





An Investigation into Domestic Water Consumption to Assist Decision Making on Water Efficiency in Urban Areas of India

**Seyed M.K. Sadr, Arpit Jain, Shilpa Gulati, Fayyaz Ali Memon, Wa'El Hussein,
Andrew P. Duncan, Dragan A. Savić and David Butler**

Water Efficiency Conference 2015

5-7 August, University of Exeter

Outline

- Introduction
- Water demand management (WDM)
- Aim
- Methodology
 - Survey on water use practices in India
 - Cluster analysis
- Results
- Discussion
- Conclusion
- References



Introduction

- Scarcity of clean and fresh water resources.
- Population explosion affecting water crisis:
 - The global population has increased from 3 to 7 billion people in five decades (UNPFA, 2011)
 - by 2025, 67% of the global population will face moderate to high water stress and half of the population will be suffering constraints in their water supply (Lazarova et al., 2001)
 - India with 1.2 billion face lack of access to safe drinking water (UNICEF, 2013)
 - Poor management and overexploitation of groundwater by all sectors in the absence of adequate regulation and effective pricing instruments severely impact water-scarce areas (GR, 2009).



Water demand management (WDM)

- The practical development and implementation of strategies
- Aim of WDM: influencing demand and shifting consumers towards sustainable water consumption behaviour.
- The WDM approach relying greatly on consumers.

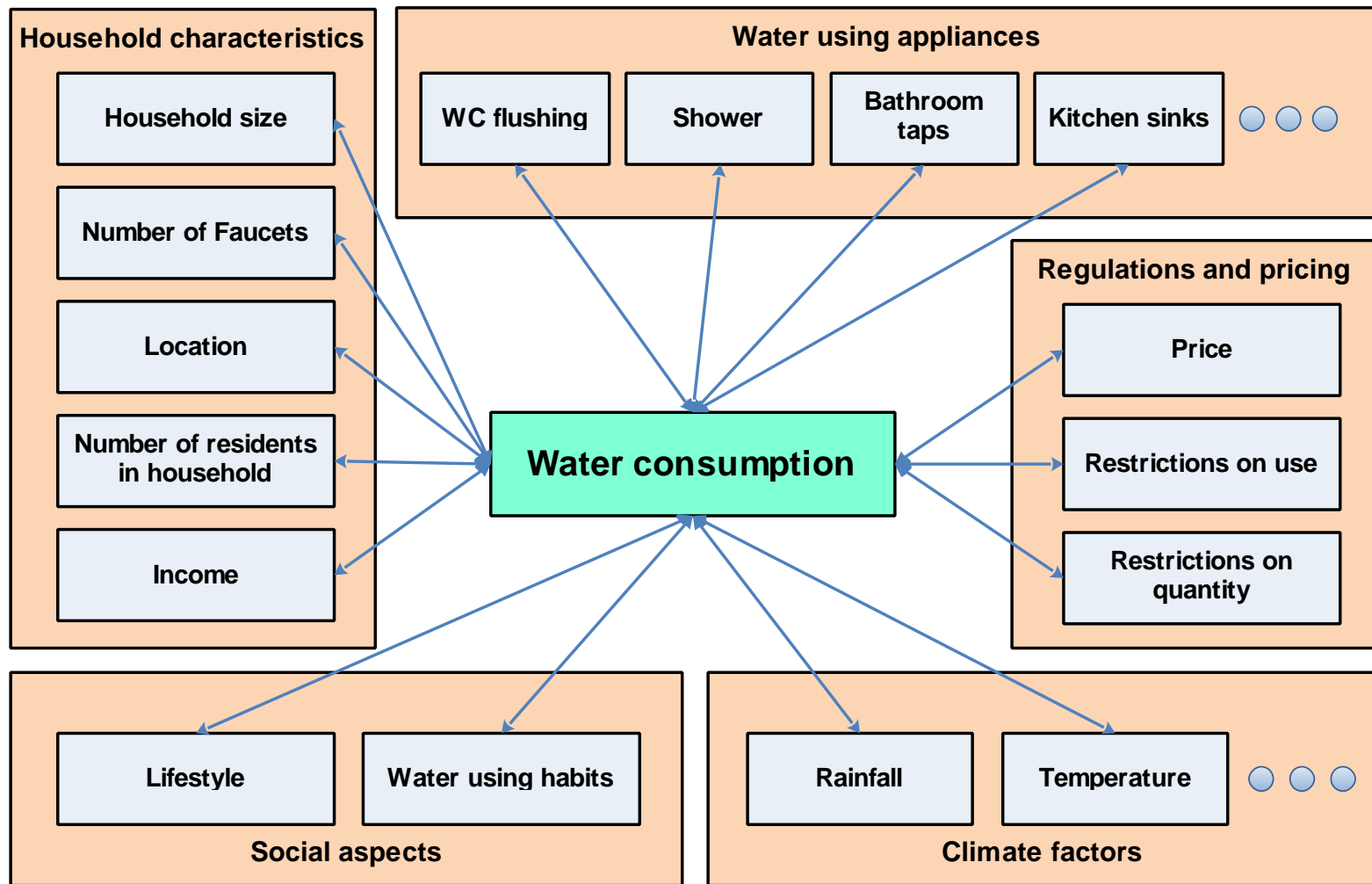


Aim

- To explore the relation between water consumption and water use behaviour and attitudes, and devices applied in households in urban areas in India



Methodology



Methodology: Survey on water use practices in India

- Including the development and distribution of a questionnaire to about 100 households of different types in the Indian city of **Jaipur**.
 - Population: 3.1 million
 - Facing a significant problem with drinking water.
- Two main sections:
 - Household characteristics
 - Nine questions
 - Aiming at categorizing and filtering information based on household characteristics e.g. household location, household type, number of occupants in each household, number of washrooms in a household, time/duration of water supply, monthly water bill, and household income.
 - Water use characteristics
 - 11 subsections
 - Aiming at identifying/classifying water consumption habits in a household in urban areas in India.

[Water use Survey](#)



Methodology: Cluster analysis

- The art of finding groups in data
- an attempt to consider recognisable dimensions of water use practices by which a number of clusters can be created
- The main focus of analysis: on water consumption for different types of households based on bathing/showering and cloth-washing



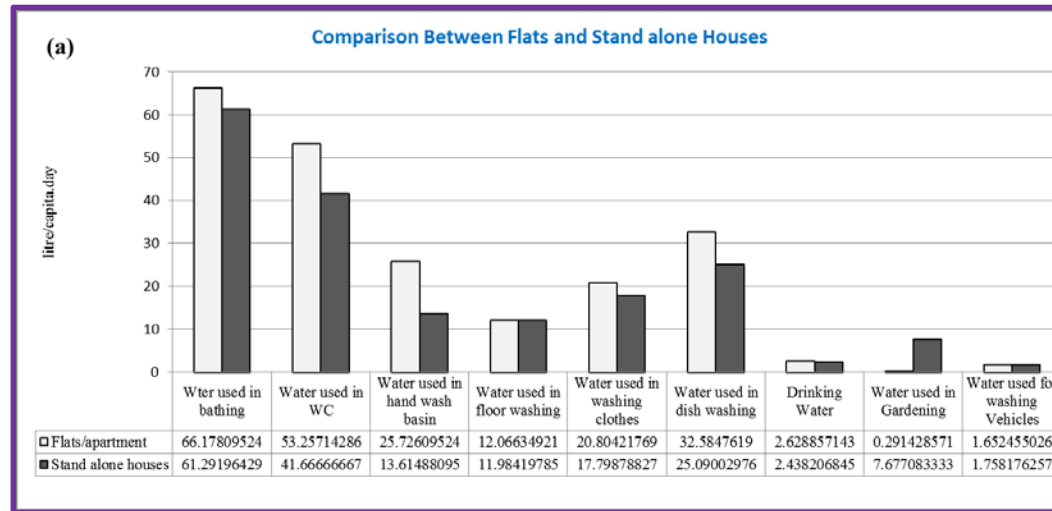
Methodology: Cluster analysis

Dimensions of bathing/showering and cloth-washing practices used for clustering analysis

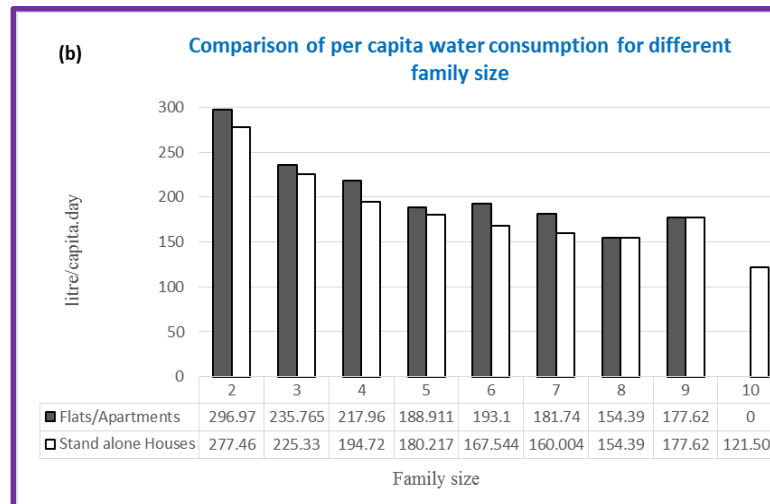
Water using practices	Dimension	Description	Normalized scale values
Bath and shower	Frequency	Number of baths and showers per week per person	0 → 1 per week or fewer
			1 → 14 per week or more
	Diversity	Duration of each shower or number of buckets (15-20 litres) used for each bath	0 → 1 minutes or fewer / 1 bucket or less
			1 → 30 or more / 6 buckets or more
	Technological preference	Bath to shower ratio	0 → always taking showers
			0.5 → taking baths and showers equally
1 → always taking baths			
Clothes washing	Frequency	Number of times clothes are washed per week per household	0 → 1 per week or fewer
			1 → 12 per week or more
	Diversity	How much water used for clothes washing per week	0 → 3 buckets / 60 litres or less
			1 → 40 buckets / 800 litres or more
	Technological preference	Manual washing to washing machine ratio	0 → always washing manually
			0.5 → equal manual washing & using washing machine
1 → always using washing machine			

Results: Analysis on bathing and showering

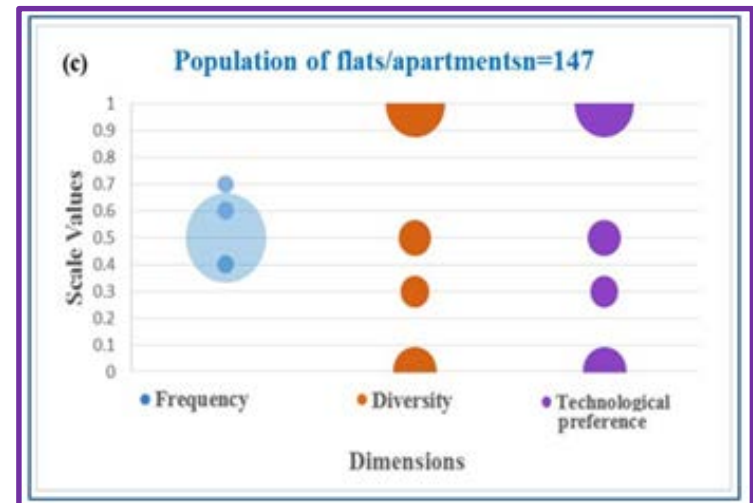
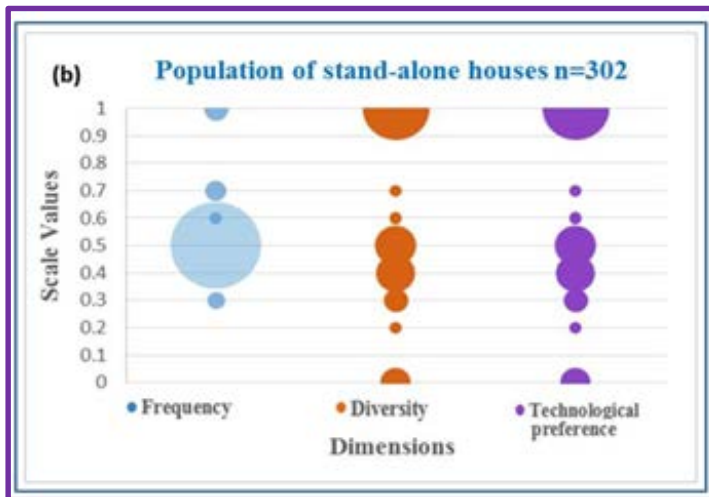
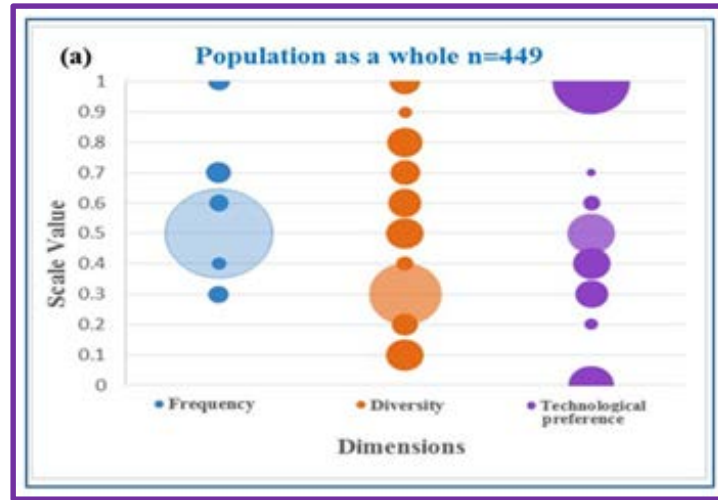
The average per capita water consumption (a) versus different household



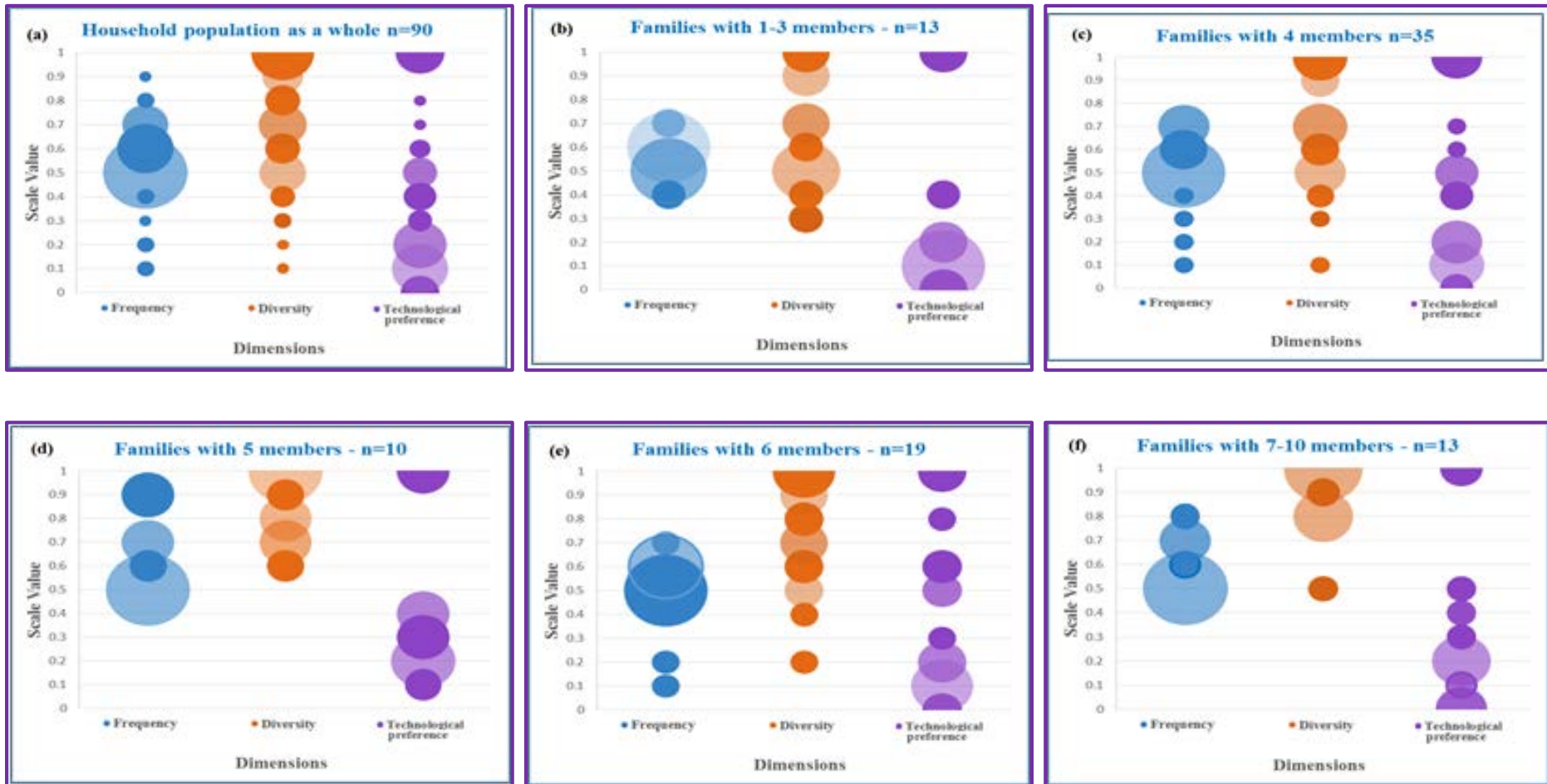
The average per capita water consumption (b) versus family sizes



Results: Analysis on bathing and showering



Results: Analysis on clothes-washing



Discussion: How to improve water use habits and switch to a water conservation mode?

- Changing human habits is a long process (Lally et al., 2010) it needs time and resources to build new habits, whereas, water scarcity is a current and existing concern in India; we need both:
 - Long term plans
 - community capacity building (CCB) or educating people
 - Short term plans
 - Applying water saving devices and microcomponents
 - Rather expensive in many places



Conclusion

- The per capita consumption varies considerably with household type and size.
- Water used in bathing/showering represented the highest proportion of water consumption in both stand-alone houses and apartments.
- Family size and income were also found to be important indicators in estimating household water consumption.
- Small families have higher water consumption in general.
- Water consumption rates for clothes-washing indicated that, on average, flat residents consume more water for clothes-washing in the households than people living in stand-alone houses.
- Water used in clothes-washing can be reduced by using/filling washing machines.
- The findings of this study draw the conclusion that although changing water use habits of any city dwellers is a long and complex process, it would substantially reduce the household water consumption.



References

- GR, Water – The India Story, Grail Research. 2009.
- Lally, P., Van Jaarsveld, C. H., Potts, H. W., and Wardle, J., How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, 2010; 40(6), 998-1009.
- Lazarova, V., Levine, B., Sack, J., Cirelli, G., Jeffrey, P., Muntau, H., and Brissaud, F. Role of water reuse for enhancing integrated water management in Europe and Mediterranean countries. *Water Science and Technology*, 2001; 43(10), 25-33.
- UNICEF. Water in India: situation and prospects. UNICEF, 2013; India Country Office, New Delhi, India
- UNPFA. State of world population 2011. United Nations Population Fund, 2011; New York, USA, ISBN 978-0-89714-990-7.



Thank you

Contact:

Fayyaz A. Memon: f.a.memon@exeter.ac.uk

Seyed M. K. Sadr: s.m.k.sadr@Exeter.ac.uk