

# A Comprehensive Assessment of Household Water Poverty in India



Rida Wanbha Nongbri  
PhD. Scholar

Department of Humanities & Social Sciences  
Indian Institute of Technology Madras  
Date: 26<sup>th</sup> August 2023

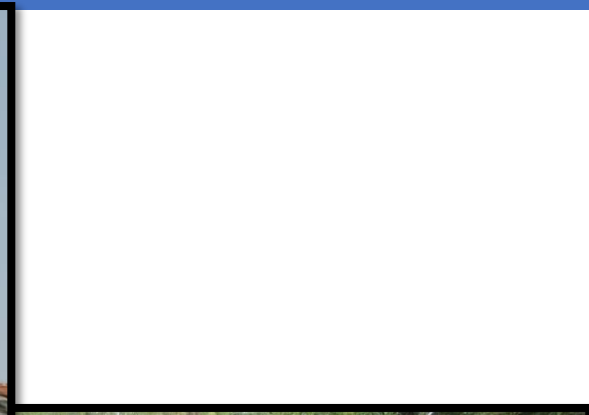
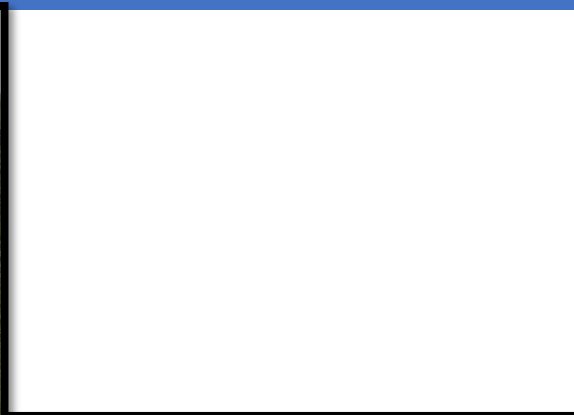
# Outline

- Background & Motivation
- Evolution of Water Poverty
- Why this approach?
- Methodology
- Results, Discussion & Robustness
- Conclusion

# Background & Motivation

- Lack of access to safe water and sanitation facilities can disproportionately affect marginalised groups hindering or lowering the Human Development Index (HDI) ranking.
- The United Nations Development Program (UNDP, 2006) explores the linkages between water vulnerability and poverty. Highlighting how inadequate access to water and sanitation heightens poverty is crucial for human well-being, productivity and overall development (UNICEF, 2019).
- Achieving SDGs is challenging when more than 2 million people face water stress (UNESCO, 2019), with African and Asian regions facing the highest.
- With 163 million Indian households lacking safe drinking water and 210 million lacking improved sanitation, India faces extreme water stress (NITI Aayog, 2019).

# Background & Motivation



# Evolution of Water Poverty

- Water Poverty can be defined as the lived condition in a household experiencing insufficient access to water to meet its needs (Kallio *et al.*, 2018).

Uni-dimensional Nature	Multidimensional Nature
<ul style="list-style-type: none"><li>Falkenmark and Lindh (1974), Rakin <i>et al.</i>, (1997), Gleick (1996), Ohlsson and Turton (2000), Sullivan (2002), Molle and Mollinga (2003)..</li></ul>	Sullivan, 2002; Lawrence <i>et al.</i> , 2003; Sullivan <i>et al.</i> , 2003; Goel <i>et al.</i> , 2020; Ladi <i>et al.</i> ; 2021; Goswami, 2022...

# Why this Approach?

<b>Composite index approach</b>	<b>Alkire-Foster approach</b>
<ul style="list-style-type: none"><li>• Consider WPI at the aggregate stage.</li></ul>	<ul style="list-style-type: none"><li>• This approach requires two distinct components – the water poverty headcount (incidence) and an adjustment measure (intensity) – to define water poverty in a multidimensional context.</li><li>• Consider WPI as the joint distribution of the incidence and intensity.</li><li>• Decomposition nature.</li></ul>

# Variable of interest

<b>Table1: Dimension, Indicators, cut-off and weight of the MWPI</b>			
<b>Dimensions</b>	<b>Indicators</b>	<b>Deprived if</b>	<b>Weight</b>
<b>Access</b>	Source	Does not have access to in-house piped water connection.	0.25
	Sanitation	Does not have semi-flush toilet facilities.	0.25
<b>Stress</b>	Supply	Water supply hour per day if less than 4 hours (mean of the data).	0.15
	Time taken	The time taken to the source from the dwelling area is more than 15 minutes (one-way) (WHO threshold).	0.15
<b>Quality</b>	Treatment	Do not treat drinking water.	0.1
<b>Capacity</b>	Adequacy	Drinking water is not adequate.	0.05
	Storage	Water storage is not available.	0.05
<b>Source: IHDS (2005 &amp; 2012)</b>			
<b>Note: General weight parentheses</b>			

# Methodology

Deprivation score ( $c_i$ ) =	$\sum_{j=1}^d w_j g_{ij}^o$
Headcount ration ( $H_0$ ) =	$\frac{q}{n}$
Intensity of poverty ( $A$ ) =	$\frac{1}{q} \sum_{i=1}^n c_i(k)$
<b>MWPI (<math>M_0</math>) =</b>	$H_0 \times A$
Contribution of dimension $j$ to MWPI	$M_o = w_j \frac{(H_j(k))}{M_0}$
Subgroup levels $MWPI$ ( $M_0(X^l)$ ) with the overall $MWPI$	$(M_0(X)) = \sum_{l=1}^m v^l M_0(X^l)$
% Contribution of each subgroup to the overall MWPI	$D_l^o = v^l \frac{M_0(X^l)}{M_0(X)}$



# Results and Discussion

- Table 2 presents India's calculated adjusted headcount ratio (H), intensity (A) and multidimensional water poverty index (MWPI).

<b>Table2: Multidimensional Water Poverty Index (k = 30%)</b>			
	Headcount ratio (H)	Intensity (A)	MWPI
<b>Round 1</b>	0.754	0.596	0.449
<b>Round 2</b>	0.713	0.573	0.409

**Source: Authors' computation, 2023**

Cont.....

# Results and Discussion

**Table 3. Contribution of poverty status with k = 30% to MWPI**

	Poverty Status	Percentage	Multi-dimensionally non-poor	Multi-dimensionally poor
<b>Round 1</b>	Non-poor	2.80	24.64	
	Moderate	21.85		
	Poor	68.46		75.36
	Extremely poor	6.90		
<b>Round 2</b>	Non-poor	2.39	28.70	
	Moderate	<b>26.31</b>		
	Poor	65.12		71.30
	Extremely poor	7.15		

**Source: Authors' computation, 2023**

Cont.....

# Results and Discussion

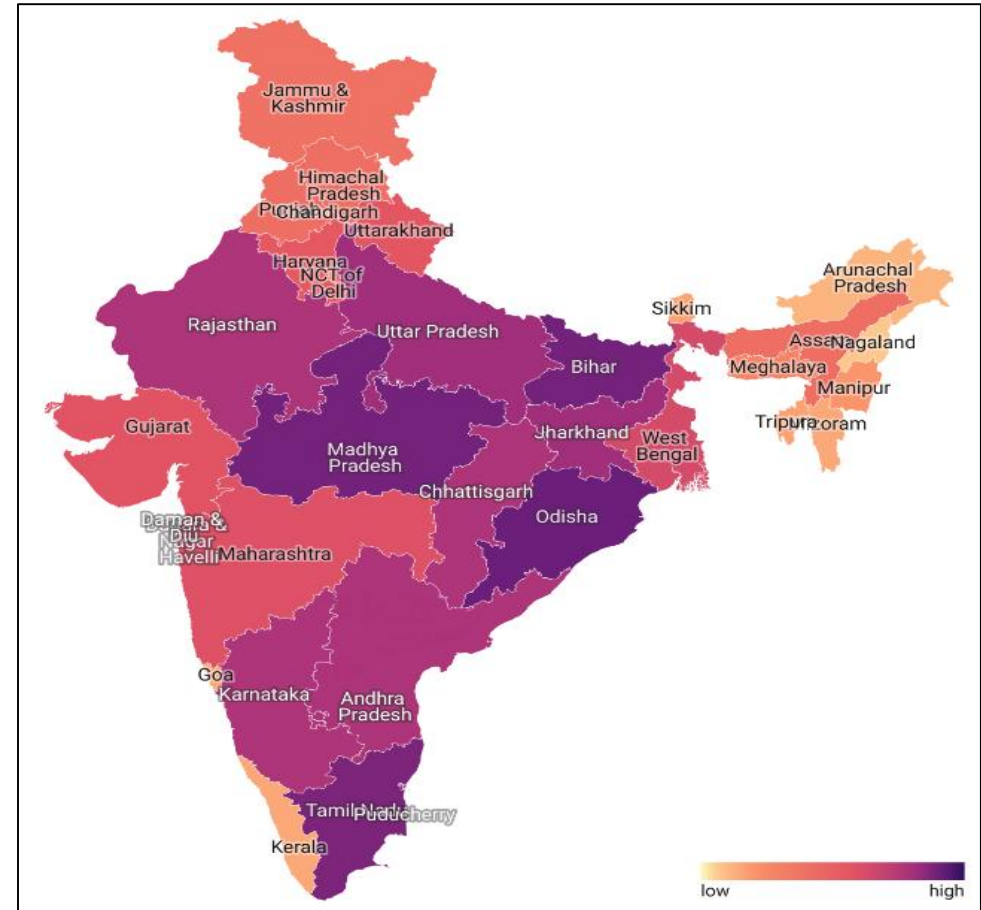
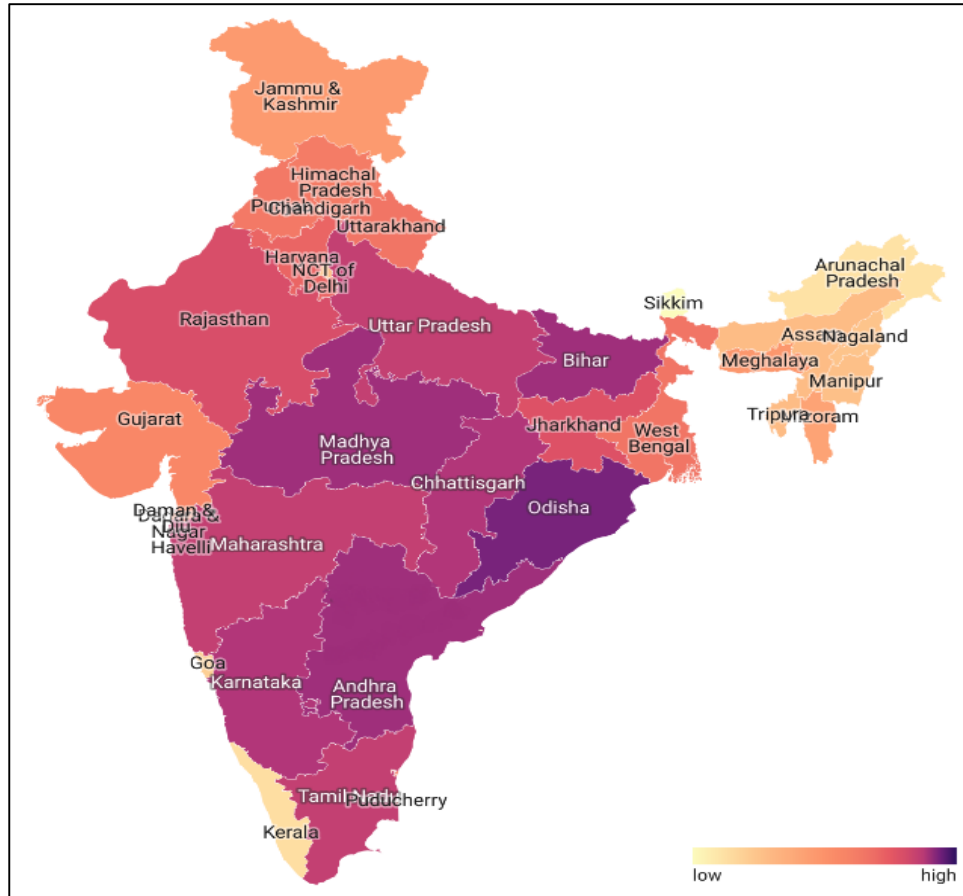
Table 4: Percentage contribution of indicators to the MWPI with k = 30%

	Dimension	Access		Stress		Quality	Capacity	
	<i>Indicator</i>	<i>Source</i>	<i>Sanitation</i>	<i>Supply</i>	<i>Time</i>	<i>Treatment</i>	<i>Adequacy</i>	<i>Storage</i>
Round1	Weight	0.25	0.25	0.15	0.15	0.10	0.05	0.05
	Uncensored (HCR)	0.73	0.59	0.33	0.25	0.68	0.08	0.10
	Censored (HCR)	0.67	0.58	0.21	0.25	0.60	0.07	0.09
	Percentage contribution (in %)	<b>37.03</b>	<b>32.49</b>	<b>7.14</b>	<b>8.30</b>	<b>13.32</b>	<b>0.75</b>	<b>1.06</b>
Round2	Weight	0.25	0.25	0.15	0.15	0.10	0.05	0.05
	Uncensored (HCR)	0.70	0.47	0.39	0.23	0.70	0.07	0.10
	Censored (HCR)	0.63	0.47	0.23	0.23	0.58	0.06	0.09
	Percentage contribution (in %)	<b>38.73</b>	<b>28.46</b>	<b>8.38</b>	<b>8.28</b>	<b>14.26</b>	<b>0.72</b>	<b>1.11</b>

Source: Authors' computation, 2023

# Results and Discussion

- State-wise classification



Cont.....

# Results and Discussion

**Table 5: Classification of Subgroup MWPI**

	Round 1		Round 2		Rural	Urban	Rural	Urban
	Rural	Urban	Rural	Urban				
<b>Population</b>	25983	10686	25152	11517				
<b>Population Distribution</b>	0.709	0.291	0.686	0.314				
<b>HCR</b>	0.862	0.491	0.822	0.475				
<b>Intensity</b>	0.610	0.538	0.591	0.507				
<b>MWPI (X<sup>l</sup>)</b>	<b>0.526</b>	<b>0.264</b>	<b>0.486</b>	<b>0.241</b>	<i>Round 1</i>		<i>Round 2</i>	
<b>% contribution of X<sup>l</sup> to MWPI</b>	<b>83.0</b>	<b>17.1</b>	<b>81.4</b>	<b>18.5</b>	<i>Rural</i>	<i>Urban</i>	<i>Rural</i>	<i>Urban</i>
<b>Headcount ratio of the indicator</b>					<i>% contribution of the indicator to X<sup>l</sup></i>			
<b>Source</b>	0.77	0.40	0.74	0.41	36.8	37.8	37.9	42.5
<b>Sanitation</b>	0.71	0.27	0.60	0.17	33.9	25.2	30.8	18.0
<b>Supply</b>	0.20	0.24	0.23	0.22	5.8	13.7	7.1	14.0
<b>Time</b>	0.30	0.13	0.27	0.13	8.5	7.2	8.4	7.8
<b>Treatment</b>	0.69	0.37	0.68	0.36	13.2	14.0	14.1	15.0
<b>Adequacy</b>	0.07	0.05	0.07	0.04	0.7	1.0	0.7	0.9
<b>Storage</b>	0.11	0.06	0.10	0.08	1.0	1.2	1.0	1.7
<b>Source: Authors' computation, 2023</b>								

Cont.....

# Results and Discussion

## Dimension-wise ranks at the state level

Highest	Round 1	Round 2
Access	Bihar	Bihar
Stress	Andhra Pradesh	Pondicherry
Quality	Bihar	Bihar
Capacity	Bihar	Bihar

Least	Round 1	Round 2
Access	Sikkim	Sikkim
Stress	Dadra Haveli	Sikkim
Quality	Goa	Kerela
Capacity	Maharashtra	Gujarat

# Robustness check

- Ranking and dominance of poverty cut-off

**Table6: Multidimensional Water Poverty Index**

		K = 5%	K = 30%	K = 50%	K = 80%	K = 100%
<b>Round1</b>	HCR	0.972	0.754	0.601	0.069	0.000
	Intensity	0.508	0.596	0.654	0.856	1.000
	MWPI	<b>0.494</b>	<b>0.449</b>	<b>0.393</b>	<b>0.059</b>	<b>0.000</b>
<b>Round2</b>	HCR	0.976	0.713	0.519	0.072	0.000
	Intensity	0.474	0.573	0.650	0.856	1.000
	MWPI	<b>0.463</b>	<b>0.409</b>	<b>0.337</b>	<b>0.061</b>	<b>0.000</b>

**Source: Author computation, 2023**

- Testing for rank robustness concerning changes in the indicator weight for state ranking.

The findings showed that the correlation between the states' ranking, as obtained from the two alternative weighting structures while considering the weight applied in the primary analysis as the baseline, and changes in the weight of the indicators was .88 for R1 and .87 for R2, suggesting a perfect association of ranks.

# Conclusion

- The results indicate that one possible area where policymakers can intervene is on specific indicators that can have long-term effects of reducing the overall poverty level of the country.
- Another focused intervention is either on the headcount ratio or the Intensity value of the respective state to find more effective results in reducing water poverty.

According to the December 2022 report of the Ministry of Jal Shakti, the implementation of JJM achieved over 55% coverage in supplying piped water to rural households.

India still requires continuous efforts and a comprehensive approach to catalyse its progress towards achieving SDG 6. Challenges related to water quality, reliability, infrastructure maintenance and equitable distribution remain significant concerns.

Therefore, with MWPI insightful data on regions experiencing the highest water poverty levels, policymakers and stakeholders can properly prioritise initiatives and allocate resources.



THANK YOU