the common national programme on ensuring safe drinking water in the vicinity of households the services by piped water supply is a better option than handpump/tubewell because improved drinking water security and

safety norms can be achieved with PWS. The paper also highlights the fact that term "coverage" alone is not sufficient indicator of water supplies system, as demonstrated in our comparison between Jharkhand and Karnataka. Although reported coverage is much higher in Jharkhand but percentage of access at household level is better in Karnataka, also the distance to sources and waiting time to collect water being less. Finally, technology is the critical enabler in ensuring safe and adequate drinking water to rural households hence planning a greater investments towards PWS should guide post 2015 development phase.

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Contact details

U.S Prasad
Address WaterAid India, CNI Bhawan,
16 Pandit Marg New Delhi 110001, India
Tel: 91-11-46084446, 9717894446
Email: usp.prasad@gmail.com

Indranil De
Address IRMA Anand, Gujrat, India
Tel: 91-2692-221919, 919913866061
Email: indranil@irma.ac.in