

RESEARCH *PROTOCOL*

RESEARCH PROTOCOL (BASED ON TEMPLATE PRISMA 2015)

Administrative information

Working title	Millenium Development Goal Target 7c on Water and Sanitation: A Systematic Literature Review
Place of publication	www.eurlibrary.nl
Authors	Johanna Weststrate, e-mail: weststrate@fsw.eur.nl , Department of Public Administration, Erasmus University Rotterdam, Mandeville Building - Room T17 -12, P.O box 1738, Rotterdam, the Netherlands Geske Dijkstra, Department of Public Administration, Erasmus University Rotterdam, Rotterdam, the Netherlands Jasper Eshuis, Department of Public Administration, Erasmus University Rotterdam, Rotterdam, the Netherlands Alberto Gianoli, Institute for Housing and Urban Development Studies, Erasmus University Rotterdam, Rotterdam, the Netherlands Maria Rusca, Department of Geography, King's College London, London, United Kingdom
Amendments	Important protocol amendments will be documented and reported (see later amendments).
Support	The research presented here was funded by the Institute for Housing and Urban Development Studies (IHS). This article was written in the context of the IHS research programme 'Dealing with Urbanisation Challenges'.

Introduction

Rationale	A total of 189 countries subscribed to the Millenium Development Goals, running from 2002 to 2015. Their Target 7c aimed to halve the number of people without sustainable access to safe water and basic sanitation, including hygiene. The Millenium Development Goals guided water and sanitation data that are collected worldwide. The goals influence national policies, donor funding strategies (Cotton and Bartram 2008; Bain et al. 2012) and service delivery to a large part of the world population. There are many academic contributions criticising MDG 7c, but knowledge is scattered. We intend to present an overview of the strengths and weaknesses of MDG 7c.
Objective	The MDGs were succeeded by the Sustainable Development Goals (SDGs) for the 2016-2030 period, including a self-standing goal, SDG 6, regarding access to water and sanitation. It is our objective to contribute to the debate on the operationalisation of this sustainable Development Goal on water and sanitation (SDG 6).

Methods

Eligibility criteria	We will include papers that are based on quantitative and qualitative data to avoid a predisposition towards a positivist or interpretive research approach. We
----------------------	---

will exclude articles that focus primarily on other MDG targets or on entirely different subject areas, such as armed conflict, green building strategies or rural livelihoods.

Information sources	We will use two academic databases: ISI Web of Science and Scopus. Our search will be limited to the social sciences domain, our field of expertise. Web of Science and Scopus provide good coverage of journals in the Social Sciences. The search will include studies published during the MDG campaign (2002-2015) and shortly after.
Search strategy	Water OR sanitation AND "Millennium Development Goals" OR "Sustainable Development Goals" OR "Joint Monitoring Programme". To secure scientific quality, we will include peer reviewed academic articles only, in the English language.
Study records	The search results will be imported into Microsoft Excel. We will use Atlas Ti to categorise the records and identify main themes.
Selection process	We will include articles in English with a focus on MDG 7c and the Joint Monitoring Programme and articles focusing on SDG 6, departing from the shortcomings of MDG 7c.
Data collection process	The main investigator/author will select the studies guided by criteria for inclusion and exclusion. The selection process will be double-checked by two co-authors.
Outcomes and prioritisation	After filtering the articles using criteria for inclusion and exclusion, we will analyse the sample using conventional content analysis (Hsieh and Shannon 2005). The core themes will be derived and agreed on by the main investigator and co-authors.
Risk of bias in individual studies	To limit the risk of bias in individual studies, we will look for evidence from multiple studies. We will include papers based on quantitative and qualitative data to avoid a predisposition towards a positivist or interpretive research approach.
Data synthesis	We will document the data synthesis in a supplement. Themes will be identified on the basis of key words. Within each theme, we will look for recurring qualitative and quantitative evidence for the strengths and weaknesses of MDG 7c.

Later amendments to the project

We made no major amendments to the research protocol but only three minor amendments to the last stage of the review, namely the data synthesis. Firstly, we decided to focus only on the weaknesses/critique on MDG 7c instead of also analysing strengths, as this critique was vital for the operationalisation of SDG 6. Secondly, we used the research outcomes to analyse SDG 6 targets and indicators and provide concrete recommendations. And finally, in line with the first and second amendment, we changed the title of the systematic literature review to: 'Sustainable Development Goal 6: Learning from the Millenium Development Goals'.

SUPPLEMENT
SYSTEMATIC
LITERATURE
REVIEW

INDEX

SCREENING THE SEARCH RESULTS

PAGE 3 - 9

CODING IN ATLAS TI

PAGE 10 - 15

ANALYSIS

PAGE 16 - 53

SCREENING THE SEARCH RESULTS

In line with the PRISMA methodology we selected articles on the basis of criteria for inclusion and exclusion. The researcher formulates and applies criteria for inclusion and exclusion to the publications found in databases. These criteria are first applied to the titles, subsequently to the abstracts and, last, the entire article. This screening process results in a sample. The sample is then analysed quantitatively and/or qualitatively, depending on the research question.

= Included / = Excluded

	Title	Abstract	Article
[Anonymous]. (1994). State department leader describes new U.S. commitment to women's rights. <i>ICPD 94 : Newsletter of the International Conference on Population and Development</i> , (14), 3-3. Anonymous author	<input checked="" type="checkbox"/>		
Adams, E. A., Boateng, G. O., & Amoyaw, J. A. (2016). Socioeconomic and demographic predictors of potable water and sanitation access in Ghana. <i>Social Indicators Research</i> , 126(2), 673-687.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adjei, P. O., & Kyei, P. O. (2013). Linkages between income, housing quality and disease occurrence in rural Ghana. <i>Journal of Housing and the Built Environment</i> , 28(1), 35-49.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adubofour, K., Obiri-Danso, K., & Quansah, C. (2013). Sanitation survey of two urban slum Muslim communities in the Kumasi metropolis, Ghana. <i>Environment and Urbanization</i> , 25(1), 189-207.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Agénor, P. -, Bayraktar, N., Moreira, E. P., & El Aynaoui, K. (2006). Achieving the Millennium Development Goals in Sub-Saharan Africa: A macroeconomic monitoring framework. <i>World Economy</i> , 29(11), 1519-1547. Excluded on criteria: Focus on MDG 7c or JMP. This article is building a model to assess whether countries have achieved the MDGs. Safe water is an indicator, but the authors touch upon the indicator safe very briefly and without any reflection or criticism.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Aguilar, M. D., & de Fuentes, A. G. (2007). Barriers to achieving the water and sanitation-related Millennium Development Goals in Cancún, Mexico at the beginning of the twenty-first century. <i>Environment and Urbanization</i> , 19(1), 243-260.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Anand, P. B. (2007). Right to water and access to water: An assessment. <i>Journal of International Development</i> , 19(4), 511-526.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Anand, P. B. (2007). Semantics of success or pragmatics of progress?: An assessment of India's progress with drinking water supply. <i>Journal of Environment and Development</i> , 16(1), 32-57.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Arku, F. S., Angmor, E. N., & Seddoh, J. -. (2013). Toilet is not a dirty word: Close to meeting the MDGs for sanitation? <i>Development in Practice</i> , 23(2), 184-195.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Ayalew, M., Chenoweth, J., Malcolm, R., Mulugetta, Y., Okotto, L. G., & Pedley, S. (2014). Small independent water providers: Their position in the regulatory framework for the supply of water in Kenya and Ethiopia. <i>Journal of Environmental Law</i> , 26(1), 105-128.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bain, R. E. S., Gundry, S. W., Wright, J. A., Yang, H., Pedley, S., & Bartram, J. K. (2012). Accounting for water quality in monitoring access to safe drinking-water as part of the millennium development goals: Lessons from five countries. <i>Bulletin of the World Health Organization</i> , 90(3), 228-235.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Baquero, Ó. F., Jiménez, A., & Pérez-Foguet, A. (2015). Reporting progress on the human right to water and sanitation through JMP and GLAAS. <i>Journal of Water Sanitation and Hygiene for Development</i> , 5(2), 310-321.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bartram, J., Brocklehurst, C., Fisher, M. B., Luyendijk, R., Hossain, R., Wardlaw, T., et al. (2014). Global monitoring of water supply and sanitation: History, methods and future challenges. <i>International Journal of Environmental Research and Public Health</i> , 11(8), 8137-8165.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Baum, R., Luh, J., & Bartram, J. (2013). Sanitation: A global estimate of sewerage connections without treatment and the resulting impact on MDG progress. <i>Environmental Science & Technology</i> , 47(4), 1994-2000.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Benn, J. (2006). Aid flow. <i>OECD Observer</i> , (254), 19-20. Excluded on criteria: peer-reviewed journal	<input type="checkbox"/>		
Bennett, H. B., Shantz, A., Shin, G., Sampson, M. L., & Meschke, J. S. (2010). Characterisation of the water quality from open and rope-pump shallow wells in rural Cambodia. <i>Water Science and Technology</i> , 61(2), 473-479.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Börkey, P., & Gillespie, B. (2006). Safe water: A quality conundrum. <i>OECD Observer</i> , (254), 16-18. Excluded on criteria: peer-reviewed journal	<input type="checkbox"/>		
Bremner, J. (2010). Improved sanitation. <i>Population Bulletin</i> , 65(2), 10-11. Article not available	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Brown, J., Vo Thi Hien, McMahan, L., Jenkins, M. W., Thie, L., Liang, K., et al. (2013). Relative benefits of on-plot water supply over other improved' sources in rural Vietnam. <i>Tropical Medicine & International Health</i> , 18(1), 65-74.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Butala, N. M., VanRooyen, M. J., & Patel, R. B. (2010). Improved health outcomes in urban slums through infrastructure upgrading. <i>Social Science and Medicine</i> , 71(5), 935-940.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Butler, J. R. A., Suadnya, W., Puspadi, K., Sutaryono, Y., Wise, R. M., Skewes, T. D., et al. (2014). Framing the application of adaptation pathways for rural livelihoods and global change in Eastern Indonesian islands. <i>Global Environmental Change</i> , 28, 368-382. Excluded on criteria: Focus on MDG target 7c for water and/or sanitation, focus on climate change instead	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Castro, J. E. (2007). Poverty and citizenship: Sociological perspectives on water services and public-private participation. <i>Geoforum</i> , 38(5), 756-771.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Chandrasekhar, S., & Mukhopadhyay, A. (2012). Multiple dimensions of urban well-being: Evidence from India. <i>Asian Population Studies</i> , 8(2), 173-186.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cho, D. I., Ogwang, T., & Opio, C. (2010). Simplifying the Water Poverty Index. <i>Social Indicators Research</i> , 97(2), 257-267.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cotton, A., & Bartram, J. (2008). Sanitation: On- or off-track? Issues of monitoring sanitation and the role of the joint monitoring programme. <i>Waterlines</i> , 27(1), 12-29	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cuesta, J. (2007). Child malnutrition and the provision of water and sanitation in the Philippines. <i>Journal of the Asia Pacific Economy</i> , 12(2), 125-157. Excluded on criteria: MDG target water and/or sanitation, instead a focus on the target for nutrition. We have mentioned the link health and water and sanitation access in the introduction.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
De Gisi, S., Petta, L., & Wendland, C. (2014). History and technology of Terra Preta sanitation. <i>Sustainability (Switzerland)</i> , 6(3), 1328-1345.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Doherty, H. (2009). Vital signs. <i>World Watch</i> , 22(3), 31. Excluded on criteria: MDG target water and/or sanitation, instead a focus on child mortality	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Engel, S., & Susilo, A. (2014). Shaming and sanitation in Indonesia: A return to colonial public health practices? <i>Development and Change</i> , 45(1), 157-178.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Erni, M., Drechsel, P., Bader, H. -, Scheidegger, R., Zurbruegg, C., & Kipfer, R. (2010). Bad for the environment, good for the farmer? Urban sanitation and nutrient flows. <i>Irrigation and Drainage Systems</i> , 24(1-2), 113-125.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fein, R. (2012). Better housing as Millennium Development Goal - Examples from Addis Abeba. [Schöner wohnen als entwicklungsziel - Einschätzungen aus Addis Abeba] <i>Geographische Rundschau</i> , 64(11), 20-27. Excluded on criteria: in the English language, in German instead.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Fisher, K. T. (2008). Politics and urban water supply. <i>Development</i> , 51(1), 30-36.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flores Baquero, O., Jiménez Fdez. de Palencia, A., & Pérez Foguet, A. (2016). Measuring disparities in access to water based on the normative content of the human right. <i>Social Indicators Research</i> , 127(2), 741-759	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flörke, M., Kynast, E., Bärlund, I., Eisner, S., Wimmer, F., & Alcamo, J. (2013). Domestic and industrial water uses of the past 60 years as a mirror of socio-economic development: A global simulation study. <i>Global Environmental Change</i> , 23(1), 144-156.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Garriga, R. G., & Foguet, A. P. (2013). Water, sanitation, hygiene and rural poverty: Issues of sector monitoring and the role of aggregated indicators. <i>Water Policy</i> , 15(6), 1018-1045. Focus on MDG 7c or JMP, the article deals with local policy making	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gates, S., Hegre, H., Nygård, H. M., & Strand, H. (2012). Development consequences of armed conflict. <i>World Development</i> , 40(9), 1713-1722. Excluded on criteria: Focus on MDG 7c or JMP	<input type="checkbox"/>		
Ghosh, D. K. (2009). Millennium Development Goals and the role of Panchayats: Exploring through west Bengal Case. <i>Journal of Rural Development</i> , 28(3), 381-407.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gine-Garriga, R., Jimenez-Fernandez de Palencia, A., & Perez-Foguet, A. (2013). Water-sanitation-hygiene mapping: An improved approach for data collection at local level. <i>Science of the Total Environment</i> , 463, 700-711. Excluded on criteria: focus on MDG 7c or JMP, no reference to MDG 7c or JMP in abstract, only in the abbreviation section	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Glaser, G. (2012). Base Sustainable Development Goals on science. <i>Nature</i> , 491(7422), 35-35. Excluded on criteria: Article in peer reviewed journal, this is a research note	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Grobicki, A., MacLeod, F., & Pischke, F. (2015). Integrated policies and practices for flood and drought risk management. <i>Water Policy</i> , 17, 180-194. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Gunawardana, I. P. P., & Galagedara, L. W. (2013). A new approach to measure sanitation performance. <i>Journal of Water Sanitation and Hygiene for Development</i> , 3(2), 269-282.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Günther, I., & Fink, G. (2013). Saving a life-year and reaching MDG 4 with investments in water and sanitation: A cost-effective policy? <i>European Journal of Development Research</i> , 25(1), 129-153. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Gupta, J. (2015). Normative issues in global environmental governance: Connecting climate change, water and forests. <i>Journal of Agricultural & Environmental Ethics</i> , 28(3), 413-433. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Gutierrez, E. (2007). Delivering pro-poor water and sanitation services: The technical and political challenges in Malawi and Zambia. <i>Geoforum</i> , 38(5), 886-900.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Hadipuro, W. (2007). Water supply vulnerability assessment for sustainable livelihood. <i>Journal of Environmental Assessment Policy and Management</i> , 9(1), 121-135.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Holden, P. (2016). The Mediterranean and the Global Sustainable Development goals. <i>Mediterranean Politics</i> , 21(2), 292-299. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Hossain, K. Z., & Ahmed, S. A. (2015). Non-conventional public-private partnerships for water supply to urban slums. <i>Urban Water Journal</i> , 12(7), 570-580.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Hossain, M. S., Johnson, F. A., Dearing, J. A., & Eigenbrod, F. (2016). Recent trends of human wellbeing in the Bangladesh delta. <i>Environmental Development</i> , 17, 21-32.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Hsu, A. (2015). Measuring policy analytical capacity for the environment: A case for engaging new actors. <i>Policy and Society</i> , 34(3-4), 197-208. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Itama, E., Olaseha, I. O., & Sridhar, M. K. C. (2007). Springs as supplementary potable water supplies for inner city populations: A study from Ibadan, Nigeria. <i>Urban Water Journal</i> , 4(1), 19-27.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Jordanova, T., Cronk, R., Obando, W., Zeledon Medina, O., Kinoshita, R., & Bartram, J. (2015). Water, sanitation, and hygiene in schools in low socio-economic regions in Nicaragua: A cross-sectional survey. <i>International Journal of Environmental Research and Public Health</i> , 12(6), 6197-6217.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kassim, S. M., & Ali, M. (2006). Solid waste collection by the private sector: Households' perspective-findings from a study in Dar es Salaam city, Tanzania. <i>Habitat International</i> , 30(4), 769-780. Excluded on criteria: Focus on MDG target 7c or JMP, focus on solid waste instead	<input type="checkbox"/>		
Kite, G., Manuel Roche, J., & Wise, L. (2014). Leaving no one behind under the post-2015 framework: Incentivizing equitable progress through data disaggregation and interim targets. <i>Development (Basingstoke)</i> , 57(3-4), 376-387.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Koff, H., & Maganda, C. (2016). The EU and the Human Right to Water and Sanitation: Normative coherence as the key to transformative development. <i>European Journal of Development Research</i> , 28(1), 91-110.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Konak, N., & Sungu-Eryilmaz, Y. (2016). Does small run-of-river hydro power development in Turkey deliver on its sustainability premise? <i>Society & Natural Resources</i> , 29(7), 807-821. Excluded on criteria: Focus on MDG target 7c or JMP, focus on hydropower (energy)	<input type="checkbox"/>		
Laré-Dondarini, A. L. (2015). Analysis of household demand for improved sanitation: The case of green latrines in Dapaong city in northern Togo. <i>Canadian Journal of Development Studies</i> , 36(4), 555-572.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Larson, B., Minten, B., & Razafindralambo, R. (2006). Unravelling the linkages between the Millennium Development Goals for poverty, education, access to water and household water use in developing countries: Evidence from Madagascar. <i>Journal of Development Studies</i> , 42(1), 22-40.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Larsson, N. (2004). Green building strategies, policies and tools: The Canadian experience. <i>International Journal for Housing Science and its Applications</i> , 28(4), 323-345. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Lee, Y., 이정석, & 흥용석. (2015). Sustainable Development Goals and official development assistance: Focusing on the water & sanitation sectors. <i>Journal of Environmental Policy and Administration</i> , 23(2), 1-20. Excluded on criteria: In the English language, in Korean	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Levänen, J., Hossain, M., Lyytinen, T., Hyvärinen, A., Numminen, S., & Halme, M. (2016). Implications of frugal innovations on sustainable development: Evaluating water and energy innovations. <i>Sustainability (Switzerland)</i> , 8(1), 1-17. Excluded on criteria: Focus on MDG target 7c and/or JMP. The authors focus on sustainable development instead, without reference to MDG 7c.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lomoy, J. (2013). Towards new global development goals. <i>OECD Observer</i> , (296), 19-21. Excluded on criteria: peer reviewed journal	<input type="checkbox"/>		
Malik, O. A., Hsu, A., Johnson, L. A., & de Sherbinin, A. (2015). A global indicator of wastewater treatment to inform the Sustainable Development Goals (SDGs). <i>Environmental Science and Policy</i> , 48, 172-185.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Martínez, J., Mboup, G., Sliuzas, R., & Stein, A. (2008). Trends in urban and slum indicators across developing world cities, 1990-2003. <i>Habitat International</i> , 32(1), 86-108.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Montanarella, L., & Panagos, P. (2015). Policy relevance of critical zone science. <i>Land use Policy</i> , 49, 86-91. Excluded on criteria: Focus on MDG target 7c and/or JMP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Ndulu, B. J. (2006). Infrastructure, regional integration and growth in Sub-Saharan Africa: Dealing with the disadvantages of geography and sovereign fragmentation. <i>Journal of African Economies</i> , 15, 212-244.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Okurut, K., Kulabako, R. N., Abbott, P., Adogo, J. M., Chenoweth, J., Pedley, S., et al. (2015). Access to improved sanitation facilities in low-income informal settlements of East African cities. <i>Journal of Water Sanitation and Hygiene for Development</i> , 5(1), 89-99.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Onda, K., LoBuglio, J., & Bartram, J. (2012). Global access to safe water: Accounting for water quality and the resulting impact on MDG progress. <i>International Journal of Environmental Research and Public Health</i> , 9(3), 880-894.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
O'Reilly, K. (2010). Combining sanitation and women's participation in water supply: An example from Rajasthan. <i>Development in Practice</i> , 20(1), 45-56.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patil, S. R., Arnold, B. F., Salvatore, A. L., Briceno, B., Ganguly, S., Colford, J. M., Jr., et al. (2014). The effect of India's Total Sanitation Campaign on defecation behaviors and child health in rural Madhya pradesh: A cluster randomized controlled trial. <i>Plos Medicine</i> , 11(8), e1001709. Excluded on criteria: focus on MDG 7c and/or JMP	<input type="checkbox"/>		
Peneva, D., & Ram, R. (2012). Trade policy and human development: A cross-country perspective. <i>International Journal of Social Economics</i> , 40(1), 51-67. Excluded on criteria: Focus on MDG 7c and/or JMP	<input type="checkbox"/>		
Pérez-Suárez, R., & López-Menéndez, A. J. (2015). Growing green? forecasting CO2 emissions with environmental kuznets curves and logistic growth models. <i>Environmental Science and Policy</i> , 54, 428-437. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Rajaraman, I., & Gupta, M. (2016). Preserving the incentive properties of statutory grants. <i>Economic and Political Weekly</i> , 51(9), 79-84.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Rasul, G. (2016). Managing the food, water, and energy nexus for achieving the Sustainable Development Goals in South Asia. <i>Environmental Development</i> , 18, 14-25. Excluded on criteria: Focus on MDG 7c or JMP's methods	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Richter, K., Benjamin, A. E., & Punpuing, S. (2009). Population and environment in Asia and the Pacific: Trends, implications and prospects or sustainable development. <i>Asia-Pacific Population Journal</i> , 24(1), 35-64+5. Not available.	<input type="checkbox"/>		

Rouse, M. (2014). The worldwide urban water and wastewater infrastructure challenge. <i>International Journal of Water Resources Development</i> , 30(1), 20-27.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Santos, M. E. (2013). Tracking poverty reduction in Bhutan: Income deprivation alongside deprivation in other sources of happiness. <i>Social Indicators Research</i> , 112(2), 259-290.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sanusi, Y. A. (2010). Water, sanitation and human development in urban fringe settlements in Nigeria. <i>Theoretical and Empirical Researches in Urban Management</i> , 8(8), 14-29.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Satterthwaite, D. (2016). Missing the Millennium Development Goal targets for water and sanitation in urban areas. <i>Environment and Urbanization</i> , 28(1), 99-118.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Satterthwaite, M. (2014). On rights-based partnerships to measure progress in water and sanitation. <i>Science and Engineering Ethics</i> , 20(4), 877-884.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Schaub-Jones, D. (2010). Should we view sanitation as just another business? the crucial role of sanitation entrepreneurship and the need for outside engagement. <i>Enterprise Development and Microfinance</i> , 21(3), 185-204.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Serrano, J. D. (2010). Access to water and sanitation in Veracruz: A local and institutional capabilities issue. [El acceso al agua y saneamiento: Un problema de capacidad institucional local análisis en el estado de Veracruz. <i>Gestión y Política Pública</i> , 19(2), 311-350. Excluded on criteria: In the English language, only available in Spanish	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Shelus, V., & Hernandez, O. L. (2015). The usefulness of a handwashing Indicator in large household surveys. <i>Journal of Water Sanitation and Hygiene for Development</i> , 5(4), 565-573.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sheuya, S. A. (2009). Urban poverty and housing transformations in informal settlements: The case of Dar-es-Salaam, Tanzania. <i>International Development Planning Review</i> , 31(1), 81-108. Excluded on criteria: Focus on MDG 7c and/or JMP's methods, focus on the effects of housing transformations on urban poverty	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Smith, L. C., & Haddad, L. (2015). Reducing child undernutrition: Past drivers and priorities for the post-MDG era. <i>World Development</i> , 68(1), 180-204. Excluded on criteria: Focus on MDG target 7c or JMP, focus is child nutrition instead	<input type="checkbox"/>		
Snehalatha, M., & Anitha, V. (2012). India's Total Sanitation Campaign: Is it on the right track? Progress and issues of TSC in Andhra Pradesh. <i>Journal of Rural Development</i> , 31(2), 173-192.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sorenson, S. B., Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. <i>Social Science and Medicine</i> , 72(9), 1522-1526.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sperling, J., Romero-Lankao, P., & Beig, G. (2016). Exploring citizen infrastructure and environmental priorities in Mumbai, india. <i>Environmental Science and Policy</i> , 60, 19-27. Excluded on criteria: Focus on MDG target 7c or JMP, focus only on SDGs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Srinivasan, U. T., Cheung, W. W. L., Watson, R., & Sumaila, U. R. (2010). Food security implications of global marine catch losses due to overfishing. <i>Journal of Bioeconomics</i> , 12(3), 183-200. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Townsend, J. (2008). The Brazilian Amazon and the UN millennium goals. <i>Geography Review</i> , 22(1), 32-33. Excluded on criteria: article, this is a piece of two pages	<input type="checkbox"/>		
Tukahirwa, J. T., Mol, A. P. J., & Oosterveer, P. (2013). Comparing urban sanitation and solid waste management in East African metropolises: The role of civil society organizations. <i>Cities</i> , 30(1), 204-211.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Tyler, M. -, & Quinn, M. (2010). A social-spatial approach to ecological governance. <i>International Journal of Interdisciplinary Social Sciences</i> , 5(6), 73-86. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Uduku, O. (2015). Designing schools for quality: An international, case study-based review. <i>International Journal of Educational Development</i> , 44, 56-64. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Van den Broek, M., & Brown, J. (2015). Blueprint for breakdown? Community based management of rural groundwater in Uganda. <i>Geoforum</i> , 67, 51-63.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Van Vuuren, D. P., Kok, M., Lucas, P. L., Prins, A. G., Alkemade, R., van den Berg, M., et al. (2015). Pathways to achieve a set of ambitious global sustainability objectives by 2050: Explorations using the IMAGE integrated assessment model. <i>Technological Forecasting and Social Change</i> , 98, 303-323. Excluded on criteria: Focus on MDG 7c or JMP's methods	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Welle, K. (2014). Monitoring performance or performing monitoring? exploring the power and political dynamics underlying monitoring the MDG for rural water in Ethiopia. <i>Canadian Journal of Development Studies</i> , 35(1), 155-169.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Welle, K., Schaefer, F., Butterworth, J., & Bostoen, K. (2012). Enabling or disabling? Reflections on the Ethiopian national WASH inventory process. <i>IDS Bulletin</i> , 43(2), 44-50.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Wilbers, G. -, Sebesvari, Z., & Renaud, F. G. (2014). Piped-water supplies in rural areas of the Mekong delta, Vietnam: Water quality and household perceptions. <i>Water (Switzerland)</i> , 6(8), 2175-2194.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Woodhouse, P. (2011). 'Environmental sustainability', agricultural intensification and water resource development in Sub-Saharan Africa. ["Sostenibilidad ambiental", agricultura intensiva y desarrollo de los recursos hídricos en África Subsahariana. <i>Revista De Economia Mundial</i> , (27), 149-170. Excluded on criteria: Focus on MDG target 7c or JMP, focus on agriculture instead	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Wouters, P., & Tarlock, A. (2012). The third wave of normativity in global water law: The duty to cooperate in the peaceful management of the world's water resources: An emerging obligation erga omnes? <i>Journal of Water Law</i> , 23(2), 51-65. Excluded on criteria: Focus on MDG target 7c or JMP, focus only on SDGs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Zaki, S., & Amin, A. T. M. N. (2009). Does basic services privatisation benefit the urban poor? some evidence from water supply privatisation in Thailand. <i>Urban Studies</i> , 46(11), 2301-2327.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Zawahri, N., Sowers, J., & Weinthal, E. (2011). The politics of assessment: Water and sanitation MDGs in the Middle East. <i>Development and Change</i> , 42(5), 1153-1178.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Zheng, Y., Hakim, S. A. I., Nahar, Q., van Agthoven, A., & Flanagan, S. V. (2013). Sanitation coverage in Bangladesh since the millennium: Consistency matters. <i>Journal of Water Sanitation and Hygiene for Development</i> , 3(2), 240-251.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
강부식. (2010). Natural resources liaison package deal program of international cooperation for climate change adaptation. <i>Korean Review of Crisis and Emergency Management</i> , 6(4), 119-138. Excluded on criteria: In the English language	<input checked="" type="checkbox"/>		

CODING IN ATLAS TI

In Atlas Ti, we identified the main themes in the debate on MDG 7c through the analysis of keywords. We found four main themes/categories and a number of subcategories.

<i>Publication</i>	<i>Keywords</i>	<i>Categories</i>
Adams et al. (2016)	Socio-economic dimensions - Socio-economic and demographic factors associated with access to potable water and improved sanitation facilities in Ghana	Inequality; national
Adjei and Kyei (2013)	Poverty, environment and health - Housing poverty and poor sanitation on health conditions in rural Ghana - reduced urban poverty - increased rural poverty	Inequality; national
Abudofour et al. (2013)	Sustainable access to safe drinking water and sanitation - Provision of these services by city authorities is often absent in slum settlements - field survey in two urban slums - Kumasi, Ghana	Inequality; urban
Aguilar and Fuentes (2007)	Barriers - Cancún, Mexico - safe water and improved sanitation services - political - different zones - urbanized areas - informal areas - newer low-income squatter settlements - Dramatic differences between zones in the quality of provision of water and sanitation - social and economic development model - various institutional considerations - attitudes and behavior of social actors	Inequality; urban Political and administrative challenges
Anand (2007a)	Whether the poor are more likely to have access to water when there is a Right to Water - small sample of countries where the right to water has been promulgated - links between MDGs and Human Rights	Inequality; Human Right to Water and Sanitation
Anand (2007b)	India - micro-level evidence does not tally with the national picture of 'tremendous progress' – policy implications – institutional mapping - inequality, quality and affordability - access to the poor - inequality - water supply -	Inequality; national Political and administrative challenges
Arku (2013)	Urban slum in Ghana - sanitary conditions were deplorable - financial, religious and other factors - urban communities	Inequality; urban
Ayalew et al. (2014)	Small independent water vendors are the only water supply option in peri-urban neighbourhoods - lack of regulation - access to water for the poor – recognized – regulated - regulatory framework – legal frameworks	Inequality; urban Political and administrative challenges
Bain et al. (2012)	The appropriateness of some indicators currently used to monitor access to safe drinking water - safe - Joint Monitoring Programme - improved or unimproved - quality of the water source	Indicator for safe water
Baquero et al. (2015)	Human right to water and sanitation - JMP - JMP-led post-2015 proposal - Non-discrimination and equality, access to information and participation and accountability are crosscutting issues	Inequality; Human Right to Water and Sanitation
Bartram et al. (2014)	International monitoring of water and sanitation - strength and limitations of current approaches - access	Indicators for safe water and basic sanitation

	and progress - Joint Monitoring Programme - JMP methods	
Baum and Bartram (2013)	Estimate of sewerage connections without treatment - sanitation component of MDGs - improved sanitation - Joint Monitoring Programme - improved sanitation facility	Indicator for basic sanitation
Bennett et al. (2010)	Water quality - open and rope-pump shallow wells - classification as unimproved and improved - Joint Monitoring Programme	Indicator for safe water
Brown et al. (2013)	Relative benefits of on-plot water supply - 'improved sources' - drinking water quality - piped water systems - 'improved water sources' outside the home	Indicator for safe water
Butala et al. (2010)	Health outcomes - urban slums - upgrades in slum household water and sanitation systems - slum upgrading in Ahmadabad - waterborne illness incidence - help achieve MDGs	Inequality; urban
Castro (2007)	Private sector participation - provision of water and sanitation services - reducing water poverty - public sector failure - essential services to the poor - imbalance - market-centred governance	Political and administrative challenges Inequality; national
Chandrasekhar and Mukhopadhyay (2012)	Urban well-being - urban poor and slum dwellers - policies to improve water and sanitation in slums - slum and non-slum areas	Inequality; urban
Cho et al. (2010)	Simplified and cost - effective indexes of water poverty - basic needs approach - investments - policy makers - better water-related policies and strategies	Inequality; methods
Cotton and Bartram	Monitoring sanitation - role of the Joint Monitoring Programme - the way JMP operates - strength and limitations	Indicator for basic sanitation
De Gisi et al. (2014)	Terra Preta sanitation - new holistic concepts - economically feasible closed loop sanitation systems - expensive end-of-pipe solutions - urine diversion - even in house sanitation systems	Water resource management
Engel and Susilo (2014)	Indonesia - Community-Led Total Sanitation - social shaming - participation - combines grassroots empowerment and neoliberal self-help doctrine - NGO's and the World Bank	Political and administrative challenges
Erni et al. (2010)	Sanitation - highly polluted surface water - nutrient flows - Khumasi - box-flow model - investment in flushing toilet - dominance of on-site sanitation - reduce the nutrient loads - water shortages	Water resource management
Fisher (2008)	Public sector failure - private sector - private sector to participate in urban water supply - political nature of urban water supply - Tabilaran	Political and administrative challenges
Flores Baquero et al. (2016)	Disparities in access to water - Human right - methodology to measure intra-community disparities - adequate tools for equity oriented policy making	Inequality; Human Right to Water and Sanitation

Florke et al. (2013)	Domestic and industrial water uses - global water use assessment - WaterGAP 3 model - water withdrawals and consumption - water for cooling - treated and untreated wastewater - reduction of untreated wastewater -securing water supply - new water-saving technologies	Water resource management
Gine Garriga and Perez Foguet (2013)	Rural poverty - sector monitoring - role of aggregated indicators - neediest must be prioritized - compare three different monitoring and evaluation approaches - standards indicators of the Joint Monitoring Programme	Indicators for safe water and basic sanitation
Ghosh, D. K. (2009).	Role of the panchayats (local government in rural areas) – drinking water – sanitation – State Government – rural-urban bias – non-governmental organisations – government officials – different tiers of panchayats	Inequality; national Political and administrative challenges
Gunawardana and Galagedera (2013)	Approach to measure sanitation performance - Joint Monitoring Programme - sanitation ladder - new and more comprehensive methodology - sanitation index for monitoring (SIM)	Indicator for basic sanitation
Gutierrez (2007)	Pro-poor water and sanitation services - Malawi and Zambia - challenges - political - rearrangements of weak state support - poor sectoral coordination - fragmented donor efforts	Inequality; national Political and administrative challenges
Hadipuro (2007)	Water supply vulnerability assessment - which half should be prioritized - methodology on water supply vulnerability assessment - policy makers	Inequality; methods
Hossain and Ahmed (2015)	Public-private partnerships - urban slums - deplorable social-environmental conditions in slums - public utilities are usually reluctant - policy hurdles - six slums of Dhaka cities - unconventional PPPs	Inequality; urban Political and administrative challenges
Hossain et. al (2016)	Human wellbeing - five dimensions - sanitation coverage - Bangladesh delta	Inequality; national
Itama et al. (2007)	Potable water supplies - water quality - inner city populations - Ibadan, Nigeria - potable water - minimum treatment - cost effective	Indicator for safe water
Jardonova et al. (2015)	Water, sanitation and hygiene – schools - Nigaragua - targets and indicators - non-household settings - schools and health centres	Indicators for safe water and basic sanitation
Kite et al. (2014)	Leaving no-one behind - equitable progress - data disaggregation - focuses on further operationalizing a post-2015 monitoring system - access to water and sanitation - stepping stone equity targets	Inequality; methods
Koff and Maganda (2016)	EU and Human Right to Water and Sanitation - post-2015 agenda - normative coherence - Policy Coherence for Development	Inequality; Human Right to Water and Sanitation
Laré-Dondarini (2015)	Green latrines - Daopong city, Togo - alternative systems of sanitation - costs of access - low-cost autonomous sanitation systems - environmental problems - sewage treatment - free output (urine and faeces) - agriculture - socio-economic determinants to uptake of green latrines	Water resource management

Larson et al. (2006)	Linkages - Poverty, education, access to water and water use - Madagascar - strong links between MDGs - determinants for access to safe water	Inequality; national
Malik et al. (2015)	Global indicator of wastewater treatment - lack of consistent definitions - wastewater treatment data - managing wastewater	Indicator for basic sanitation Water resource management
Martinez et al. (2008)	Trends in urban and slum indicators - developing world cities - slum and non-slum populations - various slum indicators - access to safe water and basic sanitation - importance of slum improvements	Inequality; urban
Ndulu (2006)	Infrastructure - invest in infrastructure - basic infrastructure to the poor; e.g. electricity, clean water roads - public investment in infrastructure - autonomous regulatory bodies - joint management of users of these services - user pay principles - exploiting the pre-existing capacity of the private sector	Political and administrative challenges
O'Reilly (2010)	Women's participation - gendered approaches to sanitation coverage - latrine building and women's participation - gendered political intervention - Rajasthan, India	Inequality; gender
Okurut et al. (2015)	Improved sanitation facilities - low-income informal settlements - East-African cities - informal settlements - inadequate sanitation - Joint Monitoring Programme - improved sanitation -	Inequality; urban Indicator for basic sanitation
Onda et al. (2012)	Global access to safe water - water quality - impact on MDG progress - improved and unimproved as an indicator - water safety - WHO and UNICEF - Rapid assessment of drinking water quality - feacally contaminated - estimate	Indicator for safe water
Rajamaran and Gupta (2016)	Statutory grants - local governments - improved sanitation - public finance - local grants - direct statutory flows - central government of India - key public goods - sewerage - water supply	Political and administrative challenges
Rouse (2014)	Urban water and wastewater infrastructure challenge - universal access to water and sanitation - extension of existing infrastructure - clear policies on objectives, priorities and service standards - infrastructure costs	Political and administrative challenges
Santos (2013)	Poverty reduction - Bhutan - income deprivation - safe water - improved sanitation - 2007 Gross National Happiness Survey - multi-dimensional poverty - poverty - poor - poverty reduction	Inequality; national
Sanusi (2010)	Water - sanitation - urban fringe settlements - city of Minna, Nigeria - little attention in terms of water and sanitation provision - low human development - risk to the health - objectives of the paper are to investigate access to water and sanitation	Inequality; urban
Satterthwaite (2014)	Right to water and sanitation - debate over post-2015 targets and indicators - UN Joint Monitoring Programme	Inequality; Human Right to Water and Sanitation

	- targets on water and sanitation - post-2015 WASH targets and indicators must be animated by human rights principles - END group - equity, equality, and non-discrimination	
Satterthwaite (2016)	Millennium Development Goal targets for water and sanitation - urban areas - disastrous performance - sustainable access to safe drinking water - urban dwellers - definitions in use for water and sanitation access - Joint Monitoring Programme - 'improved' sources - 'improved' sanitation facilities - "slums"	Inequality; urban Indicators for safe water and basic sanitation Political and administrative challenges
Schaub-Jones (2010)	Sanitation entrepreneurship - outside engagement - role of the water utility - private sanitation providers - retailers - masons - public toilet operators - latrine emptying businesses - medium and lower income communities - largely private system - regulatory and supportive role of the public sector - local government	Political and administrative challenges
Shelus and Hernandez (2015)	Handwashing proxy - large household surveys - handwashing with soap - reducing diarrheal disease mortality in children under 5 - reliable proxy to track handwashing with soap - handwashing indicator	Indicator for basic sanitation
Snehalatha and Anitha (2012)	Total Sanitation Campaign - Government of India - targets - realistic - coverage and usage status - insufficient fund allocations - lack of effective strategies for demand creation - expenditure - Village Water and Sanitation Committees - public-private partnerships - non-government organisations - sanitation behaviour change	Political and administrative challenges
Sorenson et al. (2011)	Water fetching - access to safe water - great expense of time and energy - carrying water - especially women - measuring progress	Indicator for safe water Inequality; gender
Tukahirwa et al. (2013)	Urban sanitation - East African Metropolises - civil society organisations - Community Based Organisations - Non-Governmental Organisations - extent and success - urban sanitation and solid waste management for the poor - the capitals of Kenya, Tanzania and Uganda - role of civil society institutions	Political and administrative challenges Inequality; urban
Van den Broek and Brown (2015)	Community-Based-Management - donors and governments - universal access to clean water - a third of hand pumps is non-functional - mid-west Uganda - maintenance funds and management failings - CBM model - uneasy coalition - neoliberal inspired commodification - theory of collective action - disappointing outcomes	Political and administrative challenges
Welle (2012)	Existing efforts to measure access to water supply, sanitation and hygiene services - sector monitoring - National WASH Inventory in Ethiopia - why so often costly - human resource intensive - remain underutilised	Political and administrative challenges Indicators for safe water and basic sanitation
Welle (2014)	Monitoring performance - performance monitoring - power and political dynamics - monitoring the MDG for rural water	Political and administrative challenges Indicator for safe water

Wilbers et al. (2014)	Piped water supplies - rural areas of the Mekong Delta, Vietnam - MDG to provide clean drinking water resources to communities - effectiveness of supply stations - water samples - reliable drinking water source - maintenance and distribution of water supply stations - reliable drinking water source	Indicator for safe water
Zaki and Amin (2009)	Basic services privatisation - benefit urban poor - access to safe water and sanitation - privatisation of water supply - intense debate - household level data for the poor - community and income status - significant improvement - informal settlements	Political and administrative challenges Inequality; urban
Zawahri et al. (2011)	Politics of assessment - Water and Sanitation MDGs - Middle East - Joint Monitoring Programme - assessment methodologies by JMP - overstate coverage rates - problems of access, affordability, quality of service and pollution - glaring gap between MDG statistics - national and local reports - exclusionary political regimes - international organisations - proposed reforms - incentives	Political and administrative challenges Indicators for safe water and basic sanitation
Zheng et al. 2013	Sanitation coverage - Bangladesh - household surveys - Joint Monitoring Programme 2008 definition - improved latrines - poverty reduction programmes - equity	Indicator for basic sanitation Inequality; national

Overview categories

Category	Subcategory	Number of studies
Indicator for safe water and basic sanitation	Indicator for safe water	8
	Indicator for basic sanitation	7
	Indicator for safe water and basic sanitation	6
		21
Water resource management		5
Inequality	Urban inequality	13
	National inequality	10
	Gender	2
	Methods to measure inequality	3
	Human Right to Water and Sanitation	5
		32
Political and administrative challenges		21

Table 1. Categories and subcategories

ANALYSIS

Below, we analysed the selected articles in terms of main theme/category, subcategory, research design and outcomes. The articles have been placed in alphabetical order.

A

Adams, E. A., Boateng, G. O., & Amoyaw, J. A. (2016). Socioeconomic and demographic predictors of potable water and sanitation access in Ghana. *Social Indicators Research*, 126(2), 673-687.

Category 1 Inequality Subcategory 1 National
Method(s) Statistical analysis of secondary sources

Many countries in Sub Saharan Africa have barely achieved the MDG goal of halving the number of people without access to improved drinking water. This study aims to offer insight into the socio-economic predictors of potable water and sanitation access in Ghana. The authors use the 2008 Ghana Demographic and Health Survey, including 4916 women and 4769 men, selected from enumeration areas. The dependent variables used for this study are 'improved/unimproved source of drinking water', 'improved/unimproved sanitation facilities' and 'time to water source in minutes'. The independent variables used were: wealth, education, number of household members, marital status, and gender of household head, region, and place of residence. The wealth variable is a composite indicator including ownership of materials such as television, bicycle, land, access to electricity, and type of toilet facility.

Income, education, household size, and region are significant predictors of improved water and sanitation access, according to the authors. Respondents with secondary education were 1.41 times more likely to have access to an improved source of water compared to those with no education. Those with secondary and tertiary education were 2.15 times and 2.81 times more likely to have access to improved sanitation facilities. Household wealth is a key factor influencing time to access of improved water source.

Quote

Despite substantial gains in improved drinking water facilities, notably in the last decade or so, many countries in Sub-Saharan Africa have barely achieved their Millennium Development Goal target of halving the number of people without access to improved drinking water. Over 64 % of households in the region do not have access to basic sanitation and 42 % lack safe drinking water (Waldman et al. 2013; WHO 2013). Existing water infrastructure can barely keep up with demands from spiraling populations. Drinking water sources, while already inadequate, are also subject to increasing threat of contamination. Only a third of the region's population has access to household piped-water connections (Seager 2010), forcing many to use contaminated water sources (Akpfe et al. 2011; Gleick 2014). Women and female children are often the most affected as they have to walk considerable distances in search of water.' p674.

Adjei, P. O., & Kyei, P. O. (2013). Linkages between income, housing quality and disease occurrence in rural Ghana. *Journal of Housing and the Built Environment*, 28(1), 35-49.

Category 1 Inequality Subcategory 1 National
Method(s) Multiple methods

In light of MDG 7, there is a need to examine the built environment in the rural areas, to inform policy and practices and move forward toward sustainability in these areas. According to the authors, the government's attention is on reducing poverty in the urban centres. As a result, poverty is rising in the rural areas. A survey is conducted in the rural Amansie West District of Southern Ghana, including 306 households. Households were selected with simple random and stratified sampling techniques. Random sampling was employed to select one rural community from 9 out of 12 zones of the district, for a total of 9 study areas.

The analysis following the survey focussed on the link between income, housing quality and disease occurrence in rural Ghana. Data on households' income levels and the most prevalent diseases among households were analysed separately using descriptive statistical tools such as frequency, cross-tabulation and percentage charts. In addition, interviews, 18 focus group discussions and participant observation were conducted to triangulate survey results. The focus groups consisted of male and female heads of household, discussing their perception of poverty and how this influenced health in the study area.

About 48.5 % of the households with a very high average monthly income ([GH ₵100) lived in very good houses. 1.0 % of the households with a very low average monthly income (\GH ₵20) lived in good houses. The study reveals a high incidence of malaria, skin diseases and diarrheal diseases among the children of low-income households, living in precarious housing. The authors conclude that improving housing and sanitation access in rural areas reduces poverty and diseases and should as such be prioritised to reach the MDGs.

Quote

'Poor sanitation is a major contributor to declining health in rural communities in the Amansie West District and the underpinning cause of poor sanitation is usually poverty. The nature of the built environment was found to play a significant role, alongside housing, in the spread of disease within these rural communities.'
p44.

Adubofour, K., Obiri-Danso, K., & Quansah, C. (2013). Sanitation survey of two urban slum muslim communities in the Kumasi metropolis, Ghana. *Environment and Urbanization*, 25(1), 189-207.

Category 1 Inequality Subcategory 1 Urban
Method(s) Multiple methods

This paper provides an assessment of access to improved water and sanitation in two urban slums Aboabo and Asawase in the Asawase constituency of Kumasi, Ghana in 2009. The assessment is conducted to determine the extent of 'improved' water and sanitation coverage as defined by the WHO/UNICEF Joint Monitoring Program. The authors use multiple methods: household surveys, key informant interviews, transect walks and mapping of water and sanitation facilities. The household survey includes 331 households in Aboabo and 457 in Asawase. The households were selected at random out of a total of 6,626 and 9,144 households. In addition, 33 informant interviews were conducted.

A high percentage of the population and Asawasa is connected to the piped water network, in the form of standpipes: 80% in Aboabo and 86% in Asawase. Illegal connections are common. Total improved water coverage from pipe-borne water and protected well sources is 94% and 92% for Aboabo and Asawase, respectively. As the standpipes do not provide water continuously, people rely on alternative sources such as well water and water tankers at a much higher price. 6% of the households in Aboaba and 7.9% in Asawasa rely on unimproved water sources. 58.3% of the population in Abuabo and 58% in Asawase use public toilet facilities or resort to open defecation. The rest of the population uses on site sanitation: simple pit latrine 26.6/28.2%, flush to septic tank latrine 11.8/6.1, ventilated improved pit 3.3/6.8%, bucket or pan latrine 0/1,5% and total improved latrine 6.9/2.8%.

Quote

'Although the two communities have been relatively well catered for in the provision of improved water supply, there is an extremely low level of provision for improved sanitation. Few of the households have private toilet facilities, and most of those are shared between two or more households. The only provision available to 58 per cent of the population is the few heavily patronized public toilets, which are poorly maintained. Since these do not come close to meeting demand, there are high levels of open defecation and use of flying toilets, as well as

indiscriminate disposal of children's faeces in gutters, on open plots and in nearby bushes, thus contaminating the two communities' environments with fecal matter.' p15-16.

Aguilar, M. D., & de Fuentes, A. G. (2007). Barriers to achieving the water and sanitation-related Millennium Development Goals in Cancún, Mexico at the beginning of the twenty-first century. *Environment and Urbanization*, 19(1), 243-260.

Category 1 Inequality Subcategory 1 Urban
Category 2 Political and administrative challenges
Method(s) Multiple methods

This case study identifies the barriers faced by the city of Cancún, Mexico, to making progress towards Millennium Development Goal targets on increasing safe water and basic sanitation coverage. The authors analyse socioeconomic, demographic, environmental and land use dimensions surrounding access to safe water and improved sanitation services in within six zones in Cancún, Mexico. The study relies on a review of specialized literature and in-depth interviews with actors in Cancún. The six areas selected by the scholars are: the hotel zone, mainland city centre, informal settlements undergoing urbanization, informal settlements that are fully or almost fully urbanized, recent low-income squatter settlements on the urban periphery and recent low-income squatter settlements in outlying peri-urban areas. Data was verified during field visits and processed through a geographical information system using census units as the basis for population density, coverage of piped water supply systems, volume of piped water supplied, volume of piped water consumed and losses from unaccounted-for water, volume of wastewater produced, coverage of wastewater collection and treatment systems production of sewage sludge, urban water quality and social actors involved in the use and management of drinking water

The relatively wealthy hotel and the city centre is served by a drinking water network and sewage network. The hotel area has continuous access to water while the city centre has access for a few hours a day. Operation of the sewage network is (only) subsidized in the hotel area. Although the informal areas outside the city centre, occupied between 1975 and 1995, have improved over time in terms of land tenure and drinking water provision, there is no sewage network in these neighbourhoods. The so-called low income squatter settlements in the peri-urban areas and periphery, built up over the last ten years, are the worst off in terms of services; there is no drinking water nor sewage network. Residents depend on wells and water provided by tankers. The municipality is supplying some of the water delivered by tankers free of charge. The additional amount needed, is provided by the same tankers at a price ten times as high as the price of water supplied through the public network. In terms of sanitation, open defecation and mostly unlined pit latrines are the available options. Lack of adequate sanitation in informal settlements leads to groundwater contamination and environmental degradation. Groundwater is the main drinking water source in the city. The barriers to sustainable development in Cancún are summarised as follows: (a) the socio-economic disparity and inequity produced by market forces, which is reinforced by government policies. In this way, the touristic and the wealthier areas of the city are supplied with subsidized services and have free access to resources, while the poorest neighbourhoods have either inadequate, improvised or disproportionately expensive basic services, or no access to services whatsoever; (b) the failure, for political and economic reasons, to enforce the State Drinking Water and Sanitation Law; and (c) the lack of concern shown by social actors to aquifer contamination.

Quote

Furthermore, inadequate wastewater disposal in the urbanizing and urbanized settlements, which can potentially cause serious groundwater contamination, is a significant barrier to sustainable development in both the municipality of Benito Juárez (where Cancún is located) as well as the neighbouring municipality of Isla Mujeres. Groundwater contamination could affect the current sources of drinking water supply of both

municipalities, pose risks to public health, and also pollute tourist attractions (beaches, lagoons and sea), which form the basis of economic development in the area.'

Anand, P. B. (2007). Right to water and access to water: An assessment. *Journal of International Development*, 19(4), 511-526.

Category 1 Inequality Subcategory Human right
Method(s) Statistical analysis of secondary sources

Do countries recognizing the Human Right to Water have a higher level of access compared to countries who do not? Will recognizing the Human Right to water accelerate progress towards MDG 7c? The author examined the relation between right to water and access to water, by doing a longitudinal study (from 1990-2004) in four 'Right to Water' countries (Uganda, Ethiopia, Gambia, Tanzania South Africa) and five countries (China, India, Namibia, Eritrea, Guinea) that did not recognize this right. The analysis is based on JMP data. In addition, the author used the World Bank 'Governance Matters V' database to assess how these countries scored on the following indicators: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

There is a relationship between how a country scored on the World Bank governance indicators and access to water. Countries scoring high in terms of voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption, increased access to water. Formally recognizing the Human Right to Water seemed to have no impact on access to water. In Namibia, Eritrea and Tanzania access to water increased without recognizing the Right to Water.

Quote

'This analysis suggests that mechanisms of governance may be more important in improving access to water than a formal articulation of a right to water.'

Anand, P. B. (2007). Semantics of success or pragmatics of progress? : An assessment of India's progress with drinking water supply. *Journal of Environment and Development*, 16(1), 32-57.

Category 1 Inequality Subcategory 1 National
Category 2 Political and administrative challenges
Category 3 Indicator for safe water and basic sanitation Subcategory 3 Indicator for safe water
Method(s) Literature review

At macro level, figures indicate that India has made progress toward MDG 7c in terms of access to water. However, there seems to be increased tensions related to water resources at local level. The research looks further into this topic and is based on a document review. A brief institutional and policy analysis at national level is followed by a case study of the city Chennai. The author includes data on Chennai from his 2001 study.

The 'success story' of India is based on a loose definition of water access. The definition is based on 'improved' water sources within a distance of 1.6 km, leading to positive trends at national level. A distance of 1.6 km underestimates the physical labor involved in transporting water, which weighs 1 kg per liter. In addition, the risk of contamination of 'improved sources' wells and tube wells is high. This may partially explain the high rate of waterborne diseases. In the Technology Mission reports of the Government of India, it was estimated that as of 2000, some 200 districts in 17 states in India were identified to have high levels of fluoride, and the population at risk was estimated to be around 66 million. Despite economic progress access to a tap/piped water has not increased over the last 10 years in India. National figures hide

local water scarcity and competition for resources in Chennai. The negative effects of water scarcity are unequally distributed: the population in peri-urban areas is worst off and have limited access to improved water sources. As a coastal city, groundwater is subject to salt intrusion. Two thirds of the lower income population, which mainly rely on groundwater resources, reported that their water was saline, as compared to one third of the household's highest income group.

Quote

We also notice that the proportion of population having access to a tap has increased ever so slightly in 10 years in rural areas and remains at less than 20%. In the case of urban households, this proportion has been more or less stagnating at around 70% for a decade. Of course, to aim to provide 100% of the population with access to a tap is not feasible in the short run. It may seem ironic that India, which is emerging as an information technology powerhouse, has to depend on wells and tube wells as the most important source of water.'

Arku, F. S., Angmor, E. N., & Seddoh, J. -. (2013). Toilet is not a dirty word: Close to meeting the MDGs for sanitation? *Development in Practice*, 23(2), 184-195.

Category 1 Inequality Subcategory 1 Urban
Method(s) Multiple methods

The authors investigate progress toward MDG 7c in terms of access to sanitation in Tulaku and Taabo, informal settlements in the suburbs of Ashaiman in the Greater Accra Region of Ghana. Methods used are participant observation, and semi-structured interviews. 122 people were interviewed in Talaku and 164 in Taabo. A simple random sampling technique was used to select 50% of the homes for the study: 61 and 82 houses from respectively Tulaku and Taabo. Each house is inhabited by more than one household. As such, for each house two adults from two different households took part in the study.

Most of the population in Talaku and Taabo relies on paid shared toilets: 64% of the respondent used public latrines, while 29% used private facilities, and 2% used both. 89% of the respondents who used paid public toilets were female and 11% male. Only 1% of the respondents practiced open defecation, while 4% had toilet facilities at home. Public toilets were poorly maintained, but cheaper than the private facilities. 36% of the interviewees reported that the toilets were in an unhygienic condition. The toilets were often far away and occupied, the respondents had to wait in line. 92% did not wash their hands after toilet use.

Quote

Improving access to water and sanitation facilities has been a priority on the international development agenda. Halving the number of those who do not have access to sanitation facilities is an MDG target. This study assessed the toilet conditions in an urban slum in Ghana. Many felt that the sanitary conditions were deplorable; they were unsatisfied with having to walk over half a kilometre before using a toilet.' p184.

Ayalew, M., Chenoweth, J., Malcolm, R., Mulugetta, Y., Okotto, L. G., & Pedley, S. (2014). Small independent water providers: Their position in the regulatory framework for the supply of water in Kenya and Ethiopia. *Journal of Environmental Law*, 26(1), 105-128.

Category 1 Inequality Subcategory 1 Urban
Category 2 Political and administrative challenges
Method(s) Multiple methods

The article focuses on small-scale water providers (SIPs), operating in urban low-income areas. These providers are often the only option for people living in low-income areas. Considering MDG7c of halving the population without sustainable access to water, the authors consider the role of SIP's and the water

quality regulation and prices in Kisumu, Kenya and Addis Ababa, Ethiopia. The study relies on a water quality assessment, document review, semi-structured interviews, a household survey and focus group discussions. The water quality of the sources used by small-scale providers was tested. The study was integrated by a socio-legal analysis of the regulatory framework and enforcement of quality standards and price. A two-level stratification was used to determine the availability of drinking water. Water availability defined the first level of stratification and socio-economic status the second level. Reconnaissance surveys were carried out to identify areas served by small-scale providers. 310 households were surveyed. Households were asked about the sources of the water they used and water samples were tested for thermotolerant coliforms (TTCs), as indicators of the microbiological water quality. The presence of these microorganisms is an indicator that the water has been in contact with human or animal faeces. Water samples were collected in sterile containers and stored on ice for transport back to the laboratory. The water was analyzed within 6 hours of sample collection.

Many of the samples tested in both Addis Ababa and Kisumu were below WHO standard. TTC's were present in 84% of the tests in Kisumu, compared to 40.2% in Addis Ababa. In Kisumu, the Water Act 2002 states water providers can only provide water below a certain quantity, easily trespassed. Above these limits, a license is required, but only the Water Services Boards are eligible to apply for such licenses. As a result, SIPs operate illegally. Price and water quality are not regulated. In Addis Ababa, just like in Kisumu, SIPs fall outside the legal system. The city does not provide permits to SIPs and as a result fails to regulate both price and quality.

Quote

Regulation of water quality and the implementation of other measures to improve human health are very relevant to the attainment of the human rights to life and to water and represent an urgent finding of the study where the supply of water is, in large part, delivered by SIPs. The water usage study showed that in Kisumu, most wells currently fail to meet the WHO drinking water quality guidelines, but the supply of well water helps boost water supply to households for non-consumptive purposes to an acceptable level.' p23.

B

Bain, R. E. S., Gundry, S. W., Wright, J. A., Yang, H., Pedley, S., & Bartram, J. K. (2012). Accounting for water quality in monitoring access to safe drinking-water as part of the millennium development goals: Lessons from five countries. *Bulletin of the World Health Organization*, 90(3), 228-235.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water

Method(s) Statistical analysis of secondary sources

The study compares access to water and sanitation as measured by JMP from 2000-2015, with data on water quality collected by the JMP Rapid Assessment of Drinking-Water Quality (RADWQ) project in Ethiopia, Jordan, Nicaragua, Nigeria and Tajikistan. The WHO guidelines were used to determine if water was safe. The aim of this study is to determine how accounting for RADWQ data on water source quality affects Joint Monitoring Program assessments of progress towards achieving MDG Target 7c. The JMP RADWQ project was executed in 2004 and 2005. 1500 sources were tested in each country for the presence of thermotolerant coliform bacteria, fluoride, and arsenic and nitrate compounds. The authors matched the source types reported by RADWQ with those in the 'regular' JMP household surveys and censuses, adjusting the proportion with access to water from each source type using estimates of the percentage microbial compliance and percentage overall compliance for each source type reported by the RADWQ project. In the absence of data, the authors presumed sources were 100% compliant.

In four of the five countries, the population with access to safe drinking water in 2008 declined when water quality was used as an indicator. In Ethiopia, the population with access to safe water decreased 11%, in Nicaragua 16%, Nigeria 15% and Tajikistan 7%.

Quote

'Adjustment for microbial and chemical contamination meant that in all countries except Jordan the estimated proportion of the population needing to gain access to safe drinking-water between 2008 and 2015 to reach the 2015 target increased.'

Baquero, Ó. F., Jiménez, A., & Pérez-Foguet, A. (2015). Reporting progress on the Human Right to Water and Sanitation through JMP and GLAAS. *Journal of Water Sanitation and Hygiene for Development*, 5(2), 310-321

Category 1 Inequality Subcategory Human right
Method(s) Literature review

The authors investigate in how far data collected by JMP post-2015 and GLAAS is suitable to measure the Human Right to Water. The indicators are based on HR General Comment 15 and include availability, quality, acceptability, physical accessibility and affordability. The analysis is based on a JMP report (2015) describing WASH targets and indicators post-2015.

Data collected by JMP and GLAAS is valuable to measuring the Human Right to Water, though there are some gaps, among which affordability, information on subsidies to poor people and the existence of regulation. JMP post-2015 includes Human Rights elements. Instead of one technology based indicator, 'improved/unimproved sources' used from 2000 to 2015, JMP seems to be moving towards a set of indicators including physical accessibility, continuity, seasonality and water quality. JMP plans to collect disaggregated data; distinguishing between rich and poor, urban and rural, slums and formal urban settlements, and disadvantaged groups and the general population (Joint Monitoring Programme, 2014).

Quote

'By contrast, there are still some critical gaps if both UN water platforms are to be used to report progress on HRW. Affordability at a household level remains unsolved in the post-2015 proposal despite HR experts having expressed concerns about the importance of visualising it. The GLAAS provides relevant information but it is not sufficient to reveal important indicators as to the percentage of poor people that benefit from special subsidies. Moreover, it could be possible to measure the proportion of households that have been disconnected from their water supply at least once a year, but the question has not been addressed.' p319.

Bartram, J., Brocklehurst, C., Fisher, M. B., Luyendijk, R., Hossain, R., Wardlaw, T., et al. (2014). Global monitoring of water supply and sanitation: History, methods and future challenges. *International Journal of Environmental Research and Public Health*, 11(8), 8137-8165.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water and basic sanitation
Method(s) Literature review

A paper discussing international monitoring in the water and sanitation sector and JMP's way of measuring access to water and sanitation, based on a document review. The authors describe the history of international monitoring, which has been defined by international target setting. The UN Development Decade in the 1970s established targets that were monitored, in the 1980s targets were set and monitored in the context of the International Drinking-water Supply and Sanitation Decade and World Summit for

Children. From the 1990s, The World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF) report progress towards the MDG targets through their Joint Monitoring Programme for Water Supply and Sanitation (JMP, 2016). The JMP measures access to ‘improved and unimproved’ water sources and ‘improved and unimproved’ sanitation facilities as a proxy for safe water and basic sanitation access. The JMP’s binary approach has its limitations. Current methods do not address water quality, equity of access, or extra-household services. Future monitoring should also include disaggregated data to monitor compliance with the human right to water and sanitation. The JMP is exploring ways to include an indicator about water quality and accessibility, for example the data for Bangladesh was adjusted using the first nationwide arsenic survey. Sources that exceeded the Bangladesh national standard for arsenic in drinking water were excluded. This led to a 27% lower estimate of households with access to safe drinking water (Department of Public Health Engineering, 2000). Water source functionality and reliability are also aspects to be included. In the case of sanitation, it is helpful to distinguish between unimproved facilities based on their effectiveness at separating users and the wider population from human excreta (World Health Organization and United Nations Children’s Fund, 2014). There is a risk of estimation errors in JMP’s methods, among which: (a) Errors in sampling, leading to underrepresentation of certain groups. More work should be done to make sure that samples represent different populations and settlements. (b) Linear regression presumes coverage evolves linearly, however coverage often follows an s-shape. (c) The division between urban and rural is not based on geospatial data. (d) There is an assumption that households use a single source of water, while this is often not the case. (e) When data is lacking, JMP estimates that 50% of the sources is improved. Equally for sanitation there is a nominal 50% improved facilities correction where a survey or census does not use facility class definitions that coincides with JMP definitions.

Quote

While the MDG-period’s simple binary approach of reporting on “the haves and the have-nots” [11] has made the JMP findings easily absorbable by a broad audience, this approach has substantive limitations, stemming from the fact that different facility types are associated with different types and levels of benefits. While the refinement of JMP reporting beyond the improved/unimproved dichotomy (discussed in Section 5.3) begins to address these limitations, further disaggregation by class could inform the use of service ladders to rank facility classes by their desirability from a health perspective.’ p8157.

Baum, R., Luh, J., & Bartram, J. (2013). Sanitation: A global estimate of sewerage connections without treatment and the resulting impact on MDG progress. *Environmental Science & Technology*, 47(4), 1994-2000.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Method(s)	Statistical analysis of secondary sources		

The authors compare access to ‘improved’ sanitation as measured by JMP and access to sanitation with a connection to a sewage system, based on JMP and data collected by the United Nations Statistics Division (UNSD), AQUASTAT and FAO. Country-level estimates of sewage treatment prevalence in 2010 and 1990 were available for 84 and 93 countries. The authors developed an empirical model to estimate sewage treatment prevalence in other countries. The prevalence of sewage treated was predicted as a function of eight social, health, and political indicators: urban access to improved sanitation as defined by JMP, government effectiveness as evaluated by the World Bank, gross national income (GNI) per capita calculated using the Atlas method, percentage of population attaining tertiary education, percentage of the female population attaining secondary education, percentage of the population living below \$1 a day, trade (percentage of GDP), and under-5 DALYs per 100 000 children attributed to water, sanitation, and hygiene. To reassess progress toward MDG Target 7c, JMP estimates of global access to improved sanitation were adjusted by discounting the proportion of households that have sewerage connection without sewage

treatment. The authors estimated the number of people with access to sewerage connection without treatment by multiplying the total population by both the national-level sewerage connection percentage. The global population with access to sewerage connection without treatment was calculated as the sum of the corresponding individual values for all countries. Pit latrines were not included in the study. For further information on the method used, see page 1994-1995.

Currently, there is a lack of data when it comes to connections to a sewage system and sewage treatment. Based upon the data available the authors estimate the 1990 baseline population using sanitation including treatment at 36%. In 2010, the authors estimate that 40% of the global population (2.8 billion people) used improved sanitation (treatment included), as opposed to the estimate of 62% (4.3 billion people) from the JMP. The authors plead for the sanitation indicator to include a connection to a sewage system and treatment, as untreated sewage has negative consequences for human health and environment.

Quote

This paper accounts for the impact of inadequate sewerage systems; however, a similar logic would suggest that the fraction of other sanitation facilities that lead to contamination of the household, community, and/or wider environment should also be discounted from estimates of coverage with improved sanitation. We focused our attention on sewerage connections because (i) sewerage connections account for over half of all improved sanitation (Table 1 and JMP Data Resources Bank); (ii) JMP provides sewerage connection data disaggregated into rural and urban areas; (iii) there is clear evidence for adverse health and environmental effects from sewage contamination; and (iv) the available evidence suggested a substantive proportion of sewage is untreated. Another important improved sanitation technology which was not considered in this study and can lead to contamination of the household and community is the use of pit latrines which are often emptied close to the community and the contents may not be treated. By accounting for inadequacy in other technologies, we would expect an additional increase in the 1990 unimproved sanitation baseline levels, an increase in the progress required to meet MDG Target 7c, and a decrease in the estimated proportionate progress achieved to date.’ p2000.

Bennett, H. B., Shantz, A., Shin, G., Sampson, M. L., & Meschke, J. S. (2010). Characterisation of the water quality from open and rope-pump shallow wells in rural Cambodia. *Water Science and Technology*, 61(2), 473-479.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for safe water
Method(s)	Other		

The JMP differentiates between ‘improved’ and ‘unimproved’ water sources to determine access to potable water. Is this a reliable indicator? The authors tested the water quality of eight ‘unimproved’ open wells and eight ‘improved’ rope pump wells over a period of eight months in rural Cambodia. The water testing included health indicators (arsenic, fluoride, manganese, nitrate, total coliforms, E. coli, male-specific coliphage) and aesthetic ones (iron, chloride, conductivity, total dissolved solids and hardness, turbidity, pH).

18.3% of the samples coming from ‘unimproved’ open wells were unsafe according to the Cambodian drinking water standards, compared to 31.7% of the ‘improved’ rope pump wells. All samples failed to RDI’s Drinking Water Quality Index (DWQI) for aesthetics.

Quote

No significant difference was observed in the quality of water from open and rope-pump wells, despite their classification as unimproved and improved respectively by the WHO/UNICEF Joint Monitoring Programme. Contaminants present in both well types may readily be removed by simple water treatment,

suggesting that household treatment may be more beneficial to rural Cambodian households than shallow aquifer source improvements.’ p473.

Brown, J., Vo Thi Hien, McMahan, L., Jenkins, M. W., Thie, L., Liang, K., et al. (2013). Relative benefits of on-plot water supply over other improved sources in rural Vietnam. *Tropical Medicine & International Health*, 18(1), 65-74.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water
Method(s) Multiple methods

The authors study if sources considered ‘improved’ by the JMP deliver the same water quality. To that end, they measure the water quality of piped water and compare the results to other ‘improved’ water sources in the Dan Nang province in Vietnam. The study included 224 households who had and on-plot piped water connection and 76 households from the same areas with access to alternative ‘improved’ water sources. In addition to water testing, data was collected on water use and handling practices, sanitation access and behavior and diarrheal diseases, through interviews.

The households with access to piped network had access to better water quality. For instance, the E. coli counts (not including those samples that were treated by boiling) for piped water were 16 (95% CI 13-18) bacteria/100 ml compared with 63 CI 31-42) bacteria/100 ml among those from alternative ‘improved’ sources. The prevalence of diarrhea was lower among households with access to piped water. Out of 1156 people accessing piped water, 103 cases were reported over the course of four months. 42 cases were reported, out of 303 people accessing improved sources.

Quote

‘Our results suggest that on-plot water service yields benefits over other sources that are considered ‘improved’ by the WHO/UNICEF Joint Monitoring Programme.’ p65.

Butala, N. M., Van Rooyen, M. J., & Patel, R. B. (2010). Improved health outcomes in urban slums through infrastructure upgrading. *Social Science and Medicine*, 71(5), 935-940

Category 1 Inequality Subcategory 1 Urban
Method(s) Statistical analysis based on secondary sources

The Millennium Development Goals (MDGs) aim to address deplorable conditions in slums and standards for water and sanitation as well as pertinent health outcomes. Upgrades in slum household water and sanitation systems have not been evaluated to demonstrate a direct link to improved health outcomes. The authors investigate the relation between slum upgrading, including water and sanitation, and health in slums in Ahmedabad, India, through a quasi-experimental regression model using health insurance claims (for 2001-2008) as an Indicator for passive surveillance of disease incidence. The study employs a quasi-experimental method of external evaluation through passive surveillance by using a “difference-in-difference” technique, in which the change in a variable of interest between program and non-program regions is compared to control for bias. 151 health insurance claims were identified from slums that had been ‘upgraded’, each of these 151 claims was coded as to whether the illness occurred before or after a slum upgrading programme was implemented.

Slum upgrading in Ahmedabad reduced residents’ likelihood of claiming waterborne diseases from 32% to 14% and from 25% to 10% when excluding mosquito-related illnesses.

Quote

If declines in health and the potential for outbreaks in this growing population are to be prevented, governments must act now. The findings above provide a role for governments in improving the health indicators of a rapidly increasing but ignored population. This study provides a strong evidence for urban slum upgrade to reach the Millennium Development Goals.'

C

Castro, J. E. (2007). Poverty and citizenship: Sociological perspectives on water services and public-private participation. *Geoforum*, 38(5), 756-771.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Category 2 Inequality Subcategory 2 National

Method(s) Literature review

A historical analysis of the impact of private versus public water supply on the poor in Britain, France, the United States of America and Latin America, based on literature review. The aim is to investigate if the claim 'private sector participation will reduce poverty' can be backed up by historical evidence.

In London, eight companies delivered water in the 1840s. The companies did not operate in poor areas or keep quality standards. From 1902 onwards, the water companies were placed under public control. In the United States, around the 1850s, the water sector consisted of water companies both owning networks and operating and maintaining them. The companies, similarly to those in London, delivered poor quality water for a high unit price. In 1806, 94% of the water works were private. 90 years later, 53% had been taken over or built directly by the public sector. In France, despite good performance, the water sector became a public affair roughly around the end of the 19th century. The author concludes that there is no historical evidence supporting the claim that private sector participation in developing countries is more likely to reach the poor. The author concludes that the forces set in motion by the neoliberal model of water policy based on market-centred governance of water and WSS remains the crucial obstacle toward achieving MDG 7c.

Quote

'On the contrary, the historical evidence shows that profit-oriented PSP, especially if unregulated, tends to produce highly exclusionary and elitist outcomes, which are unlikely to benefit the poor.'

Chandrasekhar, S., & Mukhopadhyay, A. (2012). Multiple dimensions of urban well-being: Evidence from India. *Asian Population Studies*, 8(2), 173-186.

Category 1 Inequality Subcategory 1 Urban

Method(s) Statistical analysis based on secondary sources

In line with Millennium Development Goals, the focus of policymakers has primarily been on slum dwellers, according to this paper. The authors question if the focus of policymakers on slum dwellers is justified, using a distribution analysis to compare monthly per capita expenditure (MPCE), per capita area of household dwelling, drainage and access to water source by slum and non-slum inhabitants in India. The data source is a survey of housing conditions conducted by the National Sample Survey Organisation (NSSO) in the year 2002, covering 41,916 urban households. The survey identified 6138 slum households and squatters, 35,703 households from non-slum urban areas and 75 households without a house.

7% of the population in India lives in slums. A distinction is drawn between notified slums, non-notified slums. Notified slums are to some extent formalized by city authorities by means of a notification which

leads to improved provision of public goods including water and sanitation. Poverty is not depended on location; 30% in non-slums is considered poor, compared to 48% in notified and non-notified slums. When it comes to access to water and drainage facilities, non-notified slums are most disadvantaged, followed by notified slums. The focus on slums is justified when it comes to improving water and sanitation access.

Quote

'Concomitant with higher levels of urbanisation in developing countries, there has been a sharp increase in both the number of urban poor and slum dwellers. In line with Millennium Development Goals, the focus of policymakers has primarily been on slum dwellers. Using a nationally representative dataset from India, we compare well-being of people living in slums with those living in non-slum urban areas. We argue that while policies to improve access to water and sanitation in slums are justifiable, livelihood programmes that target only the slums would miss the poorest living in non-slum urban areas.' p173.

Cho, D. I., Ogwang, T., & Opio, C. (2010). Simplifying the Water Poverty Index. *Social Indicators Research*, 97(2), 257-267.

Category 1	Inequality	Subcategory 1	Method
Method(s)	Other		

In the context of MDG 7c, the authors attempt to simplify Lawrence et al.'s (2002) composite Water Poverty Index, composed by five dimensions: resources, access, capacity, use, and environment to reduce unnecessary costs and efforts. The index is meant to support policy initiatives in the field of water and sanitation, at local and international level. A Principal Component Analysis (PCA) is used to evaluate the Water Poverty Index. The ranking of the 147 countries by Lawrence et al.'s (2002) WPI is compared to rankings based on other indexes.

Based on the PCA, the authors simplify Lawrence et al.'s (2002) composite Water Poverty Index. The result is a three component composite index comprising of access, capacity, and environment, with unequal weights. The alternative is a two-component index consisting of capacity and environment with equal weights. The proposed indexes have high positive correlations with the Human Development Index and negative correlations with the Human Poverty Index.

Quote

'Our results, using Lawrence et al.'s (2002) data for 147 countries, question the practice of assigning equal weights to the five sub-indexes. Our findings suggest that a simplified WPI with three sub-indexes (i.e., Access, Capacity, and Environment) with unequal weights would be more cost-effective to construct without much loss of information. Furthermore, constructing an even more simplified WPI based on solely on Capacity and Environment with equal weights would suffice and would be even more cost effective.' p266.

Cotton, A., & Bartram, J. (2008). Sanitation: On- or off-track? Issues of monitoring sanitation and the role of the Joint Monitoring Programme. *Waterlines*, 27(1), 12-29.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Method(s)	Literature review		

This paper focuses on JMP's methods for reporting on the MDG sanitation target and provides recommendations on this topic.

JMP's indicator for sanitation is technology based. There is a discrepancy between national and international estimates, often due to the differences in definitions used. The authors propose to base the Indicator for

sanitation on ‘use’ instead of ‘access’. Hygiene and sustainability need to be considered when measuring access to sanitation. In addition, the authors designed a framework for in depth international monitoring of sanitation governance.

Quote

‘Health-related benefits are an outcome that arises from people making use of the improved sanitation services to which they have access. The benefits are greater when people wash their hands with soap after defecation and at other times such as prior to preparing food. Benefits are also greater when sanitation is community-wide where everyone uses the latrine and where the technologies used prevent environmental pollution. Note that the corollary is that the benefits of sewerage are reduced if the sewage is discharged to pollute other communities. Finally, safe community-wide use needs to endure with time. What does this imply for monitoring? It implies that we would ideally focus on use rather than access; assess hygiene as well as sanitation; ensure that the technologies used truly protect health; and ensure that they are sustainable (both in the sense of used in the long term and also in the sense of environmental sustainability).’

D

De Gisi, S., Petta, L., & Wendland, C. (2014). History and technology of Terra Preta sanitation. *Sustainability (Switzerland)*, 6(3), 1328-1345.

Category 1 Water resource management

Method(s) Literature review

An analysis of the use of Terra Preta Sanitation (TPS) systems, based on a document review. The authors make a case for the development of closed loop sanitation systems in order to achieve MDG 7c.

With Terra Preta, black soils, human excreta can be turned into fertile soil, suitable for agriculture. A wide variety of Terra Sanitation Systems has been tested, including dry TPS and flush toilet systems both in urban and rural contexts, but only at a small scale.

Quote

‘In order to reach the Millennium Development Goals for significantly reducing the number of people without access to adequate sanitation, new holistic concepts are needed focusing on economically feasible closed-loop ecological sanitation systems rather than on expensive end-of-pipe technologies.’ p1328.

E

Engel, S., & Susilo, A. (2014). Shaming and sanitation in Indonesia: A return to colonial public health practices? *Development and Change*, 45(1), 157-178

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Multiple methods

Progress towards the MDG target on sanitation has been slow. Is Community-Led Total Sanitation (CLTS) an effective approach to increase access to sanitation? The Government of Indonesia, supported by the World Bank, has promoted CLTS in rural areas, which uses social mobilization to encourage people to construct their own latrines. This approach, according to the authors, uses social shaming and punishments. Communities are taken through a ‘walk of shame’ to identify and raise consciousness regarding the extent of faecal matter in the village and work on a defecation mapping exercise. The shaming is intended to motivate households to take up latrine construction, at their own expense. CLTS has been implemented

with NGO and donor support in many developing countries. The authors describe two cases of a Rockefeller Foundation funded hygiene and sanitation programme in the 1920s, and the World Bank Water and Sanitation Programme (WSP) in East Java in the 2000s. The aim is ‘to highlight new insights about the outcomes of CLTS as a hybrid approach that links colonial and modern governmentality but, in its modern form, involves not just the state but also sub- and supra-national organizations of various kinds.’ The authors studied the WSP in East Java generally and specifically in KabupatenTreggalek, through WSP documents and reports from independent evaluations and interviews with regional officials. One of the key informants was a researcher working for the Jawa Pos Institute of Pro-Autonomy (JPIP), a local foundation of East Java’s largest media network that has been tasked with monitoring the implementation of WSP funded project.

In the Dutch East Indies, the Rockefeller Foundation funded a hookworm-eradication programme focused on hygiene and sanitation improvements, as this was considered to be cheaper than providing sustainable infrastructure. The authors see parallels with the 1990s, when donors changed their policies from the provision of hardware to a focus on participation and social mobilization to help communities to construct and maintain their own sanitation facilities. The authors explain how CLTS reflects the World Bank’s neo-liberal reforms; moving services outside government control to the private sector and communities. Communities are expected to finance and organize infrastructure themselves. CLTS in KabupatenTreggalek relies on techniques involving shame, enforcement, responsibility and sanctions. In some communities, those with unimproved sanitation were marked with a sticker, fines were given and in one village pictures were posted of people openly defecating. Despite the guerilla techniques, many villagers did not seem to be aware that the program existed in interviews. Follow up interviews with seven villagers in 2012 indicated that pit latrines were full and not emptied because of financial or other constraints.

Quote

In rural areas, rather than providing additional funding, the government —with support of the World Bank— has promoted the Community-Led Total Sanitation (CLTS) approach, which uses social mobilization to encourage people to construct their own latrines. In Indonesia as elsewhere, CLTS involves more than just education and encouragement; it uses social shaming and punishments. The authors argue that this is not only an inadequate approach but one which echoes coercive, race-based colonial public health practices.’ p157.

Erni, M., Drechsel, P., Bader, H. -, Scheidegger, R., Zurbruegg, C., & Kipfer, R. (2010). Bad for the environment, good for the farmer? Urban sanitation and nutrient flows. *Irrigation and Drainage Systems*, 24(1-2), 113-125.

Category 1 Water resource management
Method(s) Other

A system analysis of water and nutrient flows for the city of Kumasi, Ghana. The analysis focused on nitrogen and phosphorus and was supplemented by a farm based nutrient balance assessment. The authors use data from several studies. The main method used to derive urban water and nutrient flows is a mathematically extended material flow analysis called MMFA.

Compared to the water quality upstream of Kumasi, nitrogen and phosphorous concentrations downstream of the city are approximately 14 and 6 times higher. The largest nitrogen and phosphorous input into water bodies come from domestic sources, in particular, failing sanitation facilities, such as flushing toilets connected to septic tanks from where water infiltrates into the ground. Population growth will lead to an increased level of nutrients in the available water sources in Kumasi. The tendency has been to invest in drinking water rather than sanitation, leading to high amounts of untreated wastewater. Flushing toilets use

water that could be used for drinking. The authors plead for investments in efficient waste collection and dry toilets or low-flush toilets to meet MDG 7c.

Quote

'Given the expected population growth, and under consideration of current plans for expansion in the water and sanitation sector, nutrient inputs to receiving waters, especially to the Oda river will increase by around 40% till 2015. This increase will be supported by the planned expansion of water supply without corresponding measures for collection and treatment'. p121.

F

Fisher, K. T. (2008). Politics and urban water supply. *Development*, 51(1), 30-36.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Literature review

Despite MDG 7c aiming to halve the population without sustainable access to water, universal water works coverage has not increased in South East Asia. The author presents a case study of the privatization of the water sector in Tagbilaran, Bohol, Philippines. The research was conducted between June 2003 and October 2004.

In 2000, the Provincial Government, under Governor Rene Relampagos, privatized water supply in Tagbilaran, to attract private investment and reduce corruption. Fisher documents how the privatization of water supply has been used in political campaigns. She describes two examples of instances in which the BWUI, the company in charge, wrongfully became the subject of public scrutiny. In a third example, the author describes how the media ignores the fact that Tagbilaran's groundwater sources are being contaminated and directs the readers' attention instead to the privatization of water provision.

Quote

'Enough attention has not been given to the shortcomings of the institutional and resource management arrangements to ensure equitable provision of water that is sustainable in the long term. It is important to acknowledge the political nature of urban water supply but then to move beyond this. Research in small cities such as Tagbilaran enables complex socio-political relationships to be revealed and provides lessons for thinking through the political nature of water in other cities. It is less important to fixate on private versus public provision as both are capable of providing poor services that are inequitable and unsustainable in the absence of adequate regulation and institutions.' p35.

Flores Baquero, O., Jiménez Fdez. de Palencia, A., & Pérez Foguet, A. (2016). Measuring disparities in access to water based on the normative content of the human right. *Social Indicators Research*, 127(2), 741-759.

Category 1 Inequality Subcategory 1 Human right

Method(s) Other

One of the main contributions of a human rights based approach to the MDG/SDG agenda is the necessity to develop new methodologies to measure and better understand disparities. This study demonstrates the use of a new method to measure disparities in San Sebastian de Yali' (SSY) municipality located in Northern Nicaragua. The area includes five rural communities, 296 households in total. The sample is divided in two categories: 154 households whose water is provided by CBO's and 142 households who self-supply water.

The method is developed to measure differences in water availability, quality, acceptability, physical accessibility and affordability. The households who self-supply rely on surface water and unprotected springs, some have access to wells or buy water from their neighbours. Those served by CBO's get their water from standpipes or connections on their premise. In terms of acceptability, quality and physical accessibility self-supplying households are worse off than those serviced by community managed systems. Households do not trust the water they drink and must walk long distances to get water that contains more faecal coliforms. These users are better off only in terms of availability, as they can collect water from their own sources all year long. The cost of this survey was \$5700, it was conducted in 74 communities. The WASH budget for the municipal area in which the survey took place is \$60000. The authors recommend carrying out a similar survey every four years, so that the cost represent 2.5% of the annual municipal budget.

Quote

'The proposal includes a field data collection methodology and a set of questions to measure service level based on the human right to water normative framework. Statistically, a stratified sampling, splitting households served by community based organizations and those self-provided, is proposed. This approach implies considering reduced populations and samples, thus special care needs to be taken with sample sizes and uncertainty of estimators.' p743.

Flörke, M., Kynast, E., Bärlund, I., Eisner, S., Wimmer, F., & Alcamo, J. (2013). Domestic and industrial water uses of the past 60 years as a mirror of socio-economic development: A global simulation study. *Global Environmental Change*, 23(1), 144-156.

Category 1 Water resource management
Method(s) Other

A simulation program, WaterGAP, is used to back calculate industrial, agricultural and domestic wastewater from the 1950s onwards.

In East and Southeast Asia, Northern Africa, and Eastern and Southern Europe the amount of untreated wastewater is high. Securing water supply and reducing untreated wastewater is a priority when it comes to reaching the MDGs. Equally important is the development of policies and regulation encouraging the development of water saving technologies, according to the authors.

Quote

'How can we constructively think about future developments of water-related sectors if we do not know how water was used in the past? For example, information on water use together with the quantification of renewable water resources indicates hotspots of water stress (water scarcity) and their development over time. Nevertheless, even if agriculture is the dominating water consuming sector in many regions of the world, the domestic and industry sectors can also contribute to achieving a reduction of vulnerability to water stress. This requires that water-related policies are effectively mainstreamed into other sectoral policies such as for industry (in particular water saving in the energy sector), urban development, or tourism.' p146.

G

Gine Garriga, R. G., & Perez Foguet, A. P. (2013). Water, sanitation, hygiene and rural poverty: Issues of sector monitoring and the role of aggregated indicators. *Water Policy*, 15(6), 1018-1045.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water and basic sanitation

Method(s) Statistical analysis of secondary sources

An assessment of three existing monitoring instruments in the water and sanitation sector worldwide: a health impact indicator (prevalence of diarrhoea), JMP indicators and the WASH poverty index, from a policy-making point of view. A survey in Kenya forms the basis for this analysis. 5,050 households were surveyed and 407 water points were audited across 317 rural clusters to cover 21 targeted districts. The data was collected from January 2010 to 2010. The statistical analysis employed tools such as the Pearson's chi-square test and the Principal Component Analysis (PCA), using in both cases a standard statistical package (SPSS 15.0, 2006). The Pearson's chi-square test, specifically the SPSS Exact Tests v7.0, was performed to assess the relationship between survey variables.

The prevalence of diarrhoea alone is not a reliable indicator, according to the authors. There is significant association between prevalence of diarrhoea and i) access to improved water supplies ($P = 0.026$), and ii) sanitary disposal of children's faeces ($P = 0.009$). In contrast, no significant reduction in diarrhoea is observed with i) wealth and with ii) access to basic sanitation. In brief, slight positive impacts are observed when an improved water supply is accessed by the household and when children's faeces are disposed of safely. The authors have several recommendations towards JMP. Currently, the water indicator only considers the distance to the source. There are additional factors that determine water access, such as: affordability, reliability, continuity and water quality. The sanitation indicator does not take into account the sanitary condition of the facility. Hygiene should also be included. The authors conclude their analysis, discussing the WASH poverty index, worked out and presented in an earlier paper (by the same authors). The WASH index consists of the water supply index, initially developed by Sullivan et al (2003), the sanitation poverty index and the hygiene poverty index. This index is most suitable for policy development, according to the authors since 'it proves useful to unravel the linkages between poverty and access to basic services; and it improves the identification of target groups and allows a more equitable allocation of resources.'

Quote

'At the global level, the JMP has emerged as a consistent approach to report on WASH sector status and trends. Its major strength, and the root of its success, is the simplicity of having a few relatively well-defined and easy-to-measure indicators, which produce reasonable estimates of coverage across different contexts. However, JMP measures access through technology-based proxies, and it does not provide information on the quality of the water, the continuity of the water service, the sanitary conditions of the toilet facility, or whether economic, institutional, social or environmental reasons jeopardize the ability of households to access the services. Therefore, the simplicity of the monitoring framework is also its core limitation, and it is necessary to gain an insight into wider issues that relate to sector performance.'

Ghosh, D. K. (2009). Millennium Development Goals and the role of Panchayats: Exploring through West Bengal Case. *Journal of Rural Development*, 28(3), 381-407.

Category 1 Inequality Subcategory 1 National

Category 2 Political and administrative challenges

Method Literature review

This paper looks at the role local governments in rural areas, called panchayats, play in achieving the MDGs in terms of education, health and access to safe water and basic sanitation in the federal state of West Bengal, India. The data sources used are mostly government reports.

Officials working for the panchayats generally do not know much about the specific MDG targets. Panchayats have a role in the process of disease prevalence, including diseases related to unsafe water and poor sanitation: acute diarrhoeal, according to policies at central level. The Indian central government and federal government foresee a role for the panchayats in the provision of drinking water in operating and

maintaining water sources (Government of West Bengal 2005-2006). Drinking water is funded at central level. Access to safe drinking water is defined as follows: (1) there is one spot source for 250 persons; (2) in case of piped water supply there is one public stand post for 250 persons and assured water supply of 40 liters a day; and (3) the drinking water source exists within 1.6 km. of the habitation in the plain or 100 metres elevation in hill areas. The coverage of piped water network in rural areas remains relatively low, hand pumps and tube well are much cheaper to construct. Open wells, vulnerable to biological contamination, are a common drinking water source. Ground water depletion and aquifer pollution may be threats. There are three tiers within the Panchayat responsible for water delivery. There is not enough expertise within those tiers. In the Gram Panchayat tier, responsible for the implementation, repair and maintenance of handpumps, there is only one technical person: a junior Engineer. In terms of sanitation, the panchayats are mainly involved in the construction of latrines under the Total Sanitation Campaign, in collaboration with government officials and NGO's. Sanitary marts are organised 'as local marketing outlets in villages where on demand people can get a latrine according to their choice and capacity'. According to the Annual Administrative Report 2004-2005 of the Government of West Bengal, 4442122 households have been covered by the sanitary marts in total. Very different figures circulate on sanitation coverage in West Bengal: 27% of the population is covered according to the Census in 2001, while the NFHS3 survey claimed 45% of the population was covered. Government officials working within the panchayat are often employed by the central government. The panchayats have limited control over these officials.

Quote

'The inadequate devolution of functionaries often mars the spirit of local governance. As a consequence, the performances of the panchayats in different fields have to suffer. The study amply explains that only devolution of functions in favour of the panchayats cannot mitigate the ills of society. For reaching the MDGs adequate devolution of functionaries and funds are required.' p381.

Gunawardana, I. P. P., & Galagedara, L. W. (2013). A new approach to measure sanitation performance. *Journal of Water Sanitation and Hygiene for Development*, 3(2), 269-282.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Method (s)	Other		

The indicators used by JMP do not consider the environmental and public health risks associated with some sanitation technologies. A new method is proposed to measure sanitation coverage: the Sanitation Index for Monitoring (SIM). The existing sanitation situation in the town, village and estate communities of Pussellawa, Sri Lanka, was assessed using participatory research tools. Focus group discussions, stakeholder consultation, key informant interviews, informal discussion, questionnaire surveys and field observations. 330 households were surveyed, selected according to a stratified random sampling technique. The data gathered were used to test the applicability of the proposed sanitation index.

The authors concluded that an improved sanitation system requires (a) secure access to a hygienic latrine, and (b) treatment and safe disposal of sewage or wastewater (management of sewage/wastewater). They identified indicator variables, to reflect the improved sanitation through literature surveys and field studies. As a result, the method proposed by the authors to measure sanitation coverage has two sub-indices: (a) Latrine security and hygiene (b) Treatment and disposal system. 18 variables are considered, with an option of weighting them. The authors distinguish 12 levels of sanitation: L1T1 Very poor sanitation, L1T2 Unhygienic latrine with unimproved treatment and disposal, L1T3 Unhygienic latrine with improved treatment and disposal, L1T4 Unhygienic latrine with perfectly improved treatment and disposal, L2T1 Moderately hygienic latrine with poor treatment and disposal, L2T2 Moderately hygienic latrine with unimproved treatment and disposal, L2T3 Moderately hygienic latrine with improved treatment and disposal, L2T4 Moderately hygienic latrine with perfectly improved treatment and disposal, L3T1 Hygienic

latrine with poor treatment and disposal, L3T2 Hygienic latrine with unimproved treatment and disposal, L3T3 Hygienic latrine with improved treatment and disposal, and L3T4 Hygienic latrine with perfectly improved treatment and disposal.

Quote

'Improved sanitation facilities are defined as facilities that ensure hygienic separation of human excreta from human contact. Sanitation should be improved beyond just the containment stage and up to the extent which both technologies and functions reduce the downstream faecal contamination. The present measuring tool gives a figure for sanitation coverage with respect to infrastructure without considering its function and potential effects on the environment. This has led to overestimation of improved sanitation coverage because inefficient and inappropriate types of latrines will ultimately result in invisible human contact with excreta at some point in the water cycle.' p270.

Gutierrez, E. (2007). Delivering pro-poor water and sanitation services: The technical and political challenges in Malawi and Zambia. *Geoforum*, 38(5), 886-900.

Category 1 Inequality Subcategory 1 National
Category 2 Political and administrative challenges
Method(s) Literature review

A field note on the challenges meeting the MDGs on water and sanitation in Malawi and Zambia based on a document review. The focus is the delivery of pro-poor services.

The challenges include weak state support for water and sanitation provision, unreliable and contested indicators of coverage, poor sectoral co-ordination, and fragmented donor efforts. Indicators used by Malawi and Zambia's Poverty Reduction Strategies are different from those used by these two countries' national statistical agencies, or those established by the Joint Monitoring Program of the WHO and UNICEF. There are no indicators for equity in distribution, making it difficult to target disadvantaged groups. Water mapping exercises executed by WaterAid and UNICEF in the two countries, plotting improved water sources on to a map, show that some areas and groups benefit more than others.

Quote

'Certain steps need to be taken. This includes not only understanding the links of water and sanitation in poverty reduction, but also reviewing the funding and accountability relationships between donors, aid organisations, NGOs, local and national government bodies, and grassroots communities. Tools like annual budget analysis and water point mapping need to be institutionalised for more effective governance in the sector. The development of these tools is both a technical and political challenge for the all the concerned stakeholders in Malawi and Zambia.' p899.

H

Hadipuro, W. (2007). Water supply vulnerability assessment for sustainable livelihood. *Journal of Environmental Assessment Policy and Management*, 9(1), 121-135.

Category 1 Inequality Subcategory 1 Method
Method(s) Other

MDG 7c promises to halve the population without sustainable access to water. Which half should be prioritized? The authors developed a water vulnerability assessment. The aim is to help formulate policy interventions required to cope with the problem of water supply access faced by vulnerable groups.

The authors assess shocks, trends and seasonality in the ecological, economic, social and political dimension to identify the most vulnerable households. They distinguish the following levels: national, regional/city, community and household.

Quote

'Conceptually the assessment proposed could result in better policy decision making' p133.

Hossain, K. Z., & Ahmed, S. A. (2015). Non-conventional public-private partnerships for water supply to urban slums. *Urban Water Journal*, 12(7), 570-580.

Category 1 Inequality Subcategory 1 Urban
 Category 2 Political and administrative challenges Subcategory 2 Privatisation and community based management
 Method(s) Multiple methods

The MDGs have set the target to improve the lives of 100 million 'slum' dwellers and to increase water access. The authors investigate an approach developed by DSK (Health Centre for the Destitute), a national NGO in Bangladesh that promotes formal water provision to the slum dwellers in Dhaka. DSK forms slum dwellers community based organizations (CBOs), strengthens their capacity and builds partnership between Dhaka Water Supply and Sewerage Authority (DWASA) and the CBOs to secure public water-supply in the slums. The authors were interested in how far the approach relates to the concept of a conventional public-private partnership. Quantitative and qualitative data is collected through nine focus group discussions, semi-structured and 18 structured interviews with slum dwellers, CBO leaders, DWASA officials, local peoples' representatives and related DSK and other civil society representatives.

The authors see substantial benefits to the DSK approach. Over 100,000 slum dwellers received legal water supply through this PPP arrangement. DWASA, being a public utility agency, could change its set rules, regulations and policies to supply water to urban slums. In engaging with the slum dwellers as partners and legitimate clients, DWASA increased revenue collection and reduced system loss, which convinced the policy makers to make necessary amendments to the rules and procedures for extending services to slums. This was a major positive shift in urban water supply governance. CBOs emerged as de facto private sector entities in the urban water supply sector. They gained adequate capacity in dealing with DWASA, complying with policies, exercising financial transactions, carrying out maintenance of facilities, and undertaking development work in the slums. In this the CBOs have earned the trust and confidence of slum dwellers, DWASA and policy makers. The formal partnership amongst the CBOs, facilitating NGO (DSK) and DWASA established a sustainable model for water supply to slums. This model has now been extended to over 100 slums for over 10 years.

Quote

'Our investigations reveal a positive indication about the study hypothesis that the DSK approach has created a nonconventional model of PPP between the slum dwellers' CBOs and DWASA for effectively providing public water supply in the slums. Slums are regular features in developing countries and this is likely to remain so as urban growth continues. Providing water supply in these slums will remain a challenge for the foreseeable future, which requires alternative approaches.' p578.

Hossain, M. S., Johnson, F. A., Dearing, J. A., & Eigenbrod, F. (2016). Recent trends of human wellbeing in the Bangladesh delta. *Environmental Development*, 17, 21-32.

Category 1 Inequality Subcategory 1 National/regional

Method(s) Statistical analysis based on secondary sources

An analysis of the Household Expenditure Survey (HIES) and Demographic Health Survey (DHS) data from 1995 to 2010, to assess human wellbeing and progress toward the MDGs in the south-west coastal part of Bangladesh. Human wellbeing is a subset of economic and social wellbeing factors (OECD, 2013) and has been classified into five dimensions: health, material, security, freedom and social relations (MA, 2005). The human wellbeing indicators include improved/unimproved water and sanitation access. The HIES uses random sampling. 371 households were selected in the year 1995, 1000 in the year 2000, 7400 in the year 2005 and 12,240 in the year 2010.

Improved sanitation access in this part of Bangladesh has risen from 49% in 2000, to 72% in 2005. Access to improved water sources is 90% since the 1990s and has slightly declined over time. Water quality is not sufficiently covered by the dataset.

Quote

'The quality of life in terms of access to improved sanitation facilities and electricity connection has improved, although access to improved drinking water sources has remained not changed significantly since 1995.' p28.

I

Itama, E., Olaseha, I. O., & Sridhar, M. K. C. (2007). Springs as supplementary potable water supplies for inner city populations: A study from Ibadan, Nigeria. *Urban Water Journal*, 4(1), 19-27.

Category 1 Indicator for safe water and basic sanitation Subcategory: Indicator for safe water
Method(s) Multiple methods

An assessment of the quality of twelve spring water sources used by the inner-city populations in Ibadan, the capital of Oyo State in southwest Nigeria. In the absence of a centralised water system, residents rely on springs. Three different polythene bottles were used for collection of samples: one unfiltered sample for physico-chemical parameters, the second for analysis of heavy metals and the third, a pre-sterilized bottle for the bacteriological analysis. Physico-Chemical characteristics included pH, electrical conductivity (EC), total dissolved solids (TDS), and hardness were carried out according to standard methods described by the American Public Health Association (APHA 1998). Heavy metals analysed included lead (Pb), iron (Fe), manganese (Mn) and cadmium (Cd) and were determined using atomic absorption spectrophotometer (Alpha 4, Chemical Technical Model, UK). Two focus groups per spring were conducted on the history, water use pattern, knowledge, attitude and practice of users to water and environmental sanitation.

There is a high risk of water contamination as these springs are not sufficiently protected. Faeces and urine were smelled in the surroundings of six springs: Onipasan (SP1), Oleyo (SP3), Odo-Iye (SP4), Ogodo (SP7), Rogan (SP8) and Odo-Ibule (SP12), and overgrown vegetation and weeds were present in the immediate location of about half of these sources. In terms of the results of the water testing, the yields ranged from 3320 to 8308.8 l for an 8 h period. The physico-chemical quality was in conformity with the recommended standards. The pH values varied between 6.25- 6.89 and 6.34-6.94 and temperature values varied between 26.5-26.6 and 26.43 -26.6 for the rainy and dry seasons respectively. The total dissolved solids varied according to the soil type and terrain. The bacteriological quality needs to be corrected through simple treatment such as filtration and disinfection. The authors conclude that if these water sources are tapped effectively, these will reduce the pressure to extend piped networks and help meet the Millennium Development Goals.

Quote

'The proximity of these spring waters equally affords the women and men a source of ready supply for their daily economic activities, ranging from clothes dyeing, dry cleaning, washing of cars and other community activities.' p26.

J

Jordanova, T., Cronk, R., Obando, W., Zeledon Medina, O., Kinoshita, R., & Bartram, J. (2015). Water, sanitation, and hygiene in schools in low socio-economic regions in Nicaragua: A cross-sectional survey. *International Journal of Environmental Research and Public Health*, 12(6), 6197-6217.

The Sustainable Development Goals will address water, sanitation and hygiene access in public buildings: schools and health centres. The authors analyse the outcomes of a cross-sectional survey of WaSH in 526 schools in 12 low socio-economic status municipalities in Nicaragua conducted by UNICEF Nicaragua and partners.

WaSH coverage was significantly higher in urban than rural areas. Drinking water coverage (43%) was lower than sanitation infrastructure (64%). Eighty-one percent of schools had no hand washing stations and 74% of schools lacked soap. Sanitation facilities were not in use at 28% of schools with sanitation infrastructure and 26% of schools with water infrastructure had non-functional systems. Only 8% of schools had budgets to purchase toilet-cleaning supplies and 75% obtained supplies from students' families.

Quote

Proposed targets and indicators for the Sustainable Development Goals (SDGs) seek universal access to WaSH in non-household settings, such as schools and health care facilities [1,2,3,4]. Inadequate WaSH in schools results in adverse health outcomes among children including infectious, gastrointestinal, neuro-cognitive and psychological illnesses [5]. Inadequate WaSH conditions have been reported to reduce educational outcomes in children by contributing to absenteeism [6,7,8,9] and impaired cognitive abilities [10,11,12]. Bartlett summarized the impact of unsanitary conditions and diarrheal disease on child malnutrition and mental and social development, including IQ, school achievement levels, working memory, and behavioral problems [11]. The quality of sanitation facilities in schools can impact attendance rates of girls, especially once they have started to menstruate [13], while a more recent literature review found inconclusive evidence on the subject [14]. (Introduction article)

K

Kite, G., Manuel Roche, J., & Wise, L. (2014). Leaving no one behind under the post-2015 framework: Incentivizing equitable progress through data disaggregation and interim targets. *Development (Basingstoke)*, 57(3-4), 376-387.

Category 1	Inequality	Subcategory 1	Method
Method(s)	Other		

Currently, there are limited disaggregated data on social and economic disadvantaged groups which complicates measuring progress toward the MDGs. The authors develop a monitoring system which aims 'to leave no-one behind' by collecting disaggregated data as a recommendation towards the SDGs.

The monitoring system developed by the authors departs from the stepping stone equity targets proposed by Watkins (2014). The stepping stone equity targets set intermediate targets for national governments with regards to addressing disadvantaged groups. The authors propose to compare national progress with the progress by advantaged and disadvantaged groups.

Quote

'Equality and solidarity were among the fundamental values underpinning the Millennium Declaration (UN, 2000). However, many have argued that one of the blind spots of the Millennium Development Goals (MDGs) was precisely to ensure that progress would be shared across all segments of society (Minujin and Delamonica, 2003; Kabeer, 2010 among many others). Over the last two decades, the world has witnessed unprecedented progress in reducing multiple forms of poverty and deprivation, but unfortunately, this progress has often been uneven, leaving disadvantaged groups behind.'

Koff, H., & Maganda, C. (2016). The EU and the Human Right to Water and Sanitation: Normative coherence as the key to transformative development. *European Journal of Development Research*, 28(1), 91-110.

Category 1 Inequality Subcategory 1 Human right
Method(s) Literature review

This study examines EU development programmes in the field of water and how these reflect the core norms expressed in the Union's defining treaties. It examines links with the MDGs/SDGs. The method used is document review, including UN policy documents, reports from non-governmental organizations and United Nations databases.

The EU has a long tradition promoting transformative development, which means e.g. that foreign/trade policies should support the direction taken in the development arena and international collaboration. The authors argue that 'the EU has established policies that are congruent with the MDGs, but because they lack normative coherence with the Union's core values, they promote indicator-based development strategies and the privatization of water, rather than transformative development cooperation.' The Human Right to Water should be the basis of international development programmes in this field.

Quote

'In his November 2014 Kapuscinski Lecture for the RISC Consortium/University of Helsinki international conference and doctoral school (Martens, 2015), Martens, Executive Director of the Global Policy Forum, focused on the need for 'universal development' strategies encompassing both wealthy and poor states in the post-2015 development agenda. These sentiments have also been reflected in current global debates on the SDGs, which have included political and academic calls for transformative development characterized by normative commitments to equity, justice, human security and rights. 'Universality' expands and links the geographic and normative scopes of sustainable development discussions.' p106.

L

Laré-Dondarini, A. L. (2015). Analysis of household demand for improved sanitation: The case of green latrines in Dapaong city in Northern Togo. *Canadian Journal of Development Studies*, 36(4), 555-572.

Category 1 Water resource management
Method(s) Survey

Sub-Saharan Africa is lagging behind the rest of the world in reaching the MDG target on sanitation. The Ecosan/green toilet may be a solution to expand sanitation coverage. The author investigates the socio-economic factors influencing the uptake of a green latrine to inform policy decision making. This type of latrine separates and urine and feces and dries the feces. The urine and feces can be used as fertilizers. A survey was conducted in the city of Dapaong, Togo, with a population of 68650 inhabitants. 556 households were selected, using random stratified sampling.

There are number of socio-economic factors influencing the uptake of green latrines in Dapaong, among which: (a) Farmers have a higher probability of choosing a green latrine, because of the agricultural benefits (b) When several households live in the same house, they are less likely to choose a green latrine, because of ambiguous ownership of the dried sludge (c) Well-educated households do not like to handle dried sludge and choose other types of latrines; and (d) Household not currently in possession of an improved latrine are more likely to try out a green latrine than those already equipped with an improved latrine.

Quote

'Access to improved sanitation is a key issue in achieving the MDG, particularly in the fight against poverty and improvement of household health. This is why the green latrine is attracting growing interest among development actors, justifying the analysis of its adoption conditions in the framework of this study.' p567.

Larson, B., Minten, B., & Razafindralambo, R. (2006). Unravelling the linkages between the Millennium Development Goals for poverty, education, access to water and household water use in developing countries: Evidence from Madagascar. *Journal of Development Studies*, 42(1), 22-40.

Category 1	Inequality	Subcategory 1	National
Method(s)	Survey		

Larson et al (2006) analyse the links between poverty, education, water access, household choice of drinking water, and actual levels of water use in Madagascar, to better understand how MDG goals complement each other. The authors suggest that the findings are representative for Madagascar and other developing countries. Yet, the survey that forms the basis for this analysis has been conducted in the city of Fianarantsoa. A two-stage sampling strategy was implemented: six neighbourhoods without public taps and 13 neighbourhoods with public taps were selected in the first stage. At the second stage, 10% of households in each neighbourhood were randomly selected. The target sample size was 570 households, 547 households agreed to participate in the survey.

Households with a higher income are more likely to have a private connection and use more water. Households fetching water use on average 2300 litres per month, whereas those with a private (in house) connection use 14600 litres per month. The authors argue that the quantity of water used by poor families is not enough for them to properly practice personal and household hygiene.

Quote

'Achieving the poverty, education, and drinking water targets to meet the Millennium Development Goals are not independent endeavours. Reducing poverty and improving education will alter household choices related to water access.' p23.

M

Malik, O. A., Hsu, A., Johnson, L. A., & de Sherbinin, A. (2015). A global indicator of wastewater treatment to inform the Sustainable Development Goals (SDGs). *Environmental Science and Policy*, 48, 172-185.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Category 2	Water resource management		
Method(s)	Other		

The JMP indicator for basic sanitation does not include wastewater treatment. The authors assess the data availability on global wastewater treatment and make recommendations toward an indicator of global wastewater treatment performance in the context of the formulation of the SDG agenda.

International databases on wastewater treatment are maintained by UNDS (82 countries), OECD (31 countries), the Pinsert Makers Water Yearbook and FAO. These databases have several limitations e.g. data at urban level is used to represent entire countries, definitions vary and inconsistent reporting over time. The authors propose a utility based indicator: the weighted average of volumes of wastewater treated at all utilities in a country, normalized by the population served by a given utility.

Quote

To address the gap in available, comparable national wastewater treatment data, this paper presents the first-ever dataset of a country-level wastewater treatment indicator at the global scale. Our immediate goal was to develop an indicator of water quality to include in the 2014 edition of the Environmental Performance Index (EPI), a biennial global ranking of country performance on a range of environmental issues (Hsu et al., 2014). A secondary objective was to evaluate the global availability of national data to assess wastewater treatment to inform current proposals for a wastewater treatment indicator in the UN SDG process.' p173.

Martínez, J., Mboup, G., Sliuzas, R., & Stein, A. (2008). Trends in urban and slum indicators across developing world cities, 1990-2003. *Habitat International*, 32(1), 86-108.

Category 1 Inequality Subcategory 1 Urban
Method(s) Statistical analysis of secondary sources

Improved information is needed to meet the MDGs. Martinez et al. (2008) analyse trends in the living conditions, including water and sanitation access, of slum and non-slum populations over the period 1990-2003. The data source used for the analysis is the UN HABITAT's Global Urban Indicators Database (UIP-III). 188 cities have been included, though in many cities only partial data sets are available.

There is general improvement in various slum indicators, such as durable structures, access to safe water and access to improved sanitation. Improvement in access to safe water is met through decentralised water systems. A piped drinking water network is often not extended to informal settlements and there is little progress in this area. While the median access to safe water in urban areas remains above 90% between 1990 and 2003, the median connection to piped water fluctuated between 56% and 65% in the same period. Only 20 cities had data on access to piped water. In informal settlements, citizens depend on onsite sanitation e.g. improved pit latrines, septic tanks. The median percentage of households connected to sewers has increased from 44% to 70%. Sub-Saharan Africa is worse off in access to safe water and improved sanitation than other MDG regions, progress has been below other MDG regions. Households connected to sewers only make up for 13% of the population.

Quote

This evidence supports the importance of promoting and adopting large-scale slum improvement programmes and their relevance in the achievement of the MDGs. This sustains the concerns of some researchers (see Satterthwaite, 2003) about ignoring the urban issue when reporting that urban poverty is less serious than rural poverty and that "it has little or no relevance to the achievement of the MDGs" (see Sabn & Stijel, 2003; in Satterthwaite, 2003). It also points to the urgent need to develop and promote innovations in proactive approaches to shelter and servicing that provide accessible alternatives for the world's growing urban population and especially for the urban poor. p104.

N

Ndulu, B. J. (2006). Infrastructure, regional integration and growth in Sub-Saharan Africa: Dealing with the disadvantages of geography and sovereign fragmentation. *Journal of African Economies*, 15, 212-244.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Literature review

The author, a World Bank staff member, makes a case for the expansion of infrastructure in the light of the MDGs, including water supply infrastructure, for economic growth and poverty reduction.

Quote

'Much of the effort to create the conditions for growth in Africa has emphasised how government policy and behaviour has increased risk and barriers to competition—dealing with 'sins of commission.' Governments also have an important role in providing public goods, supporting the provision of infrastructure, and addressing market failures. The under-provision of these can significantly increase costs to firms and make potential opportunities unprofitable— hence, they are 'sins of omission'. The background papers for the Africa Commission correctly identify three fundamental constraints to Africa's future prosperity: geography, market integration and institutions. The papers encourage government action and international support to ameliorate the effects of these constraints.' p237.

O

O'Reilly, K. (2010). Combining sanitation and women's participation in water supply: An example from Rajasthan. *Development in Practice*, 20(1), 45-56.

Category 1 Inequality Subcategory 1 Gender

Method(s) Other

Women participation is seen as integral to meeting MDG 7c. The author studied the way women benefitted from a latrine building project. She researched a German-funded project in rural Rajasthan, India from 1997 to 2005, providing latrines in rural areas with the aim of improving sanitation and hygiene. Because of cultural norms, women in this area are not supposed to relieve themselves during the day out in the open field. Women, who do not possess an indoor latrine, wait until dark.

The project did not have the intended effect. The project did not change the cultural norm. The latrine was built on the premise, near the road. The exposed location was considered unsuitable for women. The latrine was seen as a status symbol, not as a way to promote health. Generally, men and guests used the latrines.

Quote

'Women may be the agents best able to promote sanitation among other women, but a host of other factors (for example, latrines as status symbols) play a role in determining whether women do or do not use latrines.' p53.

Okurut, K., Kulabako, R. N., Abbott, P., Adogo, J. M., Chenoweth, J., Pedley, S., et al. (2015). Access to improved sanitation facilities in low-income informal settlements of East African cities. *Journal of Water Sanitation and Hygiene for Development*, 5(1), 89-99.

Category 1 Inequality Subcategory 1 Urban

Method(s) Multiple methods

Attempts to increase access to improved sanitation as defined by JMP in low-income informal settlements have yielded slow progress. The authors present an assessment of access to sanitation and barriers to household uptake of improved sanitation facilities in low income areas in Kampala (Uganda), Kigali (Rwanda) and Kisumu (Kenya). A household assessment was conducted including 5387 households in the eight settlements of the three cities between May and September 2012. The samples sizes for Kigali (n ¼

1,794), Kampala (n = 1,666) and Kisumu (n = 1,927) were determined using the national statistics. Qualitative data was collected: in total 23 focus group discussions and 97 interviews were held.

The authors found high levels of open defecation in Kisumu (17.3%). Education and property ownership are brought forward as key determinants when it comes to open defecation. The percentage of the population using private toilets without self-reported problems is very low: respectively 7.5% in Kigali, 6.1% in Kampala and 0.1% in Kisumu. In Kigali, 99% of the population does not safely empty the latrine they own, compared to 1% in Kampala and Kisumu. Often latrines are manually emptied and faecal sludge is poured in trenches nearby; in other cases the pit is simply closed. The barriers to access improved sanitation varied between the three cities: Kigali has many unimproved technologies and needs education on appropriate technologies and opening up the market for sanitation service providers like constructors and emptiers; Kampala relies on public toilets that are constructed far from the users' homes; and Kisumu has the highest number of shared toilets that are emptied without consideration for hygiene, high levels of open defecation and hence the need for social interventions.

Quote

'More than half of the respondents (59.7%) reported using sanitation facilities that are included in the WHO/UNICEF Joint Monitoring Programme definition of improved sanitation. However, a high proportion of these facilities did not provide access to basic sanitation. Less than 5% of all the respondents did not report problems related to sustainable access to basic sanitation.' p89.

Onda, K., LoBuglio, J., & Bartram, J. (2012). Global access to safe water: Accounting for water quality and the resulting impact on MDG progress. *International Journal of Environmental Research and Public Health*, 9(3), 880-894.

Category 1 Indicator for safe water and sanitation Subcategory 1 Indicator for safe water
Method(s) Statistical analysis of secondary sources

The authors used RADWQ data to adjust JMP estimates for access to safe water. A Principal Components Analysis (PCA) was used to predict the percentage of piped and of other-improved water supplies that are faecally contaminated; and of these sources, the percentage lacking basic sanitary protection against contamination.

Extrapolating RADWQ data, it is estimated that 1.8 billion people (28% of the global population) used unsafe water in 2010. The JMP estimate is that 783 million people (11%) used unimproved sources in 2010.

Quote

'While these estimates are imprecise, their magnitude and health and development implications suggest that greater attention is needed to better understand and manage the problem of contamination of improved water sources.' p892.

R

Rajaraman, I., & Gupta, M. (2016). Preserving the incentive properties of statutory grants. *Economic and Political Weekly*, 51(9), 79-84.

Category 1 Political and administrative challenges
Method(s) Other

A financial analysis of statutory grants in India: grants transferred from the central government, through states, to local governments, for basic services, such as sewerage, solid waste management, water supply,

road maintenance, in the period 2010-2015. According to the authors, 'local governments are the nodes at which the Sustainable Development Goals for improved sanitation and public health have to be delivered. This is the level at which public finance attention has to be focused.'

The authors draw a number of conclusions. The basic flow is not steady each year. In urban areas, the shortfall peaks at 20%, in rural areas at 15%. Ten of the 28 states did receive their rural basic grant in full every year, as did eight states for the urban basic grant. States must meet certain conditions to be eligible for the performance grant. Two rural and six urban states qualified in an earlier year of the period but not routinely qualify in years following, still received the performance grant. The performance grants do not cover allocations, there an aggregate shortfall of 25%. Six states did not qualify for the rural performance grant in any year and 11 did not qualify for the urban grant. The authors did not find a justification; why these states do not meet the criteria.

Quote

'The key public goods with a local spatial reach - sewerage, solid waste management, water supply, road maintenance - can reliably be supplied by local government only if the funding stream, whether from own revenue or external grants, is steady.' p79.

Rouse, M. (2014). The worldwide urban water and wastewater infrastructure challenge. *International Journal of Water Resources Development*, 30(1), 20-27.

Category 1 Political and administrative challenges

Method(s) Literature review

The author discusses what is needed to achieve water and wastewater infrastructure coverage in the context of the post-2015 SDG's.

Universal access to water and wastewater networked infrastructure is affordable, according to the author, as the costs of not having access are greater than the investment required to achieve it. The author stresses the importance of maintenance, cost recovery, strategic planning, innovation and regulation.

Quote

'Achieving universal access to water and sanitation services of a required standard will take time. It is a matter not only of financing and building the infrastructure but also of the need for improved governance, capacity building and training to achieve effective operations and maintenance for sustainability.' p24.

S

Santos, M. E. (2013). Tracking poverty reduction in Bhutan: Income deprivation alongside deprivation in other sources of happiness. *Social Indicators Research*, 112(2), 259-290.

Category 1 Inequality Subcategory 1 National

Method(s) Statistical analysis of secondary sources

This paper focuses on multidimensional poverty reduction in Bhutan, based on the 2003 and 2007 Bhutan living standard survey. The method used captures the proportion of weighted deprivations that the poor experience in a society out of all the total potential deprivations that the society could experience (Alkire and Foster, 2007 and 2011). The indicators weighted were: consumption expenditure, education and health of the household, access to clean water and improved sanitation (MDG/JMP indicators) and clean cooking fuel, access to electricity and number of people per room.

Since the late 1980s, Bhutan has established the Gross National Happiness Index (GNH) based on four pillars: (1) sustainable development, (2) preservation and promotion of culture, (3) conservation of the environment and (4) good governance. Within this approach, the Millennium Development Goals (MDGs) have become core development priorities in the country. The analysis shows that poverty has reduced significantly from 2003 to 2007. Progress has made in several areas: access to roads, electricity, water, sanitation, and education. According to the authors, it seems likely the above may be attributed to Bhutan's pro-poor policies.

Quote

Fourthly, we consider the MDG 7: ensure environmental sustainability. Two of the considered indicators within this goal are usual MDG indicators: access to clean water and improved sanitation. Bhutan has progressed significantly in increasing access to both, yet much more progress can be made.' p266 and 267.

Sanusi, Y. A. (2010). Water, sanitation and human development in urban fringe settlements in Nigeria. *Theoretical and Empirical Researches in Urban Management*, 8(8), 14-29.

Category 1 Inequality Subcategory 1 Urban
Method(s) Multiple methods

Against the background of MDG 7c, the authors assess the state of water supply and sanitation in five fringe settlements of Minna, Nigeria. 75 household surveys were conducted in the settlements unserved by the formal water utility. The Questions were posed on sources of water supply, location, adequacy, coping mechanisms to water inadequacy, water quality and treatment, as well as water fetching practices. Furthermore, the survey included questions on type of location and conditions of toilets, waste water disposal, solid waste type and disposal, and knowledge of sanitation campaign. In addition, focus groups were held to gain insight into challenges faced by women.

The settlements Dama (550 inhabitants), Jatapi (600 inhabitants), Gidan Kwano (700 inhabitants), Epigi (450 inhabitants) and Lunko (500 inhabitants) depend on wells, streams and boreholes for drinking water. Households treat the water by boiling (17%) and adding alum (89%). In all settlements, the water quantity is less than 10 liters per person. The water sources are affected by the seasonal variations: during heavy rains the water is reported to be polluted, while the sources dry up in the dry season. Women and children must walk longer distances in order to fetch water. 68% of the population practices open defecation, 31% uses pit latrines. 95% of the population wishes they had better sanitation.

Quote

The present state of water and sanitation in these settlements connote low human development and stand at risk to the health of the people. The danger of serious impact on health with current urbanization of these settlements calls for re-evaluation of a laissez-faire approach that leaves the residents to informal adjustment.' p14.

Satterthwaite, M. (2014). On rights-based partnerships to measure progress in water and sanitation. *Science and Engineering Ethics*, 20(4), 877-884.

Category 1 Inequality Subcategory 1 Human rights
Method(s) Other

A short commentary describing the work of the Equity and Non-Discrimination Working Group (JMP END Working Group), one of the four working groups developing post-2015 targets and indicators for the water and sanitation sector in 2012. The working group is led by UN Special Rapporteur on the Human

Right to Safe Drinking Water and Sanitation, Catarina de Albuquerque. The author served as a Rapporteur for the END group.

The indicators proposed by the END group depart from the core Human Rights principles: equality and non-discrimination. Following these principles, the END group proposed SDG targets and indicators. The group recommended to collect disaggregated data on rich/poor groups, urban/rural, slums/formal urban settlements, disadvantaged groups/general population. The progress of the worst-off and the better off is calculated and translated into a 'disparity in use' index; the gap between percentages of the better off and worst-off using the services under each target.

Quote

'The debate over post-2015 goals, targets, and indicators related to water and sanitation has been the locus for a meeting of minds among human rights lawyers, development practitioners, and economists. The water and sanitation sector, represented by major UN agencies, development partners, and implementing NGOs has embraced the right to water and sanitation and has worked to operationalize the rights-based approach through discussions about the post-2015 development framework.' p879.

Satterthwaite, D. (2016). Missing the Millennium Development Goal targets for water and sanitation in urban areas. *Environment and Urbanization*, 28(1), 99-118.

Category 1	Inequality	Subcategory 1	Urban
Category 2	Indicator for safe water and sanitation	Subcategory 2	Indicator for safe water and sanitation
Method(s)	Statistical analysis of secondary sources		

A review of progress towards the MDG 7c for water and sanitation in urban areas, including informal settlements from 1990-2015. This article fits within different categories as it criticizes JMP methods of measuring access to water and sanitation, including the indicator for safe water and improved sanitation.

JMP provides insufficient data to assess sustainable access to water and sanitation. The water sources and sanitation facilities represent a large spectrum in terms of quality. From the way JMP measures access to water and sanitation, it is unclear if water is suitable for drinking and if latrines are emptied and sludge treated. According to JMP, 95% of the urban population has drinking water from an improved source. 75% is connected to a piped network. Zooming in on the least developed countries, only 32% of the urban population had piped water on premises in 2015. In Sub-Saharan Africa only 33% of the urban population had piped water on premises in 2015 compared to the 43% in 1990. 57 countries missed data on improved sanitation and could not be assessed. Based on JMP data, the proportion of the urban population with improved sanitation increased from 79% to 82% between 1990 and 2015; for low- and middle-income nations, it went from 69% to 77%, and for the least developed countries, from 37% to 47%. There is no data on sewage connection and treatment. Current types of sanitation e.g. pit latrines, seen as improved sanitation, are unsuitable for the densities of urban areas and may lead to groundwater contamination. The author questions the drop in slums in urban areas, this may be attributed to the fact the definition of a slum is, among other criteria, based on JMP's definition of improved water and sanitation. JMP's definition is less strict than UN-Habitat previous definition of access to water and sanitation.

Quote

'Any sanitation intervention that is not connecting toilets to sewers needs to take account of the collection, disposal and treatment of the faecal matter. If toilet wastes are going to a septic tank, is this actually working? Many simply push their untreated liquid wastes into local and often open drains. For pit latrines of various kinds, can they be emptied easily? And is there a local treatment plant that can treat the wastes? Usually not. Conventional pit-emptying trucks are often of no use in informal settlements because there is no road access or

roads are too steep or muddy. Cheap yet effective systems for disposing of waste are difficult in urban contexts. The journey time between latrines or septic tanks and the treatment plant has to be short, and often it is not. This raises costs. Another concern is that toilet wastes in pit latrines may well be contaminating groundwater sources. In many urban contexts, toilets are shared by two or three adjoining households. Community-managed public toilets and washing facilities are often the most appropriate solutions that can be practically implemented, yet these are considered 'unimproved' by the JMP.' p101.

Schaub-Jones, D. (2010). Should we view sanitation as just another business? The crucial role of sanitation entrepreneurship and the need for outside engagement. *Enterprise Development and Microfinance*, 21(3), 185-204.

Category 1 Political and administrative challenges Subcategory 1 Privatisation
Method(s) Other

The MDG target on sanitation lags well behind others. In low and middle income countries, the sanitation sector consists of a large number of private providers. The author discusses ways to strengthen the sanitation market. The paper is based on professional experience and literary sources.

There is a lack of data on the sanitation sector in terms of type of clients served by small-scale providers and the affordability of the service to low-income groups. Schaub-Jones sees room for intervention for 'outsiders': the public sector, donors, NGO's and CBO's. These interventions are categorized in the following way: (1) to expand the sanitation market to reach poorer households; (2) to encourage sanitation markets to be more efficient; and (3) to regulate unsanitary practices that impact public health.

Quote

Providers of services range from the masons that build household latrines to the entrepreneurs that build and run toilet blocks, from manual pit emptiers to privately-run vacuum trucks. Customers for these services are perhaps even more diverse, from pay-and-go users of toilet blocks to landlords letting out accommodation, from homemakers making home improvements to tenants emptying a shared latrine. Most sanitation transactions taking place in this context have little direct involvement of public authorities.' p188.

Shelus, V., & Hernandez, O. L. (2015). The usefulness of a handwashing indicator in large household surveys. *Journal of Water Sanitation and Hygiene for Development*, 5(4), 565-573.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for basic sanitation
Method Statistical analysis of secondary sources

The post-2015 SDG agenda may include indicators for hygiene. The aim of this study is to test the usefulness of a proxy for handwashing: the presence of functional hand washing stations. A multivariate analysis is used to see if there is link between this specific proxy for hand washing and child diarrheal disease. The analysis is based on the Demographic Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS) data from five sub-Saharan African countries: Ethiopia, Ghana, Malawi, Sierra Leone, and Zimbabwe.

The study 'presents limited to moderate evidence supporting the potential usefulness of an Indicator for tracking hand washing practices: the presence of a functional HWS with needed supplies.'

Quote

Low handwashing rates worldwide, and especially in low and middle income countries, call for programs to promote good hygiene. In such programs it is crucial to track the effectiveness of efforts to change practices. This

requires reliable measures of the practice. However, tracking handwashing practices is difficult; self-reports may not be reliable. Because handwashing is a socially acceptable practice (even where prevalence is low) study participants may over-report this practice, resulting in 'respondent bias'. Manun'Ebo et al. (1997) detected over-reporting of handwashing before food preparation and eating, and Danquab (2010) found over-reporting of handwashing with soap after defecation. Thus, alternative methods for tracking handwashing practices are needed.' p566.

Snehalatha, M., & Anitha, V. (2012). India's Total Sanitation Campaign: Is it on the right track? Progress and issues of TSC in Andhra Pradesh. *Journal of Rural Development*, 31(2), 173-192.

Category 1 Political and administrative challenges

Method(s) Multiple method(s)

The Total Sanitation Campaign (TSC) is set up in India to increase access to improved sanitation and meet MDG7c. The authors present an evaluation of the TSC based on data from the online TSC monitoring website, from Department of Drinking Water Supply (DDWS), including budget documents. In addition, field data from IRC's WASHCost study were utilized. One of the authors works for IRC. The study focuses on India and the state Andhra Pradesh. The Total Sanitation Campaign was launched in 1999 and set targets until 2012. The program included the construction of 69 million Individual Household Latrines (IHHL), School Sanitation and Hygiene Education (SSHE), 25769 community sanitary complexes, 1,33,114 Anganwadi toilets.

From 2000-2010, 'it could be seen from Fig.1 that the targets reached in the last 10 years is below 56 % in IHHL for BPL though it is 79% in school toilets and 68% in Anganwadi toilets for all India, while the achievement per cent for Andhra Pradesh is 62.' Later, on the authors state, 'at all India level, the achievement targets of IHHL (35.34 %) was much lesser as compared with the achievements of school toilets (69.75 %) and anganwadi toilets (63.46%).' Less than 35% of the budget latrines was spent as intended, except for school sanitation and anganwadi toilets. The panchayats (traditional local governments) did not receive the grants or decide to spend it where they see the need. Information, communication and education are important components in a country where 74% of the rural population considers open defecation acceptable. Though this component was included in the TSC, in reality the budget was spent on infrastructure. The sanitation built remains often unused because of cultural norms.

Quote

'Village Water and Sanitation Committees (VWSC) do not exist in the villages and the water and sanitation component is given least priority by the Panchayat.' p190.

Sorenson, S. B., Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. *Social Science and Medicine*, 72(9), 1522-1526.

Category 1 Inequality Subcategory 1 Gender

Category 2 Indicator for safe water and basic sanitation Subcategory 2 Indicator for safe water

Method(s) Statistical analysis of secondary sources

An analysis of gender differences with regard to water fetching, based on the MICS-3 survey in 44 countries, used by the JMP. The authors disagree on the indicators currently used and make recommendations for new indicators.

In most households, women are responsible for water fetching (58.7%), followed by men (30.7%) and children (9.1%). There is a positive association between women fetching water and access to unimproved sources ($r=0.35$). The association is higher when the improved source is not on the premise ($r=0.43$). Currently, UNICEF considers an improved source to be a source at 1 km distance. According to JMP, to provide for the minimal daily needs of one person, the water fetcher would carry a container for 0.62 miles, obtain about 5 gallons of water, and walk back 0.62 miles bearing roughly 44 pounds of water. The authors propose other indicators that account for water fetching: time spent, caloric expenditure and opportunity costs.

Quote

Women and children are the most common water carriers, and they spend considerable time (many trips take more than an hour) supplying water to their households. Time is but one measure of the cost of fetching water; caloric expenditures, particularly during droughts, and other measures that affect health and quality of life must be considered. The full costs of fetching water must be considered when measuring progress toward two Millennium Development Goals - increasing access to safe drinking water and seeking an end to poverty.’ p1522.

T

Tukahirwa, J. T., Mol, A. P. J., & Oosterveer, P. (2013). Comparing urban sanitation and solid waste management in East African metropolises: The role of civil society organizations. *Cities*, 30(1), 204-211.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Category 2 Urban Subcategory 2 Inequality

Method(s) Multiple methods

Sanitation and wastewater services have received attention as a result of MDG7c. These services are to a large extent delivered by NGO’s and CBO’s in low and middle income countries, yet not much is known about the result. The authors present a comparative analysis of NGO/CBO waste collection and sanitation services in Kampala, Nairobi and Dar es Salaam based on interviews, direct observations and a survey in informal settlements. The survey was conducted with 337, 206 and 200 households for Kampala, Nairobi and Dar es Salaam respectively. Questions were asked regarding respondents’ characteristics, their access to NGO/CBO services, as well as their experiences and opinions regarding services of NGOs/CBOs. The theoretical point of departure is institutional pluralism. The term ‘refers to situations where individuals or organizations act within multiple institutional spheres. Individuals and organizations are then confronted with two or more sets of ‘rules of the game’ at the same time, and hence are subject to and have to cope with multiple regulatory regimes and multiple normative orders.’

‘Institutional pluralism’ is a way of describing how sanitation and solid waste is managed in Kampala, Nairobi and Dar es Salaam: ‘the three cities consist of plural systems with a multitude of institutions, both formal and informal.’ According to the authors this has been accelerated by the government’s incapacity to provide those services as by the neoliberal (donor) policies that facilitated privatization of most public service. Almost all, private and public, organizations rely on donor funding. All three cities rely to a large extent on NGO’s and CBO’s for the provision of sanitation in low income areas. In Kampala, these organizations are recognized by the government, who set up the Uganda Water and Sanitation NGO network. In Dar es Salaam and Nairobi there is limited cooperation between NGO’s, CBO’s and the government. 50% of the respondents were satisfied with the services delivered by NGOs and CBOs. Unsatisfied respondents often mention the poor maintenance of sanitation facilities when asked for an explanation.

Quote

Nonetheless, the contribution of NGOs/CBOs to sanitation and solid waste service delivery to the urban poor across the three cities is significant (see Tukahirwa, Mol, & Oosterveer, 2011; Tukahirwa et al., 2010; Ministry of Water and Environment, 2010; Schouten & Mathenge, 2010; ILO, 2007; Kassim & Ali, 2006; Karanja, 2005; Ikiara, Karanja, & Davies, 2004). Except for sanitation in Kampala, the contribution of these organizations to serving the poor is higher than that of governmental and private sector institutions.’ p208.

V

Van den Broek, M., & Brown, J. (2015). Blueprint for breakdown? Community Based Management of rural groundwater in Uganda. *Geoforum*, 67, 51-63.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Multiple methods: Ethnographic fieldwork, surveys and interviews

According to the authors, the belief that groundwater in rural areas is best managed according to the Community Based Management (CBM) model is the dominant paradigm across Sub-Saharan Africa. While donors and governments focus on increasing water access in the context of the MDGs and SDGs, a third of hand pumps are non-functional. The authors investigate the Community-Based Management of hand pumps, financed by a donor and implemented by an NGO, across Masindi and Kiryandongo districts in rural mid-west Uganda. Their study is based on ethnographic fieldwork, surveys and interviews.

Communities in Uganda are reluctant to pay water fees regularly to the water user commission in charge, as a result there are no funds for maintenance. Some water user commission members are threatened while trying to collect the fees. Water commissions were unable to enforce the lower grades of sanctions, such as public shaming and confiscation of jerry cans, on community members for non-payment. Top down CBM does not seem to work in Uganda.

Quote

‘The solution to the effective maintenance of handpumps is proving a formidable challenge, and central to achieving the sixth post-2015 Sustainable Development Goal are questions over who should finance the running costs of rural water points. It has been demonstrated conceptually and empirically that there are problems with commodification and within grassroots approaches, and collectively the CBM model is undermined once the voluntary service of the WUC moves towards commodification. Reforms within the CBM paradigm do not offer any guarantee of improved outcomes - they do not overcome the central failings of willingness to pay and to participate. In sum the CBM model has turned out to be a blueprint for breakdown.’ p61.

W

Welle, K. (2014). Monitoring performance or performing monitoring? Exploring the power and political dynamics underlying monitoring the MDG for rural water in Ethiopia. *Canadian Journal of Development Studies*, 35(1), 155-169.

Category 1 Political and administrative challenges

Category 2 Indicator for safe water

Method(s) Multiple methods

The author demonstrates the limitations of performance monitoring, ‘most prominently exemplified in the MDGs’. The case study focusses on the political dynamics behind diverging figures on water access in Ethiopia’s Southern region in 2008. Methods include document reviews, participant observation, and semi-structured interviews. For data analysis, the process tracing method was employed, a research methodology that traces the micro-steps and links that lead to a specific outcome (Bennett and George 2005a, 2005b). The findings in this article are based on document reviews, participant observation, and semi-structured interviews. For data analysis, the process tracing method was employed, a research methodology that traces the micro-steps and links that lead to a specific outcome (Bennett and George 2005a, 2005b).

In 2007, the regional Bureau of Water Resources reported access for the region as 69%, the zonal sector department reported it as 27%, while Woreda sector offices in the zone (lowest level) provided a figure of 12-15%, based on different information sources. Conflict arose in the same year, when the region was tormented by a drought. More than 50% of the population were judged to be in urgent need of water. Emergency reports and response operations that tankered water to communities in need contradicted the water access figures reported by the regional Bureau of Water Resources. The Minister visited the area to review the situation. Despite the critical situation, the Minister decided upon the method that delivered the highest access figures, as this reflected well on his own performance.

Quote

‘This article highlighted that monitoring processes can involve contestations over data and calculation methods; for example, the case of regular reporting in the Southern Region, the intervention of the Minister to impose his interpretation on the WRI results, and rows over internationally reported JMP figures versus national figures reported by MoWR. This emphasises the political nature of monitoring processes and the wider governance debates surrounding them. p165.’

Welle, K., Schaefer, F., Butterworth, J., & Bostoen, K. (2012). Enabling or disabling? Reflections on the Ethiopian national WASH inventory process. *IDS Bulletin*, 43(2), 44-50.

Category 1 Political and administrative challenges
Category 2 Indicator for safe water and basic sanitation
Method(s) Multiple methods

An analysis of the National WASH Inventory (NWI) in Ethiopia, through the lens of political economy. Observations, documents, training and workshops form the basis for this study. The authors investigate why the NWI remains underutilised.

The NWI is funded by international donors and financial institutes: UNICEF, the World Bank/Department for International Development (DFID) and the African Development Bank. It is in their interest to document the performance of government interventions. The Ministry of Water and Energy (MoWE) has a stake in the NWI ‘to assert its authority over the official progress achieved in the sector.’ The MoWE has repeatedly had differences over official water supply access figures with regional water offices but also with the Central Statistical Agency (CSA). The data collection has been done at regional level, using temporary staff rather than Water Officers who would stay on the job. The data collection is planned to be at Woreda level. However, not all woreda’s are well-equipped. Woreda’s without donor funding lack the resources to collect data.

Quote

One issue that emerges from the analysis is the mismatch between the clear bias in both the design and implementation of the NWI process towards interests at the central level, namely sector donors and the Federal Government, and the responsibilities for implementing WASH services in Ethiopia which are decentralised to the Woreda level. p49.

Wilbers, G. -, Sebesvari, Z., & Renaud, F. G. (2014). Piped-water supplies in rural areas of the Mekong delta, Vietnam: Water quality and household perceptions. *Water (Switzerland)*, 6(8), 2175-2194.

Category 1 Indicator for safe water
Method(s) Multiple methods

The focus of this study is the effectiveness of piped-water supply stations in the rural Mekong Delta, Vietnam, built to meet MDG 7c. The results are obtained through testing of water supplied by 41 facilities and 542 household interviews throughout the study region.

39% of the households interviewed had potential access to piped water. More than 50% of the respondents with access to a piped-water supply did not use this supply as a source of drinking water. The reasons for rejecting pipe water were high connection fees, the preference for other water sources and perceived poor quality and/or quantity. The water quality was lower when stations used ground water compared to stations that used surface water, in some cases both exceeded WHO drinking water standards. Management strategies should be developed to prevent (ground) water sources being polluted as well as improve water treatment.

Quote

'Although piped-water is considered to be a safe and clean water source by the national government, WHO and Vietnamese drinking water guidelines are exceeded at water supply stations in the selected study sites of the Mekong Delta in Vietnam for pH, turbidity, Cl, NH4, Fe, Hg, E. coli, and total coliforms (among the investigated parameters in this study). Furthermore, the quality of piped-water varies depending on location and intake source. Some piped-water supply stations that use groundwater resources were found to exceed drinking water guidelines for Cl, although this was not observed for supply stations using surface water. Due to overexploitation of groundwater resources in the MD for drinking, domestic and irrigation purposes, groundwater levels continue to drop which increases saline intrusion. Therefore, piped-water stations that use groundwater have a risk of becoming unsuitable, since desalination techniques are too expensive for this developing region.' p2190.

Z

Zaki, S., & Amin, A. T. M. N. (2009). Does basic services privatisation benefit the urban poor? Some evidence from water supply privatisation in Thailand. *Urban Studies*, 46(11), 2301-2327.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management
Category 2 Inequality Subcategory 2 Urban
Method(s) Survey

According to the authors, 'improving water and sanitation access has become a key global focus since the adoption of the MDGs'. Against this background, the authors study the effect of water supply privatization contract between the PWA (public authority) and the PTW (concessionaire) on water provision in low-income urban areas in Thailand. They present the analysis of a questionnaire survey of 212 urban households in Pathumthani municipality, Bangkok Metropolitan Region, of which 86 in informal communities. The questionnaire addresses water access, quality and price in 1998 and 2003, before and after the privatization.

Access to water by income-poor households throughout the municipality has increased from 50% in 1998 to 88.6% in 2003. In informal settlements water access has increased from 28 to 84% over the same period. The water was perceived to be of better quality after the privatization in terms of clarity, taste and turbidity. In informal settlements 95.5% of the respondents reported spending less or equal to 375 baht per month

in 1998, compared to 74% in 2003, a negative change of 21.5%. The negative change in the statistics on Income-poor households is 16.1%: declining from 91.7% to 75.6%.

Quote

The positive outcome of the scheme presented in this paper, in the form of improvement in access and quality, especially for the urban poor, seems to have resulted from a mix of market- and welfare-oriented policies. Instead of following a generalised neoliberal dictate, the scheme was structured and implemented by: divesting key components of the water supply service except tariff setting, which allowed the application of a cross-subsidy to avoid any potential adverse effect to the poor from privatisation; ensuring that, instead of a single large contract, the privatised components were unbundled and contracted separately for varying durations, which effectively mitigated the risk of privatising a natural monopoly such as water supply; and, motivating the company (PTW) to expand coverage to seek profit.'

Zawahri, N., Sowers, J., & Weinthal, E. (2011). The politics of assessment: Water and sanitation MDGs in the Middle East. *Development and Change*, 42(5), 1153-1178.

Category 1	Political and administrative challenges	
Category 2	Indicator for safe water and sanitation	Subcategory 2 Indicator for safe water and sanitation
Method(s)	Literature review	

The authors compare JMP figures on water and sanitation access in the Middle East and North Africa (MENA) region with participatory assessments, reports from other UN agencies, donor projects, domestic ministries and agencies and academic research.

The data sources offer a different picture than JMP of water and sanitation access in the MENA. JMP data collection in the MENA is based on outdated administrative boundaries instead of densities. Governments prioritize urban areas inside these administrative boundaries (UNDP and INP, 2004). Sanitation coverage is very low in informal areas (World Bank, 2008). The Palestinian refugee and Bedouin population is often not included in the equation. The water quality of improved sources is insufficient. This is backed by the 2008 Environmental Performance Index (EPI) for the MENA and the RADQW survey in Jordan. The EPI reveals that none of the MENA states achieve a score of more than 70, where 100 is classified as meeting international standards for water quality. Syria, Yemen, Algeria and Lebanon were not included, suggesting a lack of monitoring systems or data submission. In absence of water provided by the government, private providers in Lebanon and the West Bank deliver water against higher prices and without being subject to regulation. In rural and informal urban areas, the population often depends on septic tanks. The contents of the septic tanks are disposed nearby, threatening human health by contributing to water pollution and contamination. In Jordan the entire population in rural areas is not connected to a sewage system. Water treatment facilities have limited capacity in e.g. Jordan, secondary cities in Egypt and the Gaza strip.

Quote

Local and contextual factors that determine whether coverage is meaningful (Is water potable? How is sewage disposed of? Are sanitation networks maintained?) may drop out entirely. The result is assessment techniques that fail to capture the original MDG objectives to improve potable water and sanitation services.' p1170.

Zheng, Y., Hakim, S. A. I., Nahar, Q., van Agthoven, A., & Flanagan, S. V. (2013). Sanitation coverage in Bangladesh since the Millennium: Consistency matters. *Journal of Water Sanitation and Hygiene for Development*, 3(2), 240-251.

Category 1 Inequality Subcategory 1 National
Method(s) Statistical analysis of secondary sources

The authors look at progress towards the MDG's target for sanitation in Bangladesh, based on DHS and MICS surveys between 1994 and 2009 in urban and rural areas, and urban slums. The surveys used different definitions. The authors applied WHO and UNICEF Joint Monitoring Program's 2008 definition for open defecation and improved/unimproved sanitation facilities to identify trends.

Bangladesh has increased sanitation coverage. 30% of the population had access to improved sanitation in 2006, the number increased to 57% in 2009. Open defecation has declined from 30% in 1994 to 6.8% in 2009, primarily due to progress in rural areas. Access to shared sanitation facilities increased from 13% in 2006 to 24% in 2009. The authors criticize JMP's decision to exclude shared facilities, which may be suitable in dense urban areas. Shared improved latrines are only slightly less clean than individual ones. Least progress is seen among the poorest quintile, this group relies on shared latrines. Open defecation among this group has declined from 60%, in 1997 to 20% in 2007.

Quote

'Re-analysis of household survey data of Bangladesh after applying a consistent definition for sanitation facilities as described in the WHO and UNICEF JMP 2008 report has found that Bangladesh is on track to meet its MDG target for sanitation of about 63% for 2015, assuming a more reasonable 1990 baseline value of 25%. However, due to its high population density, progress will likely slow down if improved sanitation facilities that are shared continue to be counted separately by JMP. In densely populated developing countries, the pros and cons of only counting individual household improved sanitation facilities towards the MDG target should be carefully weighed.' p249.

SUPPLEMENT
SYSTEMATIC
LITERATURE
REVIEW

INDEX

SCREENING THE SEARCH RESULTS

PAGE 3 - 9

CODING IN ATLAS TI

PAGE 10 - 15

ANALYSIS

PAGE 16 - 53

SCREENING THE SEARCH RESULTS

In line with the PRISMA methodology we selected articles on the basis of criteria for inclusion and exclusion. The researcher formulates and applies criteria for inclusion and exclusion to the publications found in databases. These criteria are first applied to the titles, subsequently to the abstracts and, last, the entire article. This screening process results in a sample. The sample is then analysed quantitatively and/or qualitatively, depending on the research question.

= Included / = Excluded

	Title	Abstract	Article
[Anonymous]. (1994). State department leader describes new U.S. commitment to women's rights. <i>ICPD 94 : Newsletter of the International Conference on Population and Development</i> , (14), 3-3. Anonymous author	<input checked="" type="checkbox"/>		
Adams, E. A., Boateng, G. O., & Amoyaw, J. A. (2016). Socioeconomic and demographic predictors of potable water and sanitation access in Ghana. <i>Social Indicators Research</i> , 126(2), 673-687.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adjei, P. O., & Kyei, P. O. (2013). Linkages between income, housing quality and disease occurrence in rural Ghana. <i>Journal of Housing and the Built Environment</i> , 28(1), 35-49.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adubofour, K., Obiri-Danso, K., & Quansah, C. (2013). Sanitation survey of two urban slum Muslim communities in the Kumasi metropolis, Ghana. <i>Environment and Urbanization</i> , 25(1), 189-207.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Agénor, P. -, Bayraktar, N., Moreira, E. P., & El Aynaoui, K. (2006). Achieving the Millennium Development Goals in Sub-Saharan Africa: A macroeconomic monitoring framework. <i>World Economy</i> , 29(11), 1519-1547. Excluded on criteria: Focus on MDG 7c or JMP. This article is building a model to assess whether countries have achieved the MDGs. Safe water is an indicator, but the authors touch upon the indicator safe very briefly and without any reflection or criticism.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Aguilar, M. D., & de Fuentes, A. G. (2007). Barriers to achieving the water and sanitation-related Millennium Development Goals in Cancún, Mexico at the beginning of the twenty-first century. <i>Environment and Urbanization</i> , 19(1), 243-260.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Anand, P. B. (2007). Right to water and access to water: An assessment. <i>Journal of International Development</i> , 19(4), 511-526.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Anand, P. B. (2007). Semantics of success or pragmatics of progress?: An assessment of India's progress with drinking water supply. <i>Journal of Environment and Development</i> , 16(1), 32-57.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Arku, F. S., Angmor, E. N., & Seddoh, J. -. (2013). Toilet is not a dirty word: Close to meeting the MDGs for sanitation? <i>Development in Practice</i> , 23(2), 184-195.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Ayalew, M., Chenoweth, J., Malcolm, R., Mulugetta, Y., Okotto, L. G., & Pedley, S. (2014). Small independent water providers: Their position in the regulatory framework for the supply of water in Kenya and Ethiopia. <i>Journal of Environmental Law</i> , 26(1), 105-128.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bain, R. E. S., Gundry, S. W., Wright, J. A., Yang, H., Pedley, S., & Bartram, J. K. (2012). Accounting for water quality in monitoring access to safe drinking-water as part of the millennium development goals: Lessons from five countries. <i>Bulletin of the World Health Organization</i> , 90(3), 228-235.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Baquero, Ó. F., Jiménez, A., & Pérez-Foguet, A. (2015). Reporting progress on the human right to water and sanitation through JMP and GLAAS. <i>Journal of Water Sanitation and Hygiene for Development</i> , 5(2), 310-321.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bartram, J., Brocklehurst, C., Fisher, M. B., Luyendijk, R., Hossain, R., Wardlaw, T., et al. (2014). Global monitoring of water supply and sanitation: History, methods and future challenges. <i>International Journal of Environmental Research and Public Health</i> , 11(8), 8137-8165.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Baum, R., Luh, J., & Bartram, J. (2013). Sanitation: A global estimate of sewerage connections without treatment and the resulting impact on MDG progress. <i>Environmental Science & Technology</i> , 47(4), 1994-2000.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Benn, J. (2006). Aid flow. <i>OECD Observer</i> , (254), 19-20. Excluded on criteria: peer-reviewed journal	<input type="checkbox"/>		
Bennett, H. B., Shantz, A., Shin, G., Sampson, M. L., & Meschke, J. S. (2010). Characterisation of the water quality from open and rope-pump shallow wells in rural Cambodia. <i>Water Science and Technology</i> , 61(2), 473-479.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Börkey, P., & Gillespie, B. (2006). Safe water: A quality conundrum. <i>OECD Observer</i> , (254), 16-18. Excluded on criteria: peer-reviewed journal	<input type="checkbox"/>		
Bremner, J. (2010). Improved sanitation. <i>Population Bulletin</i> , 65(2), 10-11. Article not available	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Brown, J., Vo Thi Hien, McMahan, L., Jenkins, M. W., Thie, L., Liang, K., et al. (2013). Relative benefits of on-plot water supply over other improved' sources in rural Vietnam. <i>Tropical Medicine & International Health</i> , 18(1), 65-74.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Butala, N. M., VanRooyen, M. J., & Patel, R. B. (2010). Improved health outcomes in urban slums through infrastructure upgrading. <i>Social Science and Medicine</i> , 71(5), 935-940.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Butler, J. R. A., Suadnya, W., Puspadi, K., Sutaryono, Y., Wise, R. M., Skewes, T. D., et al. (2014). Framing the application of adaptation pathways for rural livelihoods and global change in Eastern Indonesian islands. <i>Global Environmental Change</i> , 28, 368-382. Excluded on criteria: Focus on MDG target 7c for water and/or sanitation, focus on climate change instead	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Castro, J. E. (2007). Poverty and citizenship: Sociological perspectives on water services and public-private participation. <i>Geoforum</i> , 38(5), 756-771.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Chandrasekhar, S., & Mukhopadhyay, A. (2012). Multiple dimensions of urban well-being: Evidence from India. <i>Asian Population Studies</i> , 8(2), 173-186.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cho, D. I., Ogwang, T., & Opio, C. (2010). Simplifying the Water Poverty Index. <i>Social Indicators Research</i> , 97(2), 257-267.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cotton, A., & Bartram, J. (2008). Sanitation: On- or off-track? Issues of monitoring sanitation and the role of the joint monitoring programme. <i>Waterlines</i> , 27(1), 12-29	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Cuesta, J. (2007). Child malnutrition and the provision of water and sanitation in the Philippines. <i>Journal of the Asia Pacific Economy</i> , 12(2), 125-157. Excluded on criteria: MDG target water and/or sanitation, instead a focus on the target for nutrition. We have mentioned the link health and water and sanitation access in the introduction.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
De Gisi, S., Petta, L., & Wendland, C. (2014). History and technology of Terra Preta sanitation. <i>Sustainability (Switzerland)</i> , 6(3), 1328-1345.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Doherty, H. (2009). Vital signs. <i>World Watch</i> , 22(3), 31. Excluded on criteria: MDG target water and/or sanitation, instead a focus on child mortality	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Engel, S., & Susilo, A. (2014). Shaming and sanitation in Indonesia: A return to colonial public health practices? <i>Development and Change</i> , 45(1), 157-178.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Erni, M., Drechsel, P., Bader, H. -, Scheidegger, R., Zurbruegg, C., & Kipfer, R. (2010). Bad for the environment, good for the farmer? Urban sanitation and nutrient flows. <i>Irrigation and Drainage Systems</i> , 24(1-2), 113-125.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fein, R. (2012). Better housing as Millennium Development Goal - Examples from Addis Abeba. [Schöner wohnen als entwicklungsziel - Einschätzungen aus Addis Abeba] <i>Geographische Rundschau</i> , 64(11), 20-27. Excluded on criteria: in the English language, in German instead.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Fisher, K. T. (2008). Politics and urban water supply. <i>Development</i> , 51(1), 30-36.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flores Baquero, O., Jiménez Fdez. de Palencia, A., & Pérez Foguet, A. (2016). Measuring disparities in access to water based on the normative content of the human right. <i>Social Indicators Research</i> , 127(2), 741-759	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flörke, M., Kynast, E., Bärlund, I., Eisner, S., Wimmer, F., & Alcamo, J. (2013). Domestic and industrial water uses of the past 60 years as a mirror of socio-economic development: A global simulation study. <i>Global Environmental Change</i> , 23(1), 144-156.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Garriga, R. G., & Foguet, A. P. (2013). Water, sanitation, hygiene and rural poverty: Issues of sector monitoring and the role of aggregated indicators. <i>Water Policy</i> , 15(6), 1018-1045. Focus on MDG 7c or JMP, the article deals with local policy making	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gates, S., Hegre, H., Nygård, H. M., & Strand, H. (2012). Development consequences of armed conflict. <i>World Development</i> , 40(9), 1713-1722. Excluded on criteria: Focus on MDG 7c or JMP	<input checked="" type="checkbox"/>		
Ghosh, D. K. (2009). Millennium Development Goals and the role of Panchayats: Exploring through west Bengal Case. <i>Journal of Rural Development</i> , 28(3), 381-407.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Gine-Garriga, R., Jimenez-Fernandez de Palencia, A., & Perez-Foguet, A. (2013). Water-sanitation-hygiene mapping: An improved approach for data collection at local level. <i>Science of the Total Environment</i> , 463, 700-711. Excluded on criteria: focus on MDG 7c or JMP, no reference to MDG 7c or JMP in abstract, only in the abbreviation section	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Glaser, G. (2012). Base Sustainable Development Goals on science. <i>Nature</i> , 491(7422), 35-35. Excluded on criteria: Article in peer reviewed journal, this is a research note	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Grobicki, A., MacLeod, F., & Pischke, F. (2015). Integrated policies and practices for flood and drought risk management. <i>Water Policy</i> , 17, 180-194. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Gunawardana, I. P. P., & Galagedara, L. W. (2013). A new approach to measure sanitation performance. <i>Journal of Water Sanitation and Hygiene for Development</i> , 3(2), 269-282.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Günther, I., & Fink, G. (2013). Saving a life-year and reaching MDG 4 with investments in water and sanitation: A cost-effective policy? <i>European Journal of Development Research</i> , 25(1), 129-153. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Gupta, J. (2015). Normative issues in global environmental governance: Connecting climate change, water and forests. <i>Journal of Agricultural & Environmental Ethics</i> , 28(3), 413-433. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Gutierrez, E. (2007). Delivering pro-poor water and sanitation services: The technical and political challenges in Malawi and Zambia. <i>Geoforum</i> , 38(5), 886-900.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Hadipuro, W. (2007). Water supply vulnerability assessment for sustainable livelihood. <i>Journal of Environmental Assessment Policy and Management</i> , 9(1), 121-135.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Holden, P. (2016). The Mediterranean and the Global Sustainable Development goals. <i>Mediterranean Politics</i> , 21(2), 292-299. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Hossain, K. Z., & Ahmed, S. A. (2015). Non-conventional public-private partnerships for water supply to urban slums. <i>Urban Water Journal</i> , 12(7), 570-580.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Hossain, M. S., Johnson, F. A., Dearing, J. A., & Eigenbrod, F. (2016). Recent trends of human wellbeing in the Bangladesh delta. <i>Environmental Development</i> , 17, 21-32.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Hsu, A. (2015). Measuring policy analytical capacity for the environment: A case for engaging new actors. <i>Policy and Society</i> , 34(3-4), 197-208. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Itama, E., Olaseha, I. O., & Sridhar, M. K. C. (2007). Springs as supplementary potable water supplies for inner city populations: A study from Ibadan, Nigeria. <i>Urban Water Journal</i> , 4(1), 19-27.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Jordanova, T., Cronk, R., Obando, W., Zeledon Medina, O., Kinoshita, R., & Bartram, J. (2015). Water, sanitation, and hygiene in schools in low socio-economic regions in Nicaragua: A cross-sectional survey. <i>International Journal of Environmental Research and Public Health</i> , 12(6), 6197-6217.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kassim, S. M., & Ali, M. (2006). Solid waste collection by the private sector: Households' perspective-findings from a study in Dar es Salaam city, Tanzania. <i>Habitat International</i> , 30(4), 769-780. Excluded on criteria: Focus on MDG target 7c or JMP, focus on solid waste instead	<input type="checkbox"/>		
Kite, G., Manuel Roche, J., & Wise, L. (2014). Leaving no one behind under the post-2015 framework: Incentivizing equitable progress through data disaggregation and interim targets. <i>Development (Basingstoke)</i> , 57(3-4), 376-387.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Koff, H., & Maganda, C. (2016). The EU and the Human Right to Water and Sanitation: Normative coherence as the key to transformative development. <i>European Journal of Development Research</i> , 28(1), 91-110.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Konak, N., & Sungu-Eryilmaz, Y. (2016). Does small run-of-river hydro power development in Turkey deliver on its sustainability premise? <i>Society & Natural Resources</i> , 29(7), 807-821. Excluded on criteria: Focus on MDG target 7c or JMP, focus on hydropower (energy)	<input type="checkbox"/>		
Laré-Dondarini, A. L. (2015). Analysis of household demand for improved sanitation: The case of green latrines in Dapaong city in northern Togo. <i>Canadian Journal of Development Studies</i> , 36(4), 555-572.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Larson, B., Minten, B., & Razafindralambo, R. (2006). Unravelling the linkages between the Millennium Development Goals for poverty, education, access to water and household water use in developing countries: Evidence from Madagascar. <i>Journal of Development Studies</i> , 42(1), 22-40.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Larsson, N. (2004). Green building strategies, policies and tools: The Canadian experience. <i>International Journal for Housing Science and its Applications</i> , 28(4), 323-345. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Lee, Y., 이정석, & 흥용석. (2015). Sustainable Development Goals and official development assistance: Focusing on the water & sanitation sectors. <i>Journal of Environmental Policy and Administration</i> , 23(2), 1-20. Excluded on criteria: In the English language, in Korean	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Levänen, J., Hossain, M., Lyytinen, T., Hyvärinen, A., Numminen, S., & Halme, M. (2016). Implications of frugal innovations on sustainable development: Evaluating water and energy innovations. <i>Sustainability (Switzerland)</i> , 8(1), 1-17. Excluded on criteria: Focus on MDG target 7c and/or JMP. The authors focus on sustainable development instead, without reference to MDG 7c.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lomoy, J. (2013). Towards new global development goals. <i>OECD Observer</i> , (296), 19-21. Excluded on criteria: peer reviewed journal	<input type="checkbox"/>		
Malik, O. A., Hsu, A., Johnson, L. A., & de Sherbinin, A. (2015). A global indicator of wastewater treatment to inform the Sustainable Development Goals (SDGs). <i>Environmental Science and Policy</i> , 48, 172-185.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Martínez, J., Mboup, G., Sliuzas, R., & Stein, A. (2008). Trends in urban and slum indicators across developing world cities, 1990-2003. <i>Habitat International</i> , 32(1), 86-108.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Montanarella, L., & Panagos, P. (2015). Policy relevance of critical zone science. <i>Land use Policy</i> , 49, 86-91. Excluded on criteria: Focus on MDG target 7c and/or JMP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Ndulu, B. J. (2006). Infrastructure, regional integration and growth in Sub-Saharan Africa: Dealing with the disadvantages of geography and sovereign fragmentation. <i>Journal of African Economies</i> , 15, 212-244.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Okurut, K., Kulabako, R. N., Abbott, P., Adogo, J. M., Chenoweth, J., Pedley, S., et al. (2015). Access to improved sanitation facilities in low-income informal settlements of East African cities. <i>Journal of Water Sanitation and Hygiene for Development</i> , 5(1), 89-99.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Onda, K., LoBuglio, J., & Bartram, J. (2012). Global access to safe water: Accounting for water quality and the resulting impact on MDG progress. <i>International Journal of Environmental Research and Public Health</i> , 9(3), 880-894.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
O'Reilly, K. (2010). Combining sanitation and women's participation in water supply: An example from Rajasthan. <i>Development in Practice</i> , 20(1), 45-56.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Patil, S. R., Arnold, B. F., Salvatore, A. L., Briceno, B., Ganguly, S., Colford, J. M., Jr., et al. (2014). The effect of India's Total Sanitation Campaign on defecation behaviors and child health in rural Madhya pradesh: A cluster randomized controlled trial. <i>Plos Medicine</i> , 11(8), e1001709. Excluded on criteria: focus on MDG 7c and/or JMP	<input type="checkbox"/>		
Peneva, D., & Ram, R. (2012). Trade policy and human development: A cross-country perspective. <i>International Journal of Social Economics</i> , 40(1), 51-67. Excluded on criteria: Focus on MDG 7c and/or JMP	<input type="checkbox"/>		
Pérez-Suárez, R., & López-Menéndez, A. J. (2015). Growing green? forecasting CO2 emissions with environmental kuznets curves and logistic growth models. <i>Environmental Science and Policy</i> , 54, 428-437. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Rajaraman, I., & Gupta, M. (2016). Preserving the incentive properties of statutory grants. <i>Economic and Political Weekly</i> , 51(9), 79-84.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Rasul, G. (2016). Managing the food, water, and energy nexus for achieving the Sustainable Development Goals in South Asia. <i>Environmental Development</i> , 18, 14-25. Excluded on criteria: Focus on MDG 7c or JMP's methods	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Richter, K., Benjamin, A. E., & Punpuing, S. (2009). Population and environment in Asia and the Pacific: Trends, implications and prospects or sustainable development. <i>Asia-Pacific Population Journal</i> , 24(1), 35-64+5. Not available.	<input type="checkbox"/>		

Rouse, M. (2014). The worldwide urban water and wastewater infrastructure challenge. <i>International Journal of Water Resources Development</i> , 30(1), 20-27.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Santos, M. E. (2013). Tracking poverty reduction in Bhutan: Income deprivation alongside deprivation in other sources of happiness. <i>Social Indicators Research</i> , 112(2), 259-290.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sanusi, Y. A. (2010). Water, sanitation and human development in urban fringe settlements in Nigeria. <i>Theoretical and Empirical Researches in Urban Management</i> , 8(8), 14-29.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Satterthwaite, D. (2016). Missing the Millennium Development Goal targets for water and sanitation in urban areas. <i>Environment and Urbanization</i> , 28(1), 99-118.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Satterthwaite, M. (2014). On rights-based partnerships to measure progress in water and sanitation. <i>Science and Engineering Ethics</i> , 20(4), 877-884.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Schaub-Jones, D. (2010). Should we view sanitation as just another business? the crucial role of sanitation entrepreneurship and the need for outside engagement. <i>Enterprise Development and Microfinance</i> , 21(3), 185-204.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Serrano, J. D. (2010). Access to water and sanitation in Veracruz: A local and institutional capabilities issue. [El acceso al agua y saneamiento: Un problema de capacidad institucional local análisis en el estado de Veracruz. <i>Gestión y Política Pública</i> , 19(2), 311-350. Excluded on criteria: In the English language, only available in Spanish	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Shelus, V., & Hernandez, O. L. (2015). The usefulness of a handwashing Indicator in large household surveys. <i>Journal of Water Sanitation and Hygiene for Development</i> , 5(4), 565-573.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sheuya, S. A. (2009). Urban poverty and housing transformations in informal settlements: The case of Dar-es-Salaam, Tanzania. <i>International Development Planning Review</i> , 31(1), 81-108. Excluded on criteria: Focus on MDG 7c and/or JMP's methods, focus on the effects of housing transformations on urban poverty	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Smith, L. C., & Haddad, L. (2015). Reducing child undernutrition: Past drivers and priorities for the post-MDG era. <i>World Development</i> , 68(1), 180-204. Excluded on criteria: Focus on MDG target 7c or JMP, focus is child nutrition instead	<input type="checkbox"/>		
Snehalatha, M., & Anitha, V. (2012). India's Total Sanitation Campaign: Is it on the right track? Progress and issues of TSC in Andhra Pradesh. <i>Journal of Rural Development</i> , 31(2), 173-192.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sorenson, S. B., Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. <i>Social Science and Medicine</i> , 72(9), 1522-1526.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sperling, J., Romero-Lankao, P., & Beig, G. (2016). Exploring citizen infrastructure and environmental priorities in Mumbai, india. <i>Environmental Science and Policy</i> , 60, 19-27. Excluded on criteria: Focus on MDG target 7c or JMP, focus only on SDGs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Srinivasan, U. T., Cheung, W. W. L., Watson, R., & Sumaila, U. R. (2010). Food security implications of global marine catch losses due to overfishing. <i>Journal of Bioeconomics</i> , 12(3), 183-200. Excluded on criteria: Focus on MDG target 7c or JMP	<input type="checkbox"/>		
Townsend, J. (2008). The Brazilian Amazon and the UN millennium goals. <i>Geography Review</i> , 22(1), 32-33. Excluded on criteria: article, this is a piece of two pages	<input type="checkbox"/>		
Tukahirwa, J. T., Mol, A. P. J., & Oosterveer, P. (2013). Comparing urban sanitation and solid waste management in East African metropolises: The role of civil society organizations. <i>Cities</i> , 30(1), 204-211.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Tyler, M. -, & Quinn, M. (2010). A social-spatial approach to ecological governance. <i>International Journal of Interdisciplinary Social Sciences</i> , 5(6), 73-86. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Uduku, O. (2015). Designing schools for quality: An international, case study-based review. <i>International Journal of Educational Development</i> , 44, 56-64. Excluded on criteria: Focus on MDG target 7c or JMP	<input checked="" type="checkbox"/>		
Van den Broek, M., & Brown, J. (2015). Blueprint for breakdown? Community based management of rural groundwater in Uganda. <i>Geoforum</i> , 67, 51-63.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Van Vuuren, D. P., Kok, M., Lucas, P. L., Prins, A. G., Alkemade, R., van den Berg, M., et al. (2015). Pathways to achieve a set of ambitious global sustainability objectives by 2050: Explorations using the IMAGE integrated assessment model. <i>Technological Forecasting and Social Change</i> , 98, 303-323. Excluded on criteria: Focus on MDG 7c or JMP's methods	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Welle, K. (2014). Monitoring performance or performing monitoring? exploring the power and political dynamics underlying monitoring the MDG for rural water in Ethiopia. <i>Canadian Journal of Development Studies</i> , 35(1), 155-169.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Welle, K., Schaefer, F., Butterworth, J., & Bostoen, K. (2012). Enabling or disabling? Reflections on the Ethiopian national WASH inventory process. <i>IDS Bulletin</i> , 43(2), 44-50.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Wilbers, G. -, Sebesvari, Z., & Renaud, F. G. (2014). Piped-water supplies in rural areas of the Mekong delta, Vietnam: Water quality and household perceptions. <i>Water (Switzerland)</i> , 6(8), 2175-2194.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Woodhouse, P. (2011). 'Environmental sustainability', agricultural intensification and water resource development in Sub-Saharan Africa. ["Sostenibilidad ambiental", agricultura intensiva y desarrollo de los recursos hídricos en África Subsahariana. <i>Revista De Economía Mundial</i> , (27), 149-170. Excluded on criteria: Focus on MDG target 7c or JMP, focus on agriculture instead	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Wouters, P., & Tarlock, A. (2012). The third wave of normativity in global water law: The duty to cooperate in the peaceful management of the world's water resources: An emerging obligation erga omnes? <i>Journal of Water Law</i> , 23(2), 51-65. Excluded on criteria: Focus on MDG target 7c or JMP, focus only on SDGs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Zaki, S., & Amin, A. T. M. N. (2009). Does basic services privatisation benefit the urban poor? some evidence from water supply privatisation in Thailand. <i>Urban Studies</i> , 46(11), 2301-2327.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Zawahri, N., Sowers, J., & Weinthal, E. (2011). The politics of assessment: Water and sanitation MDGs in the Middle East. <i>Development and Change</i> , 42(5), 1153-1178.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Zheng, Y., Hakim, S. A. I., Nahar, Q., van Agthoven, A., & Flanagan, S. V. (2013). Sanitation coverage in Bangladesh since the millennium: Consistency matters. <i>Journal of Water Sanitation and Hygiene for Development</i> , 3(2), 240-251.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
강부식. (2010). Natural resources liaison package deal program of international cooperation for climate change adaptation. <i>Korean Review of Crisis and Emergency Management</i> , 6(4), 119-138. Excluded on criteria: In the English language	<input checked="" type="checkbox"/>		

CODING IN ATLAS TI

In Atlas Ti, we identified the main themes in the debate on MDG 7c through the analysis of keywords. We found four main themes/categories and a number of subcategories.

<i>Publication</i>	<i>Keywords</i>	<i>Categories</i>
Adams et al. (2016)	Socio-economic dimensions - Socio-economic and demographic factors associated with access to potable water and improved sanitation facilities in Ghana	Inequality; national
Adjei and Kyei (2013)	Poverty, environment and health - Housing poverty and poor sanitation on health conditions in rural Ghana - reduced urban poverty - increased rural poverty	Inequality; national
Abudofour et al. (2013)	Sustainable access to safe drinking water and sanitation - Provision of these services by city authorities is often absent in slum settlements - field survey in two urban slums - Kumasi, Ghana	Inequality; urban
Aguilar and Fuentes (2007)	Barriers - Cancún, Mexico - safe water and improved sanitation services - political - different zones - urbanized areas - informal areas - newer low-income squatter settlements - Dramatic differences between zones in the quality of provision of water and sanitation - social and economic development model - various institutional considerations - attitudes and behavior of social actors	Inequality; urban Political and administrative challenges
Anand (2007a)	Whether the poor are more likely to have access to water when there is a Right to Water - small sample of countries where the right to water has been promulgated - links between MDGs and Human Rights	Inequality; Human Right to Water and Sanitation
Anand (2007b)	India - micro-level evidence does not tally with the national picture of 'tremendous progress' – policy implications – institutional mapping - inequality, quality and affordability - access to the poor - inequality - water supply -	Inequality; national Political and administrative challenges
Arku (2013)	Urban slum in Ghana - sanitary conditions were deplorable - financial, religious and other factors - urban communities	Inequality; urban
Ayalew et al. (2014)	Small independent water vendors are the only water supply option in peri-urban neighbourhoods - lack of regulation - access to water for the poor – recognized – regulated - regulatory framework – legal frameworks	Inequality; urban Political and administrative challenges
Bain et al. (2012)	The appropriateness of some indicators currently used to monitor access to safe drinking water - safe - Joint Monitoring Programme - improved or unimproved - quality of the water source	Indicator for safe water
Baquero et al. (2015)	Human right to water and sanitation - JMP - JMP-led post-2015 proposal - Non-discrimination and equality, access to information and participation and accountability are crosscutting issues	Inequality; Human Right to Water and Sanitation
Bartram et al. (2014)	International monitoring of water and sanitation - strength and limitations of current approaches - access	Indicators for safe water and basic sanitation

	and progress - Joint Monitoring Programme - JMP methods	
Baum and Bartram (2013)	Estimate of sewerage connections without treatment - sanitation component of MDGs - improved sanitation - Joint Monitoring Programme - improved sanitation facility	Indicator for basic sanitation
Bennett et al. (2010)	Water quality - open and rope-pump shallow wells - classification as unimproved and improved - Joint Monitoring Programme	Indicator for safe water
Brown et al. (2013)	Relative benefits of on-plot water supply - 'improved sources' - drinking water quality - piped water systems - 'improved water sources' outside the home	Indicator for safe water
Butala et al. (2010)	Health outcomes - urban slums - upgrades in slum household water and sanitation systems - slum upgrading in Ahmadabad - waterborne illness incidence - help achieve MDGs	Inequality; urban
Castro (2007)	Private sector participation - provision of water and sanitation services - reducing water poverty - public sector failure - essential services to the poor - imbalance - market-centred governance	Political and administrative challenges Inequality; national
Chandrasekhar and Mukhopadhyay (2012)	Urban well-being - urban poor and slum dwellers - policies to improve water and sanitation in slums - slum and non-slum areas	Inequality; urban
Cho et al. (2010)	Simplified and cost - effective indexes of water poverty - basic needs approach - investments - policy makers - better water-related policies and strategies	Inequality; methods
Cotton and Bartram	Monitoring sanitation - role of the Joint Monitoring Programme - the way JMP operates - strength and limitations	Indicator for basic sanitation
De Gisi et al. (2014)	Terra Preta sanitation - new holistic concepts - economically feasible closed loop sanitation systems - expensive end-of-pipe solutions - urine diversion - even in house sanitation systems	Water resource management
Engel and Susilo (2014)	Indonesia - Community-Led Total Sanitation - social shaming - participation - combines grassroots empowerment and neoliberal self-help doctrine - NGO's and the World Bank	Political and administrative challenges
Erni et al. (2010)	Sanitation - highly polluted surface water - nutrient flows - Khumasi - box-flow model - investment in flushing toilet - dominance of on-site sanitation - reduce the nutrient loads - water shortages	Water resource management
Fisher (2008)	Public sector failure - private sector - private sector to participate in urban water supply - political nature of urban water supply - Tabilaran	Political and administrative challenges
Flores Baquero et al. (2016)	Disparities in access to water - Human right - methodology to measure intra-community disparities - adequate tools for equity oriented policy making	Inequality; Human Right to Water and Sanitation

Florke et al. (2013)	Domestic and industrial water uses - global water use assessment - WaterGAP 3 model - water withdrawals and consumption - water for cooling - treated and untreated wastewater - reduction of untreated wastewater -securing water supply - new water-saving technologies	Water resource management
Gine Garriga and Perez Foguet (2013)	Rural poverty - sector monitoring - role of aggregated indicators - neediest must be prioritized - compare three different monitoring and evaluation approaches - standards indicators of the Joint Monitoring Programme	Indicators for safe water and basic sanitation
Ghosh, D. K. (2009).	Role of the panchayats (local government in rural areas) – drinking water – sanitation – State Government – rural-urban bias – non-governmental organisations – government officials – different tiers of panchayats	Inequality; national Political and administrative challenges
Gunawardana and Galagedera (2013)	Approach to measure sanitation performance - Joint Monitoring Programme - sanitation ladder - new and more comprehensive methodology - sanitation index for monitoring (SIM)	Indicator for basic sanitation
Gutierrez (2007)	Pro-poor water and sanitation services - Malawi and Zambia - challenges - political - rearrangements of weak state support - poor sectoral coordination - fragmented donor efforts	Inequality; national Political and administrative challenges
Hadipuro (2007)	Water supply vulnerability assessment - which half should be prioritized - methodology on water supply vulnerability assessment - policy makers	Inequality; methods
Hossain and Ahmed (2015)	Public-private partnerships - urban slums - deplorable social-environmental conditions in slums - public utilities are usually reluctant - policy hurdles - six slums of Dhaka cities - unconventional PPPs	Inequality; urban Political and administrative challenges
Hossain et. al (2016)	Human wellbeing - five dimensions - sanitation coverage - Bangladesh delta	Inequality; national
Itama et al. (2007)	Potable water supplies - water quality - inner city populations - Ibadan, Nigeria - potable water - minimum treatment - cost effective	Indicator for safe water
Jardonova et al. (2015)	Water, sanitation and hygiene – schools - Nigaragua - targets and indicators - non-household settings - schools and health centres	Indicators for safe water and basic sanitation
Kite et al. (2014)	Leaving no-one behind - equitable progress - data disaggregation - focuses on further operationalizing a post-2015 monitoring system - access to water and sanitation - stepping stone equity targets	Inequality; methods
Koff and Maganda (2016)	EU and Human Right to Water and Sanitation - post-2015 agenda - normative coherence - Policy Coherence for Development	Inequality; Human Right to Water and Sanitation
Laré-Dondarini (2015)	Green latrines - Daopong city, Togo - alternative systems of sanitation - costs of access - low-cost autonomous sanitation systems - environmental problems - sewage treatment - free output (urine and feaces) - agriculture - socio-economic determinants to uptake of green latrines	Water resource management

Larson et al. (2006)	Linkages - Poverty, education, access to water and water use - Madagascar - strong links between MDGs - determinants for access to safe water	Inequality; national
Malik et al. (2015)	Global indicator of wastewater treatment - lack of consistent definitions - wastewater treatment data - managing wastewater	Indicator for basic sanitation Water resource management
Martinez et al. (2008)	Trends in urban and slum indicators - developing world cities - slum and non-slum populations - various slum indicators - access to safe water and basic sanitation - importance of slum improvements	Inequality; urban
Ndulu (2006)	Infrastructure - invest in infrastructure - basic infrastructure to the poor; e.g. electricity, clean water roads - public investment in infrastructure - autonomous regulatory bodies - joint management of users of these services - user pay principles - exploiting the pre-existing capacity of the private sector	Political and administrative challenges
O'Reilly (2010)	Women's participation - gendered approaches to sanitation coverage - latrine building and women's participation - gendered political intervention - Rajasthan, India	Inequality; gender
Okurut et al. (2015)	Improved sanitation facilities - low-income informal settlements - East-African cities - informal settlements - inadequate sanitation - Joint Monitoring Programme - improved sanitation -	Inequality; urban Indicator for basic sanitation
Onda et al. (2012)	Global access to safe water - water quality - impact on MDG progress - improved and unimproved as an indicator - water safety - WHO and UNICEF - Rapid assessment of drinking water quality - feacally contaminated - estimate	Indicator for safe water
Rajamaran and Gupta (2016)	Statutory grants - local governments - improved sanitation - public finance - local grants - direct statutory flows - central government of India - key public goods - sewerage - water supply	Political and administrative challenges
Rouse (2014)	Urban water and wastewater infrastructure challenge - universal access to water and sanitation - extension of existing infrastructure - clear policies on objectives, priorities and service standards - infrastructure costs	Political and administrative challenges
Santos (2013)	Poverty reduction - Bhutan - income deprivation - safe water - improved sanitation - 2007 Gross National Happiness Survey - multi-dimensional poverty - poverty - poor - poverty reduction	Inequality; national
Sanusi (2010)	Water - sanitation - urban fringe settlements - city of Minna, Nigeria - little attention in terms of water and sanitation provision - low human development - risk to the health - objectives of the paper are to investigate access to water and sanitation	Inequality; urban
Satterthwaite (2014)	Right to water and sanitation - debate over post-2015 targets and indicators - UN Joint Monitoring Programme	Inequality; Human Right to Water and Sanitation

	- targets on water and sanitation - post-2015 WASH targets and indicators must be animated by human rights principles - END group - equity, equality, and non-discrimination	
Satterthwaite (2016)	Millennium Development Goal targets for water and sanitation - urban areas - disastrous performance - sustainable access to safe drinking water - urban dwellers - definitions in use for water and sanitation access - Joint Monitoring Programme - 'improved' sources - 'improved' sanitation facilities - "slums"	Inequality; urban Indicators for safe water and basic sanitation Political and administrative challenges
Schaub-Jones (2010)	Sanitation entrepreneurship - outside engagement - role of the water utility - private sanitation providers - retailers - masons - public toilet operators - latrine emptying businesses - medium and lower income communities - largely private system - regulatory and supportive role of the public sector - local government	Political and administrative challenges
Shelus and Hernandez (2015)	Handwashing proxy - large household surveys - handwashing with soap - reducing diarrheal disease mortality in children under 5 - reliable proxy to track handwashing with soap - handwashing indicator	Indicator for basic sanitation
Snehalatha and Anitha (2012)	Total Sanitation Campaign - Government of India - targets - realistic - coverage and usage status - insufficient fund allocations - lack of effective strategies for demand creation - expenditure - Village Water and Sanitation Committees - public-private partnerships - non-government organisations - sanitation behaviour change	Political and administrative challenges
Sorenson et al. (2011)	Water fetching - access to safe water - great expense of time and energy - carrying water - especially women - measuring progress	Indicator for safe water Inequality; gender
Tukahirwa et al. (2013)	Urban sanitation - East African Metropolises - civil society organisations - Community Based Organisations - Non-Governmental Organisations - extent and success - urban sanitation and solid waste management for the poor - the capitals of Kenya, Tanzania and Uganda - role of civil society institutions	Political and administrative challenges Inequality; urban
Van den Broek and Brown (2015)	Community-Based-Management - donors and governments - universal access to clean water - a third of hand pumps is non-functional - mid-west Uganda - maintenance funds and management failings - CBM model - uneasy coalition - neoliberal inspired commodification - theory of collective action - disappointing outcomes	Political and administrative challenges
Welle (2012)	Existing efforts to measure access to water supply, sanitation and hygiene services - sector monitoring - National WASH Inventory in Ethiopia - why so often costly - human resource intensive - remain underutilised	Political and administrative challenges Indicators for safe water and basic sanitation
Welle (2014)	Monitoring performance - performance monitoring - power and political dynamics - monitoring the MDG for rural water	Political and administrative challenges Indicator for safe water

Wilbers et al. (2014)	Piped water supplies - rural areas of the Mekong Delta, Vietnam - MDG to provide clean drinking water resources to communities - effectiveness of supply stations - water samples - reliable drinking water source - maintenance and distribution of water supply stations - reliable drinking water source	Indicator for safe water
Zaki and Amin (2009)	Basic services privatisation - benefit urban poor - access to safe water and sanitation - privatisation of water supply - intense debate - household level data for the poor - community and income status - significant improvement - informal settlements	Political and administrative challenges Inequality; urban
Zawahri et al. (2011)	Politics of assessment - Water and Sanitation MDGs - Middle East - Joint Monitoring Programme - assessment methodologies by JMP - overstate coverage rates - problems of access, affordability, quality of service and pollution - glaring gap between MDG statistics - national and local reports - exclusionary political regimes - international organisations - proposed reforms - incentives	Political and administrative challenges Indicators for safe water and basic sanitation
Zheng et al. 2013	Sanitation coverage - Bangladesh - household surveys - Joint Monitoring Programme 2008 definition - improved latrines - poverty reduction programmes - equity	Indicator for basic sanitation Inequality; national

Overview categories

Category	Subcategory	Number of studies
Indicator for safe water and basic sanitation	Indicator for safe water	8
	Indicator for basic sanitation	7
	Indicator for safe water and basic sanitation	6
		21
Water resource management		5
Inequality	Urban inequality	13
	National inequality	10
	Gender	2
	Methods to measure inequality	3
	Human Right to Water and Sanitation	5
		32
Political and administrative challenges		21

Table 1. Categories and subcategories

ANALYSIS

Below, we analysed the selected articles in terms of main theme/category, subcategory, research design and outcomes. The articles have been placed in alphabetical order.

A

Adams, E. A., Boateng, G. O., & Amoyaw, J. A. (2016). Socioeconomic and demographic predictors of potable water and sanitation access in Ghana. *Social Indicators Research*, 126(2), 673-687.

Category 1 Inequality Subcategory 1 National
Method(s) Statistical analysis of secondary sources

Many countries in Sub Saharan Africa have barely achieved the MDG goal of halving the number of people without access to improved drinking water. This study aims to offer insight into the socio-economic predictors of potable water and sanitation access in Ghana. The authors use the 2008 Ghana Demographic and Health Survey, including 4916 women and 4769 men, selected from enumeration areas. The dependent variables used for this study are 'improved/unimproved source of drinking water', 'improved/unimproved sanitation facilities' and 'time to water source in minutes'. The independent variables used were: wealth, education, number of household members, marital status, and gender of household head, region, and place of residence. The wealth variable is a composite indicator including ownership of materials such as television, bicycle, land, access to electricity, and type of toilet facility.

Income, education, household size, and region are significant predictors of improved water and sanitation access, according to the authors. Respondents with secondary education were 1.41 times more likely to have access to an improved source of water compared to those with no education. Those with secondary and tertiary education were 2.15 times and 2.81 times more likely to have access to improved sanitation facilities. Household wealth is a key factor influencing time to access of improved water source.

Quote

Despite substantial gains in improved drinking water facilities, notably in the last decade or so, many countries in Sub-Saharan Africa have barely achieved their Millennium Development Goal target of halving the number of people without access to improved drinking water. Over 64 % of households in the region do not have access to basic sanitation and 42 % lack safe drinking water (Waldman et al. 2013; WHO 2013). Existing water infrastructure can barely keep up with demands from spiraling populations. Drinking water sources, while already inadequate, are also subject to increasing threat of contamination. Only a third of the region's population has access to household piped-water connections (Seager 2010), forcing many to use contaminated water sources (Akpfe et al. 2011; Gleick 2014). Women and female children are often the most affected as they have to walk considerable distances in search of water.' p674.

Adjei, P. O., & Kyei, P. O. (2013). Linkages between income, housing quality and disease occurrence in rural Ghana. *Journal of Housing and the Built Environment*, 28(1), 35-49.

Category 1 Inequality Subcategory 1 National
Method(s) Multiple methods

In light of MDG 7, there is a need to examine the built environment in the rural areas, to inform policy and practices and move forward toward sustainability in these areas. According to the authors, the government's attention is on reducing poverty in the urban centres. As a result, poverty is rising in the rural areas. A survey is conducted in the rural Amansie West District of Southern Ghana, including 306 households. Households were selected with simple random and stratified sampling techniques. Random sampling was employed to select one rural community from 9 out of 12 zones of the district, for a total of 9 study areas.

The analysis following the survey focussed on the link between income, housing quality and disease occurrence in rural Ghana. Data on households' income levels and the most prevalent diseases among households were analysed separately using descriptive statistical tools such as frequency, cross-tabulation and percentage charts. In addition, interviews, 18 focus group discussions and participant observation were conducted to triangulate survey results. The focus groups consisted of male and female heads of household, discussing their perception of poverty and how this influenced health in the study area.

About 48.5 % of the households with a very high average monthly income ([GH ₵100) lived in very good houses. 1.0 % of the households with a very low average monthly income (\GH ₵20) lived in good houses. The study reveals a high incidence of malaria, skin diseases and diarrheal diseases among the children of low-income households, living in precarious housing. The authors conclude that improving housing and sanitation access in rural areas reduces poverty and diseases and should as such be prioritised to reach the MDGs.

Quote

'Poor sanitation is a major contributor to declining health in rural communities in the Amansie West District and the underpinning cause of poor sanitation is usually poverty. The nature of the built environment was found to play a significant role, alongside housing, in the spread of disease within these rural communities.'
p44.

Adubofour, K., Obiri-Danso, K., & Quansah, C. (2013). Sanitation survey of two urban slum muslim communities in the Kumasi metropolis, Ghana. *Environment and Urbanization*, 25(1), 189-207.

Category 1 Inequality Subcategory 1 Urban
Method(s) Multiple methods

This paper provides an assessment of access to improved water and sanitation in two urban slums Aboabo and Asawase in the Asawase constituency of Kumasi, Ghana in 2009. The assessment is conducted to determine the extent of 'improved' water and sanitation coverage as defined by the WHO/UNICEF Joint Monitoring Program. The authors use multiple methods: household surveys, key informant interviews, transect walks and mapping of water and sanitation facilities. The household survey includes 331 households in Aboabo and 457 in Asawase. The households were selected at random out of a total of 6,626 and 9,144 households. In addition, 33 informant interviews were conducted.

A high percentage of the population and Asawasa is connected to the piped water network, in the form of standpipes: 80% in Aboabo and 86% in Asawase. Illegal connections are common. Total improved water coverage from pipe-borne water and protected well sources is 94% and 92% for Aboabo and Asawase, respectively. As the standpipes do not provide water continuously, people rely on alternative sources such as well water and water tankers at a much higher price. 6% of the households in Aboaba and 7.9% in Asawasa rely on unimproved water sources. 58.3% of the population in Abuabo and 58% in Asawase use public toilet facilities or resort to open defecation. The rest of the population uses on site sanitation: simple pit latrine 26.6/28.2%, flush to septic tank latrine 11.8/6.1, ventilated improved pit 3.3/6.8%, bucket or pan latrine 0/1,5% and total improved latrine 6.9/2.8%.

Quote

'Although the two communities have been relatively well catered for in the provision of improved water supply, there is an extremely low level of provision for improved sanitation. Few of the households have private toilet facilities, and most of those are shared between two or more households. The only provision available to 58 per cent of the population is the few heavily patronized public toilets, which are poorly maintained. Since these do not come close to meeting demand, there are high levels of open defecation and use of flying toilets, as well as

indiscriminate disposal of children's faeces in gutters, on open plots and in nearby bushes, thus contaminating the two communities' environments with fecal matter.' p15-16.

Aguilar, M. D., & de Fuentes, A. G. (2007). Barriers to achieving the water and sanitation-related Millennium Development Goals in Cancún, Mexico at the beginning of the twenty-first century. *Environment and Urbanization*, 19(1), 243-260.

Category 1 Inequality Subcategory 1 Urban
Category 2 Political and administrative challenges
Method(s) Multiple methods

This case study identifies the barriers faced by the city of Cancún, Mexico, to making progress towards Millennium Development Goal targets on increasing safe water and basic sanitation coverage. The authors analyse socioeconomic, demographic, environmental and land use dimensions surrounding access to safe water and improved sanitation services in within six zones in Cancún, Mexico. The study relies on a review of specialized literature and in-depth interviews with actors in Cancún. The six areas selected by the scholars are: the hotel zone, mainland city centre, informal settlements undergoing urbanization, informal settlements that are fully or almost fully urbanized, recent low-income squatter settlements on the urban periphery and recent low-income squatter settlements in outlying peri-urban areas. Data was verified during field visits and processed through a geographical information system using census units as the basis for population density, coverage of piped water supply systems, volume of piped water supplied, volume of piped water consumed and losses from unaccounted-for water, volume of wastewater produced, coverage of wastewater collection and treatment systems production of sewage sludge, urban water quality and social actors involved in the use and management of drinking water

The relatively wealthy hotel and the city centre is served by a drinking water network and sewage network. The hotel area has continuous access to water while the city centre has access for a few hours a day. Operation of the sewage network is (only) subsidized in the hotel area. Although the informal areas outside the city centre, occupied between 1975 and 1995, have improved over time in terms of land tenure and drinking water provision, there is no sewage network in these neighbourhoods. The so-called low income squatter settlements in the peri-urban areas and periphery, built up over the last ten years, are the worst off in terms of services; there is no drinking water nor sewage network. Residents depend on wells and water provided by tankers. The municipality is supplying some of the water delivered by tankers free of charge. The additional amount needed, is provided by the same tankers at a price ten times as high as the price of water supplied through the public network. In terms of sanitation, open defecation and mostly unlined pit latrines are the available options. Lack of adequate sanitation in informal settlements leads to groundwater contamination and environmental degradation. Groundwater is the main drinking water source in the city. The barriers to sustainable development in Cancún are summarised as follows: (a) the socio-economic disparity and inequity produced by market forces, which is reinforced by government policies. In this way, the touristic and the wealthier areas of the city are supplied with subsidized services and have free access to resources, while the poorest neighbourhoods have either inadequate, improvised or disproportionately expensive basic services, or no access to services whatsoever; (b) the failure, for political and economic reasons, to enforce the State Drinking Water and Sanitation Law; and (c) the lack of concern shown by social actors to aquifer contamination.

Quote

Furthermore, inadequate wastewater disposal in the urbanizing and urbanized settlements, which can potentially cause serious groundwater contamination, is a significant barrier to sustainable development in both the municipality of Benito Juárez (where Cancún is located) as well as the neighbouring municipality of Isla Mujeres. Groundwater contamination could affect the current sources of drinking water supply of both

municipalities, pose risks to public health, and also pollute tourist attractions (beaches, lagoons and sea), which form the basis of economic development in the area.'

Anand, P. B. (2007). Right to water and access to water: An assessment. *Journal of International Development*, 19(4), 511-526.

Category 1 Inequality Subcategory Human right
Method(s) Statistical analysis of secondary sources

Do countries recognizing the Human Right to Water have a higher level of access compared to countries who do not? Will recognizing the Human Right to water accelerate progress towards MDG 7c? The author examined the relation between right to water and access to water, by doing a longitudinal study (from 1990-2004) in four 'Right to Water' countries (Uganda, Ethiopia, Gambia, Tanzania South Africa) and five countries (China, India, Namibia, Eritrea, Guinea) that did not recognize this right. The analysis is based on JMP data. In addition, the author used the World Bank 'Governance Matters V' database to assess how these countries scored on the following indicators: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

There is a relationship between how a country scored on the World Bank governance indicators and access to water. Countries scoring high in terms of voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption, increased access to water. Formally recognizing the Human Right to Water seemed to have no impact on access to water. In Namibia, Eritrea and Tanzania access to water increased without recognizing the Right to Water.

Quote

'This analysis suggests that mechanisms of governance may be more important in improving access to water than a formal articulation of a right to water.'

Anand, P. B. (2007). Semantics of success or pragmatics of progress? : An assessment of India's progress with drinking water supply. *Journal of Environment and Development*, 16(1), 32-57.

Category 1 Inequality Subcategory 1 National
Category 2 Political and administrative challenges
Category 3 Indicator for safe water and basic sanitation Subcategory 3 Indicator for safe water
Method(s) Literature review

At macro level, figures indicate that India has made progress toward MDG 7c in terms of access to water. However, there seems to be increased tensions related to water resources at local level. The research looks further into this topic and is based on a document review. A brief institutional and policy analysis at national level is followed by a case study of the city Chennai. The author includes data on Chennai from his 2001 study.

The 'success story' of India is based on a loose definition of water access. The definition is based on 'improved' water sources within a distance of 1.6 km, leading to positive trends at national level. A distance of 1.6 km underestimates the physical labor involved in transporting water, which weighs 1 kg per liter. In addition, the risk of contamination of 'improved sources' wells and tube wells is high. This may partially explain the high rate of waterborne diseases. In the Technology Mission reports of the Government of India, it was estimated that as of 2000, some 200 districts in 17 states in India were identified to have high levels of fluoride, and the population at risk was estimated to be around 66 million. Despite economic progress access to a tap/piped water has not increased over the last 10 years in India. National figures hide

local water scarcity and competition for resources in Chennai. The negative effects of water scarcity are unequally distributed: the population in peri-urban areas is worst off and have limited access to improved water sources. As a coastal city, groundwater is subject to salt intrusion. Two thirds of the lower income population, which mainly rely on groundwater resources, reported that their water was saline, as compared to one third of the household's highest income group.

Quote

We also notice that the proportion of population having access to a tap has increased ever so slightly in 10 years in rural areas and remains at less than 20%. In the case of urban households, this proportion has been more or less stagnating at around 70% for a decade. Of course, to aim to provide 100% of the population with access to a tap is not feasible in the short run. It may seem ironic that India, which is emerging as an information technology powerhouse, has to depend on wells and tube wells as the most important source of water.'

Arku, F. S., Angmor, E. N., & Seddoh, J. -. (2013). Toilet is not a dirty word: Close to meeting the MDGs for sanitation? *Development in Practice*, 23(2), 184-195.

Category 1 Inequality Subcategory 1 Urban
Method(s) Multiple methods

The authors investigate progress toward MDG 7c in terms of access to sanitation in Tulaku and Taabo, informal settlements in the suburbs of Ashaiman in the Greater Accra Region of Ghana. Methods used are participant observation, and semi-structured interviews. 122 people were interviewed in Talaku and 164 in Taabo. A simple random sampling technique was used to select 50% of the homes for the study: 61 and 82 houses from respectively Tulaku and Taabo. Each house is inhabited by more than one household. As such, for each house two adults from two different households took part in the study.

Most of the population in Talaku and Taabo relies on paid shared toilets: 64% of the respondent used public latrines, while 29% used private facilities, and 2% used both. 89% of the respondents who used paid public toilets were female and 11% male. Only 1% of the respondents practiced open defecation, while 4% had toilet facilities at home. Public toilets were poorly maintained, but cheaper than the private facilities. 36% of the interviewees reported that the toilets were in an unhygienic condition. The toilets were often far away and occupied, the respondents had to wait in line. 92% did not wash their hands after toilet use.

Quote

Improving access to water and sanitation facilities has been a priority on the international development agenda. Halving the number of those who do not have access to sanitation facilities is an MDG target. This study assessed the toilet conditions in an urban slum in Ghana. Many felt that the sanitary conditions were deplorable; they were unsatisfied with having to walk over half a kilometre before using a toilet.' p184.

Ayalew, M., Chenoweth, J., Malcolm, R., Mulugetta, Y., Okotto, L. G., & Pedley, S. (2014). Small independent water providers: Their position in the regulatory framework for the supply of water in Kenya and Ethiopia. *Journal of Environmental Law*, 26(1), 105-128.

Category 1 Inequality Subcategory 1 Urban
Category 2 Political and administrative challenges
Method(s) Multiple methods

The article focuses on small-scale water providers (SIPs), operating in urban low-income areas. These providers are often the only option for people living in low-income areas. Considering MDG7c of halving the population without sustainable access to water, the authors consider the role of SIP's and the water

quality regulation and prices in Kisumu, Kenya and Addis Ababa, Ethiopia. The study relies on a water quality assessment, document review, semi-structured interviews, a household survey and focus group discussions. The water quality of the sources used by small-scale providers was tested. The study was integrated by a socio-legal analysis of the regulatory framework and enforcement of quality standards and price. A two-level stratification was used to determine the availability of drinking water. Water availability defined the first level of stratification and socio-economic status the second level. Reconnaissance surveys were carried out to identify areas served by small-scale providers. 310 households were surveyed. Households were asked about the sources of the water they used and water samples were tested for thermotolerant coliforms (TTCs), as indicators of the microbiological water quality. The presence of these microorganisms is an indicator that the water has been in contact with human or animal faeces. Water samples were collected in sterile containers and stored on ice for transport back to the laboratory. The water was analyzed within 6 hours of sample collection.

Many of the samples tested in both Addis Ababa and Kisumu were below WHO standard. TTC's were present in 84% of the tests in Kisumu, compared to 40.2% in Addis Ababa. In Kisumu, the Water Act 2002 states water providers can only provide water below a certain quantity, easily trespassed. Above these limits, a license is required, but only the Water Services Boards are eligible to apply for such licenses. As a result, SIPs operate illegally. Price and water quality are not regulated. In Addis Ababa, just like in Kisumu, SIPs fall outside the legal system. The city does not provide permits to SIPs and as a result fails to regulate both price and quality.

Quote

Regulation of water quality and the implementation of other measures to improve human health are very relevant to the attainment of the human rights to life and to water and represent an urgent finding of the study where the supply of water is, in large part, delivered by SIPs. The water usage study showed that in Kisumu, most wells currently fail to meet the WHO drinking water quality guidelines, but the supply of well water helps boost water supply to households for non-consumptive purposes to an acceptable level.' p23.

B

Bain, R. E. S., Gundry, S. W., Wright, J. A., Yang, H., Pedley, S., & Bartram, J. K. (2012). Accounting for water quality in monitoring access to safe drinking-water as part of the millennium development goals: Lessons from five countries. *Bulletin of the World Health Organization*, 90(3), 228-235.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water

Method(s) Statistical analysis of secondary sources

The study compares access to water and sanitation as measured by JMP from 2000-2015, with data on water quality collected by the JMP Rapid Assessment of Drinking-Water Quality (RADWQ) project in Ethiopia, Jordan, Nicaragua, Nigeria and Tajikistan. The WHO guidelines were used to determine if water was safe. The aim of this study is to determine how accounting for RADWQ data on water source quality affects Joint Monitoring Program assessments of progress towards achieving MDG Target 7c. The JMP RADWQ project was executed in 2004 and 2005. 1500 sources were tested in each country for the presence of thermotolerant coliform bacteria, fluoride, and arsenic and nitrate compounds. The authors matched the source types reported by RADWQ with those in the 'regular' JMP household surveys and censuses, adjusting the proportion with access to water from each source type using estimates of the percentage microbial compliance and percentage overall compliance for each source type reported by the RADWQ project. In the absence of data, the authors presumed sources were 100% compliant.

In four of the five countries, the population with access to safe drinking water in 2008 declined when water quality was used as an indicator. In Ethiopia, the population with access to safe water decreased 11%, in Nicaragua 16%, Nigeria 15% and Tajikistan 7%.

Quote

'Adjustment for microbial and chemical contamination meant that in all countries except Jordan the estimated proportion of the population needing to gain access to safe drinking-water between 2008 and 2015 to reach the 2015 target increased.'

Baquero, Ó. F., Jiménez, A., & Pérez-Foguet, A. (2015). Reporting progress on the Human Right to Water and Sanitation through JMP and GLAAS. *Journal of Water Sanitation and Hygiene for Development*, 5(2), 310-321

Category 1 Inequality Subcategory Human right
Method(s) Literature review

The authors investigate in how far data collected by JMP post-2015 and GLAAS is suitable to measure the Human Right to Water. The indicators are based on HR General Comment 15 and include availability, quality, acceptability, physical accessibility and affordability. The analysis is based on a JMP report (2015) describing WASH targets and indicators post-2015.

Data collected by JMP and GLAAS is valuable to measuring the Human Right to Water, though there are some gaps, among which affordability, information on subsidies to poor people and the existence of regulation. JMP post-2015 includes Human Rights elements. Instead of one technology based indicator, 'improved/unimproved sources' used from 2000 to 2015, JMP seems to be moving towards a set of indicators including physical accessibility, continuity, seasonality and water quality. JMP plans to collect disaggregated data; distinguishing between rich and poor, urban and rural, slums and formal urban settlements, and disadvantaged groups and the general population (Joint Monitoring Programme, 2014).

Quote

'By contrast, there are still some critical gaps if both UN water platforms are to be used to report progress on HRW. Affordability at a household level remains unsolved in the post-2015 proposal despite HR experts having expressed concerns about the importance of visualising it. The GLAAS provides relevant information but it is not sufficient to reveal important indicators as to the percentage of poor people that benefit from special subsidies. Moreover, it could be possible to measure the proportion of households that have been disconnected from their water supply at least once a year, but the question has not been addressed.' p319.

Bartram, J., Brocklehurst, C., Fisher, M. B., Luyendijk, R., Hossain, R., Wardlaw, T., et al. (2014). Global monitoring of water supply and sanitation: History, methods and future challenges. *International Journal of Environmental Research and Public Health*, 11(8), 8137-8165.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water and basic sanitation
Method(s) Literature review

A paper discussing international monitoring in the water and sanitation sector and JMP's way of measuring access to water and sanitation, based on a document review. The authors describe the history of international monitoring, which has been defined by international target setting. The UN Development Decade in the 1970s established targets that were monitored, in the 1980s targets were set and monitored in the context of the International Drinking-water Supply and Sanitation Decade and World Summit for

Children. From the 1990s, The World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF) report progress towards the MDG targets through their Joint Monitoring Programme for Water Supply and Sanitation (JMP, 2016). The JMP measures access to ‘improved and unimproved’ water sources and ‘improved and unimproved’ sanitation facilities as a proxy for safe water and basic sanitation access. The JMP’s binary approach has its limitations. Current methods do not address water quality, equity of access, or extra-household services. Future monitoring should also include disaggregated data to monitor compliance with the human right to water and sanitation. The JMP is exploring ways to include an indicator about water quality and accessibility, for example the data for Bangladesh was adjusted using the first nationwide arsenic survey. Sources that exceeded the Bangladesh national standard for arsenic in drinking water were excluded. This led to a 27% lower estimate of households with access to safe drinking water (Department of Public Health Engineering, 2000). Water source functionality and reliability are also aspects to be included. In the case of sanitation, it is helpful to distinguish between unimproved facilities based on their effectiveness at separating users and the wider population from human excreta (World Health Organization and United Nations Children’s Fund, 2014). There is a risk of estimation errors in JMP’s methods, among which: (a) Errors in sampling, leading to underrepresentation of certain groups. More work should be done to make sure that samples represent different populations and settlements. (b) Linear regression presumes coverage evolves linearly, however coverage often follows an s-shape. (c) The division between urban and rural is not based on geospatial data. (d) There is an assumption that households use a single source of water, while this is often not the case. (e) When data is lacking, JMP estimates that 50% of the sources is improved. Equally for sanitation there is a nominal 50% improved facilities correction where a survey or census does not use facility class definitions that coincides with JMP definitions.

Quote

While the MDG-period’s simple binary approach of reporting on “the haves and the have-nots” [11] has made the JMP findings easily absorbable by a broad audience, this approach has substantive limitations, stemming from the fact that different facility types are associated with different types and levels of benefits. While the refinement of JMP reporting beyond the improved/unimproved dichotomy (discussed in Section 5.3) begins to address these limitations, further disaggregation by class could inform the use of service ladders to rank facility classes by their desirability from a health perspective.’ p8157.

Baum, R., Luh, J., & Bartram, J. (2013). Sanitation: A global estimate of sewerage connections without treatment and the resulting impact on MDG progress. *Environmental Science & Technology*, 47(4), 1994-2000.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Method(s)	Statistical analysis of secondary sources		

The authors compare access to ‘improved’ sanitation as measured by JMP and access to sanitation with a connection to a sewage system, based on JMP and data collected by the United Nations Statistics Division (UNSD), AQUASTAT and FAO. Country-level estimates of sewage treatment prevalence in 2010 and 1990 were available for 84 and 93 countries. The authors developed an empirical model to estimate sewage treatment prevalence in other countries. The prevalence of sewage treated was predicted as a function of eight social, health, and political indicators: urban access to improved sanitation as defined by JMP, government effectiveness as evaluated by the World Bank, gross national income (GNI) per capita calculated using the Atlas method, percentage of population attaining tertiary education, percentage of the female population attaining secondary education, percentage of the population living below \$1 a day, trade (percentage of GDP), and under-5 DALYs per 100 000 children attributed to water, sanitation, and hygiene. To reassess progress toward MDG Target 7c, JMP estimates of global access to improved sanitation were adjusted by discounting the proportion of households that have sewerage connection without sewage

treatment. The authors estimated the number of people with access to sewerage connection without treatment by multiplying the total population by both the national-level sewerage connection percentage. The global population with access to sewerage connection without treatment was calculated as the sum of the corresponding individual values for all countries. Pit latrines were not included in the study. For further information on the method used, see page 1994-1995.

Currently, there is a lack of data when it comes to connections to a sewage system and sewage treatment. Based upon the data available the authors estimate the 1990 baseline population using sanitation including treatment at 36%. In 2010, the authors estimate that 40% of the global population (2.8 billion people) used improved sanitation (treatment included), as opposed to the estimate of 62% (4.3 billion people) from the JMP. The authors plead for the sanitation indicator to include a connection to a sewage system and treatment, as untreated sewage has negative consequences for human health and environment.

Quote

This paper accounts for the impact of inadequate sewerage systems; however, a similar logic would suggest that the fraction of other sanitation facilities that lead to contamination of the household, community, and/or wider environment should also be discounted from estimates of coverage with improved sanitation. We focused our attention on sewerage connections because (i) sewerage connections account for over half of all improved sanitation (Table 1 and JMP Data Resources Bank); (ii) JMP provides sewerage connection data disaggregated into rural and urban areas; (iii) there is clear evidence for adverse health and environmental effects from sewage contamination; and (iv) the available evidence suggested a substantive proportion of sewage is untreated. Another important improved sanitation technology which was not considered in this study and can lead to contamination of the household and community is the use of pit latrines which are often emptied close to the community and the contents may not be treated. By accounting for inadequacy in other technologies, we would expect an additional increase in the 1990 unimproved sanitation baseline levels, an increase in the progress required to meet MDG Target 7c, and a decrease in the estimated proportionate progress achieved to date.’ p2000.

Bennett, H. B., Shantz, A., Shin, G., Sampson, M. L., & Meschke, J. S. (2010). Characterisation of the water quality from open and rope-pump shallow wells in rural Cambodia. *Water Science and Technology*, 61(2), 473-479.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for safe water
Method(s)	Other		

The JMP differentiates between ‘improved’ and ‘unimproved’ water sources to determine access to potable water. Is this a reliable indicator? The authors tested the water quality of eight ‘unimproved’ open wells and eight ‘improved’ rope pump wells over a period of eight months in rural Cambodia. The water testing included health indicators (arsenic, fluoride, manganese, nitrate, total coliforms, E. coli, male-specific coliphage) and aesthetic ones (iron, chloride, conductivity, total dissolved solids and hardness, turbidity, pH).

18.3% of the samples coming from ‘unimproved’ open wells were unsafe according to the Cambodian drinking water standards, compared to 31.7% of the ‘improved’ rope pump wells. All samples failed to RDI’s Drinking Water Quality Index (DWQI) for aesthetics.

Quote

No significant difference was observed in the quality of water from open and rope-pump wells, despite their classification as unimproved and improved respectively by the WHO/UNICEF Joint Monitoring Programme. Contaminants present in both well types may readily be removed by simple water treatment,

suggesting that household treatment may be more beneficial to rural Cambodian households than shallow aquifer source improvements.’ p473.

Brown, J., Vo Thi Hien, McMahan, L., Jenkins, M. W., Thie, L., Liang, K., et al. (2013). Relative benefits of on-plot water supply over other improved sources in rural Vietnam. *Tropical Medicine & International Health*, 18(1), 65-74.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water
Method(s) Multiple methods

The authors study if sources considered ‘improved’ by the JMP deliver the same water quality. To that end, they measure the water quality of piped water and compare the results to other ‘improved’ water sources in the Dan Nang province in Vietnam. The study included 224 households who had and on-plot piped water connection and 76 households from the same areas with access to alternative ‘improved’ water sources. In addition to water testing, data was collected on water use and handling practices, sanitation access and behavior and diarrheal diseases, through interviews.

The households with access to piped network had access to better water quality. For instance, the E. coli counts (not including those samples that were treated by boiling) for piped water were 16 (95% CI 13-18) bacteria/100 ml compared with 63 CI 31-42) bacteria/100 ml among those from alternative ‘improved’ sources. The prevalence of diarrhea was lower among households with access to piped water. Out of 1156 people accessing piped water, 103 cases were reported over the course of four months. 42 cases were reported, out of 303 people accessing improved sources.

Quote

‘Our results suggest that on-plot water service yields benefits over other sources that are considered ‘improved’ by the WHO/UNICEF Joint Monitoring Programme.’ p65.

Butala, N. M., Van Rooyen, M. J., & Patel, R. B. (2010). Improved health outcomes in urban slums through infrastructure upgrading. *Social Science and Medicine*, 71(5), 935-940

Category 1 Inequality Subcategory 1 Urban
Method(s) Statistical analysis based on secondary sources

The Millennium Development Goals (MDGs) aim to address deplorable conditions in slums and standards for water and sanitation as well as pertinent health outcomes. Upgrades in slum household water and sanitation systems have not been evaluated to demonstrate a direct link to improved health outcomes. The authors investigate the relation between slum upgrading, including water and sanitation, and health in slums in Ahmedabad, India, through a quasi-experimental regression model using health insurance claims (for 2001-2008) as an Indicator for passive surveillance of disease incidence. The study employs a quasi-experimental method of external evaluation through passive surveillance by using a “difference-in-difference” technique, in which the change in a variable of interest between program and non-program regions is compared to control for bias. 151 health insurance claims were identified from slums that had been ‘upgraded’, each of these 151 claims was coded as to whether the illness occurred before or after a slum upgrading programme was implemented.

Slum upgrading in Ahmedabad reduced residents’ likelihood of claiming waterborne diseases from 32% to 14% and from 25% to 10% when excluding mosquito-related illnesses.

Quote

If declines in health and the potential for outbreaks in this growing population are to be prevented, governments must act now. The findings above provide a role for governments in improving the health indicators of a rapidly increasing but ignored population. This study provides a strong evidence for urban slum upgrade to reach the Millennium Development Goals.'

C

Castro, J. E. (2007). Poverty and citizenship: Sociological perspectives on water services and public-private participation. *Geoforum*, 38(5), 756-771.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Category 2 Inequality Subcategory 2 National

Method(s) Literature review

A historical analysis of the impact of private versus public water supply on the poor in Britain, France, the United States of America and Latin America, based on literature review. The aim is to investigate if the claim 'private sector participation will reduce poverty' can be backed up by historical evidence.

In London, eight companies delivered water in the 1840s. The companies did not operate in poor areas or keep quality standards. From 1902 onwards, the water companies were placed under public control. In the United States, around the 1850s, the water sector consisted of water companies both owning networks and operating and maintaining them. The companies, similarly to those in London, delivered poor quality water for a high unit price. In 1806, 94% of the water works were private. 90 years later, 53% had been taken over or built directly by the public sector. In France, despite good performance, the water sector became a public affair roughly around the end of the 19th century. The author concludes that there is no historical evidence supporting the claim that private sector participation in developing countries is more likely to reach the poor. The author concludes that the forces set in motion by the neoliberal model of water policy based on market-centred governance of water and WSS remains the crucial obstacle toward achieving MDG 7c.

Quote

'On the contrary, the historical evidence shows that profit-oriented PSP, especially if unregulated, tends to produce highly exclusionary and elitist outcomes, which are unlikely to benefit the poor.'

Chandrasekhar, S., & Mukhopadhyay, A. (2012). Multiple dimensions of urban well-being: Evidence from India. *Asian Population Studies*, 8(2), 173-186.

Category 1 Inequality Subcategory 1 Urban

Method(s) Statistical analysis based on secondary sources

In line with Millennium Development Goals, the focus of policymakers has primarily been on slum dwellers, according to this paper. The authors question if the focus of policymakers on slum dwellers is justified, using a distribution analysis to compare monthly per capita expenditure (MPCE), per capita area of household dwelling, drainage and access to water source by slum and non-slum inhabitants in India. The data source is a survey of housing conditions conducted by the National Sample Survey Organisation (NSSO) in the year 2002, covering 41,916 urban households. The survey identified 6138 slum households and squatters, 35,703 households from non-slum urban areas and 75 households without a house.

7% of the population in India lives in slums. A distinction is drawn between notified slums, non-notified slums. Notified slums are to some extent formalized by city authorities by means of a notification which

leads to improved provision of public goods including water and sanitation. Poverty is not depended on location; 30% in non-slums is considered poor, compared to 48% in notified and non-notified slums. When it comes to access to water and drainage facilities, non-notified slums are most disadvantaged, followed by notified slums. The focus on slums is justified when it comes to improving water and sanitation access.

Quote

'Concomitant with higher levels of urbanisation in developing countries, there has been a sharp increase in both the number of urban poor and slum dwellers. In line with Millennium Development Goals, the focus of policymakers has primarily been on slum dwellers. Using a nationally representative dataset from India, we compare well-being of people living in slums with those living in non-slum urban areas. We argue that while policies to improve access to water and sanitation in slums are justifiable, livelihood programmes that target only the slums would miss the poorest living in non-slum urban areas.' p173.

Cho, D. I., Ogwang, T., & Opio, C. (2010). Simplifying the Water Poverty Index. *Social Indicators Research*, 97(2), 257-267.

Category 1	Inequality	Subcategory 1	Method
Method(s)	Other		

In the context of MDG 7c, the authors attempt to simplify Lawrence et al.'s (2002) composite Water Poverty Index, composed by five dimensions: resources, access, capacity, use, and environment to reduce unnecessary costs and efforts. The index is meant to support policy initiatives in the field of water and sanitation, at local and international level. A Principal Component Analysis (PCA) is used to evaluate the Water Poverty Index. The ranking of the 147 countries by Lawrence et al.'s (2002) WPI is compared to rankings based on other indexes.

Based on the PCA, the authors simplify Lawrence et al.'s (2002) composite Water Poverty Index. The result is a three component composite index comprising of access, capacity, and environment, with unequal weights. The alternative is a two-component index consisting of capacity and environment with equal weights. The proposed indexes have high positive correlations with the Human Development Index and negative correlations with the Human Poverty Index.

Quote

'Our results, using Lawrence et al.'s (2002) data for 147 countries, question the practice of assigning equal weights to the five sub-indexes. Our findings suggest that a simplified WPI with three sub-indexes (i.e., Access, Capacity, and Environment) with unequal weights would be more cost-effective to construct without much loss of information. Furthermore, constructing an even more simplified WPI based on solely on Capacity and Environment with equal weights would suffice and would be even more cost effective.' p266.

Cotton, A., & Bartram, J. (2008). Sanitation: On- or off-track? Issues of monitoring sanitation and the role of the Joint Monitoring Programme. *Waterlines*, 27(1), 12-29.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Method(s)	Literature review		

This paper focuses on JMP's methods for reporting on the MDG sanitation target and provides recommendations on this topic.

JMP's indicator for sanitation is technology based. There is a discrepancy between national and international estimates, often due to the differences in definitions used. The authors propose to base the Indicator for

sanitation on ‘use’ instead of ‘access’. Hygiene and sustainability need to be considered when measuring access to sanitation. In addition, the authors designed a framework for in depth international monitoring of sanitation governance.

Quote

‘Health-related benefits are an outcome that arises from people making use of the improved sanitation services to which they have access. The benefits are greater when people wash their hands with soap after defecation and at other times such as prior to preparing food. Benefits are also greater when sanitation is community-wide where everyone uses the latrine and where the technologies used prevent environmental pollution. Note that the corollary is that the benefits of sewerage are reduced if the sewage is discharged to pollute other communities. Finally, safe community-wide use needs to endure with time. What does this imply for monitoring? It implies that we would ideally focus on use rather than access; assess hygiene as well as sanitation; ensure that the technologies used truly protect health; and ensure that they are sustainable (both in the sense of used in the long term and also in the sense of environmental sustainability).’

D

De Gisi, S., Petta, L., & Wendland, C. (2014). History and technology of Terra Preta sanitation. *Sustainability (Switzerland)*, 6(3), 1328-1345.

Category 1 Water resource management

Method(s) Literature review

An analysis of the use of Terra Preta Sanitation (TPS) systems, based on a document review. The authors make a case for the development of closed loop sanitation systems in order to achieve MDG 7c.

With Terra Preta, black soils, human excreta can be turned into fertile soil, suitable for agriculture. A wide variety of Terra Sanitation Systems has been tested, including dry TPS and flush toilet systems both in urban and rural contexts, but only at a small scale.

Quote

‘In order to reach the Millennium Development Goals for significantly reducing the number of people without access to adequate sanitation, new holistic concepts are needed focusing on economically feasible closed-loop ecological sanitation systems rather than on expensive end-of-pipe technologies.’ p1328.

E

Engel, S., & Susilo, A. (2014). Shaming and sanitation in Indonesia: A return to colonial public health practices? *Development and Change*, 45(1), 157-178

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Multiple methods

Progress towards the MDG target on sanitation has been slow. Is Community-Led Total Sanitation (CLTS) an effective approach to increase access to sanitation? The Government of Indonesia, supported by the World Bank, has promoted CLTS in rural areas, which uses social mobilization to encourage people to construct their own latrines. This approach, according to the authors, uses social shaming and punishments. Communities are taken through a ‘walk of shame’ to identify and raise consciousness regarding the extent of faecal matter in the village and work on a defecation mapping exercise. The shaming is intended to motivate households to take up latrine construction, at their own expense. CLTS has been implemented

with NGO and donor support in many developing countries. The authors describe two cases of a Rockefeller Foundation funded hygiene and sanitation programme in the 1920s, and the World Bank Water and Sanitation Programme (WSP) in East Java in the 2000s. The aim is ‘to highlight new insights about the outcomes of CLTS as a hybrid approach that links colonial and modern governmentality but, in its modern form, involves not just the state but also sub- and supra-national organizations of various kinds.’ The authors studied the WSP in East Java generally and specifically in KabupatenTreggalek, through WSP documents and reports from independent evaluations and interviews with regional officials. One of the key informants was a researcher working for the Jawa Pos Institute of Pro-Autonomy (JPIP), a local foundation of East Java’s largest media network that has been tasked with monitoring the implementation of WSP funded project.

In the Dutch East Indies, the Rockefeller Foundation funded a hookworm-eradication programme focused on hygiene and sanitation improvements, as this was considered to be cheaper than providing sustainable infrastructure. The authors see parallels with the 1990s, when donors changed their policies from the provision of hardware to a focus on participation and social mobilization to help communities to construct and maintain their own sanitation facilities. The authors explain how CLTS reflects the World Bank’s neo-liberal reforms; moving services outside government control to the private sector and communities. Communities are expected to finance and organize infrastructure themselves. CLTS in KabupatenTreggalek relies on techniques involving shame, enforcement, responsibility and sanctions. In some communities, those with unimproved sanitation were marked with a sticker, fines were given and in one village pictures were posted of people openly defecating. Despite the guerilla techniques, many villagers did not seem to be aware that the program existed in interviews. Follow up interviews with seven villagers in 2012 indicated that pit latrines were full and not emptied because of financial or other constraints.

Quote

In rural areas, rather than providing additional funding, the government —with support of the World Bank— has promoted the Community-Led Total Sanitation (CLTS) approach, which uses social mobilization to encourage people to construct their own latrines. In Indonesia as elsewhere, CLTS involves more than just education and encouragement; it uses social shaming and punishments. The authors argue that this is not only an inadequate approach but one which echoes coercive, race-based colonial public health practices.’ p157.

Erni, M., Drechsel, P., Bader, H. -, Scheidegger, R., Zurbruegg, C., & Kipfer, R. (2010). Bad for the environment, good for the farmer? Urban sanitation and nutrient flows. *Irrigation and Drainage Systems*, 24(1-2), 113-125.

Category 1 Water resource management
Method(s) Other

A system analysis of water and nutrient flows for the city of Kumasi, Ghana. The analysis focused on nitrogen and phosphorus and was supplemented by a farm based nutrient balance assessment. The authors use data from several studies. The main method used to derive urban water and nutrient flows is a mathematically extended material flow analysis called MMFA.

Compared to the water quality upstream of Kumasi, nitrogen and phosphorous concentrations downstream of the city are approximately 14 and 6 times higher. The largest nitrogen and phosphorous input into water bodies come from domestic sources, in particular, failing sanitation facilities, such as flushing toilets connected to septic tanks from where water infiltrates into the ground. Population growth will lead to an increased level of nutrients in the available water sources in Kumasi. The tendency has been to invest in drinking water rather than sanitation, leading to high amounts of untreated wastewater. Flushing toilets use

water that could be used for drinking. The authors plead for investments in efficient waste collection and dry toilets or low-flush toilets to meet MDG 7c.

Quote

'Given the expected population growth, and under consideration of current plans for expansion in the water and sanitation sector, nutrient inputs to receiving waters, especially to the Oda river will increase by around 40% till 2015. This increase will be supported by the planned expansion of water supply without corresponding measures for collection and treatment'. p121.

F

Fisher, K. T. (2008). Politics and urban water supply. *Development*, 51(1), 30-36.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Literature review

Despite MDG 7c aiming to halve the population without sustainable access to water, universal water works coverage has not increased in South East Asia. The author presents a case study of the privatization of the water sector in Tagbilaran, Bohol, Philippines. The research was conducted between June 2003 and October 2004.

In 2000, the Provincial Government, under Governor Rene Relampagos, privatized water supply in Tagbilaran, to attract private investment and reduce corruption. Fisher documents how the privatization of water supply has been used in political campaigns. She describes two examples of instances in which the BWUI, the company in charge, wrongfully became the subject of public scrutiny. In a third example, the author describes how the media ignores the fact that Tagbilaran's groundwater sources are being contaminated and directs the readers' attention instead to the privatization of water provision.

Quote

'Enough attention has not been given to the shortcomings of the institutional and resource management arrangements to ensure equitable provision of water that is sustainable in the long term. It is important to acknowledge the political nature of urban water supply but then to move beyond this. Research in small cities such as Tagbilaran enables complex socio-political relationships to be revealed and provides lessons for thinking through the political nature of water in other cities. It is less important to fixate on private versus public provision as both are capable of providing poor services that are inequitable and unsustainable in the absence of adequate regulation and institutions.' p35.

Flores Baquero, O., Jiménez Fdez. de Palencia, A., & Pérez Foguet, A. (2016). Measuring disparities in access to water based on the normative content of the human right. *Social Indicators Research*, 127(2), 741-759.

Category 1 Inequality Subcategory 1 Human right

Method(s) Other

One of the main contributions of a human rights based approach to the MDG/SDG agenda is the necessity to develop new methodologies to measure and better understand disparities. This study demonstrates the use of a new method to measure disparities in San Sebastian de Yali' (SSY) municipality located in Northern Nicaragua. The area includes five rural communities, 296 households in total. The sample is divided in two categories: 154 households whose water is provided by CBO's and 142 households who self-supply water.

The method is developed to measure differences in water availability, quality, acceptability, physical accessibility and affordability. The households who self-supply rely on surface water and unprotected springs, some have access to wells or buy water from their neighbours. Those served by CBO's get their water from standpipes or connections on their premise. In terms of acceptability, quality and physical accessibility self-supplying households are worse off than those serviced by community managed systems. Households do not trust the water they drink and must walk long distances to get water that contains more faecal coliforms. These users are better off only in terms of availability, as they can collect water from their own sources all year long. The cost of this survey was \$5700, it was conducted in 74 communities. The WASH budget for the municipal area in which the survey took place is \$60000. The authors recommend carrying out a similar survey every four years, so that the cost represent 2.5% of the annual municipal budget.

Quote

'The proposal includes a field data collection methodology and a set of questions to measure service level based on the human right to water normative framework. Statistically, a stratified sampling, splitting households served by community based organizations and those self-provided, is proposed. This approach implies considering reduced populations and samples, thus special care needs to be taken with sample sizes and uncertainty of estimators.' p743.

Flörke, M., Kynast, E., Bärlund, I., Eisner, S., Wimmer, F., & Alcamo, J. (2013). Domestic and industrial water uses of the past 60 years as a mirror of socio-economic development: A global simulation study. *Global Environmental Change*, 23(1), 144-156.

Category 1 Water resource management
Method(s) Other

A simulation program, WaterGAP, is used to back calculate industrial, agricultural and domestic wastewater from the 1950s onwards.

In East and Southeast Asia, Northern Africa, and Eastern and Southern Europe the amount of untreated wastewater is high. Securing water supply and reducing untreated wastewater is a priority when it comes to reaching the MDGs. Equally important is the development of policies and regulation encouraging the development of water saving technologies, according to the authors.

Quote

'How can we constructively think about future developments of water-related sectors if we do not know how water was used in the past? For example, information on water use together with the quantification of renewable water resources indicates hotspots of water stress (water scarcity) and their development over time. Nevertheless, even if agriculture is the dominating water consuming sector in many regions of the world, the domestic and industry sectors can also contribute to achieving a reduction of vulnerability to water stress. This requires that water-related policies are effectively mainstreamed into other sectoral policies such as for industry (in particular water saving in the energy sector), urban development, or tourism.' p146.

G

Gine Garriga, R. G., & Perez Foguet, A. P. (2013). Water, sanitation, hygiene and rural poverty: Issues of sector monitoring and the role of aggregated indicators. *Water Policy*, 15(6), 1018-1045.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for safe water and basic sanitation

Method(s) Statistical analysis of secondary sources

An assessment of three existing monitoring instruments in the water and sanitation sector worldwide: a health impact indicator (prevalence of diarrhoea), JMP indicators and the WASH poverty index, from a policy-making point of view. A survey in Kenya forms the basis for this analysis. 5,050 households were surveyed and 407 water points were audited across 317 rural clusters to cover 21 targeted districts. The data was collected from January 2010 to 2010. The statistical analysis employed tools such as the Pearson's chi-square test and the Principal Component Analysis (PCA), using in both cases a standard statistical package (SPSS 15.0, 2006). The Pearson's chi-square test, specifically the SPSS Exact Tests v7.0, was performed to assess the relationship between survey variables.

The prevalence of diarrhoea alone is not a reliable indicator, according to the authors. There is significant association between prevalence of diarrhoea and i) access to improved water supplies ($P = 0.026$), and ii) sanitary disposal of children's faeces ($P = 0.009$). In contrast, no significant reduction in diarrhoea is observed with i) wealth and with ii) access to basic sanitation. In brief, slight positive impacts are observed when an improved water supply is accessed by the household and when children's faeces are disposed of safely. The authors have several recommendations towards JMP. Currently, the water indicator only considers the distance to the source. There are additional factors that determine water access, such as: affordability, reliability, continuity and water quality. The sanitation indicator does not take into account the sanitary condition of the facility. Hygiene should also be included. The authors conclude their analysis, discussing the WASH poverty index, worked out and presented in an earlier paper (by the same authors). The WASH index consists of the water supply index, initially developed by Sullivan et al (2003), the sanitation poverty index and the hygiene poverty index. This index is most suitable for policy development, according to the authors since 'it proves useful to unravel the linkages between poverty and access to basic services; and it improves the identification of target groups and allows a more equitable allocation of resources.'

Quote

'At the global level, the JMP has emerged as a consistent approach to report on WASH sector status and trends. Its major strength, and the root of its success, is the simplicity of having a few relatively well-defined and easy-to-measure indicators, which produce reasonable estimates of coverage across different contexts. However, JMP measures access through technology-based proxies, and it does not provide information on the quality of the water, the continuity of the water service, the sanitary conditions of the toilet facility, or whether economic, institutional, social or environmental reasons jeopardize the ability of households to access the services. Therefore, the simplicity of the monitoring framework is also its core limitation, and it is necessary to gain an insight into wider issues that relate to sector performance.'

Ghosh, D. K. (2009). Millennium Development Goals and the role of Panchayats: Exploring through West Bengal Case. *Journal of Rural Development*, 28(3), 381-407.

Category 1 Inequality Subcategory 1 National

Category 2 Political and administrative challenges

Method Literature review

This paper looks at the role local governments in rural areas, called panchayats, play in achieving the MDGs in terms of education, health and access to safe water and basic sanitation in the federal state of West Bengal, India. The data sources used are mostly government reports.

Officials working for the panchayats generally do not know much about the specific MDG targets. Panchayats have a role in the process of disease prevalence, including diseases related to unsafe water and poor sanitation: acute diarrhoeal, according to policies at central level. The Indian central government and federal government foresee a role for the panchayats in the provision of drinking water in operating and

maintaining water sources (Government of West Bengal 2005-2006). Drinking water is funded at central level. Access to safe drinking water is defined as follows: (1) there is one spot source for 250 persons; (2) in case of piped water supply there is one public stand post for 250 persons and assured water supply of 40 liters a day; and (3) the drinking water source exists within 1.6 km. of the habitation in the plain or 100 metres elevation in hill areas. The coverage of piped water network in rural areas remains relatively low, hand pumps and tube well are much cheaper to construct. Open wells, vulnerable to biological contamination, are a common drinking water source. Ground water depletion and aquifer pollution may be threats. There are three tiers within the Panchayat responsible for water delivery. There is not enough expertise within those tiers. In the Gram Panchayat tier, responsible for the implementation, repair and maintenance of handpumps, there is only one technical person: a junior Engineer. In terms of sanitation, the panchayats are mainly involved in the construction of latrines under the Total Sanitation Campaign, in collaboration with government officials and NGO's. Sanitary marts are organised 'as local marketing outlets in villages where on demand people can get a latrine according to their choice and capacity'. According to the Annual Administrative Report 2004-2005 of the Government of West Bengal, 4442122 households have been covered by the sanitary marts in total. Very different figures circulate on sanitation coverage in West Bengal: 27% of the population is covered according to the Census in 2001, while the NFHS3 survey claimed 45% of the population was covered. Government officials working within the panchayat are often employed by the central government. The panchayats have limited control over these officials.

Quote

'The inadequate devolution of functionaries often mars the spirit of local governance. As a consequence, the performances of the panchayats in different fields have to suffer. The study amply explains that only devolution of functions in favour of the panchayats cannot mitigate the ills of society. For reaching the MDGs adequate devolution of functionaries and funds are required.' p381.

Gunawardana, I. P. P., & Galagedara, L. W. (2013). A new approach to measure sanitation performance. *Journal of Water Sanitation and Hygiene for Development*, 3(2), 269-282.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Method (s)	Other		

The indicators used by JMP do not consider the environmental and public health risks associated with some sanitation technologies. A new method is proposed to measure sanitation coverage: the Sanitation Index for Monitoring (SIM). The existing sanitation situation in the town, village and estate communities of Pussellawa, Sri Lanka, was assessed using participatory research tools. Focus group discussions, stakeholder consultation, key informant interviews, informal discussion, questionnaire surveys and field observations. 330 households were surveyed, selected according to a stratified random sampling technique. The data gathered were used to test the applicability of the proposed sanitation index.

The authors concluded that an improved sanitation system requires (a) secure access to a hygienic latrine, and (b) treatment and safe disposal of sewage or wastewater (management of sewage/wastewater). They identified indicator variables, to reflect the improved sanitation through literature surveys and field studies. As a result, the method proposed by the authors to measure sanitation coverage has two sub-indices: (a) Latrine security and hygiene (b) Treatment and disposal system. 18 variables are considered, with an option of weighting them. The authors distinguish 12 levels of sanitation: L1T1 Very poor sanitation, L1T2 Unhygienic latrine with unimproved treatment and disposal, L1T3 Unhygienic latrine with improved treatment and disposal, L1T4 Unhygienic latrine with perfectly improved treatment and disposal, L2T1 Moderately hygienic latrine with poor treatment and disposal, L2T2 Moderately hygienic latrine with unimproved treatment and disposal, L2T3 Moderately hygienic latrine with improved treatment and disposal, L2T4 Moderately hygienic latrine with perfectly improved treatment and disposal, L3T1 Hygienic

latrine with poor treatment and disposal, L3T2 Hygienic latrine with unimproved treatment and disposal, L3T3 Hygienic latrine with improved treatment and disposal, and L3T4 Hygienic latrine with perfectly improved treatment and disposal.

Quote

'Improved sanitation facilities are defined as facilities that ensure hygienic separation of human excreta from human contact. Sanitation should be improved beyond just the containment stage and up to the extent which both technologies and functions reduce the downstream faecal contamination. The present measuring tool gives a figure for sanitation coverage with respect to infrastructure without considering its function and potential effects on the environment. This has led to overestimation of improved sanitation coverage because inefficient and inappropriate types of latrines will ultimately result in invisible human contact with excreta at some point in the water cycle.' p270.

Gutierrez, E. (2007). Delivering pro-poor water and sanitation services: The technical and political challenges in Malawi and Zambia. *Geoforum*, 38(5), 886-900.

Category 1 Inequality Subcategory 1 National
Category 2 Political and administrative challenges
Method(s) Literature review

A field note on the challenges meeting the MDGs on water and sanitation in Malawi and Zambia based on a document review. The focus is the delivery of pro-poor services.

The challenges include weak state support for water and sanitation provision, unreliable and contested indicators of coverage, poor sectoral co-ordination, and fragmented donor efforts. Indicators used by Malawi and Zambia's Poverty Reduction Strategies are different from those used by these two countries' national statistical agencies, or those established by the Joint Monitoring Program of the WHO and UNICEF. There are no indicators for equity in distribution, making it difficult to target disadvantaged groups. Water mapping exercises executed by WaterAid and UNICEF in the two countries, plotting improved water sources on to a map, show that some areas and groups benefit more than others.

Quote

'Certain steps need to be taken. This includes not only understanding the links of water and sanitation in poverty reduction, but also reviewing the funding and accountability relationships between donors, aid organisations, NGOs, local and national government bodies, and grassroots communities. Tools like annual budget analysis and water point mapping need to be institutionalised for more effective governance in the sector. The development of these tools is both a technical and political challenge for the all the concerned stakeholders in Malawi and Zambia.' p899.

H

Hadipuro, W. (2007). Water supply vulnerability assessment for sustainable livelihood. *Journal of Environmental Assessment Policy and Management*, 9(1), 121-135.

Category 1 Inequality Subcategory 1 Method
Method(s) Other

MDG 7c promises to halve the population without sustainable access to water. Which half should be prioritized? The authors developed a water vulnerability assessment. The aim is to help formulate policy interventions required to cope with the problem of water supply access faced by vulnerable groups.

The authors assess shocks, trends and seasonality in the ecological, economic, social and political dimension to identify the most vulnerable households. They distinguish the following levels: national, regional/city, community and household.

Quote

'Conceptually the assessment proposed could result in better policy decision making' p133.

Hossain, K. Z., & Ahmed, S. A. (2015). Non-conventional public-private partnerships for water supply to urban slums. *Urban Water Journal*, 12(7), 570-580.

Category 1 Inequality Subcategory 1 Urban
Category 2 Political and administrative challenges Subcategory 2 Privatisation and community based management
Method(s) Multiple methods

The MDGs have set the target to improve the lives of 100 million 'slum' dwellers and to increase water access. The authors investigate an approach developed by DSK (Health Centre for the Destitute), a national NGO in Bangladesh that promotes formal water provision to the slum dwellers in Dhaka. DSK forms slum dwellers community based organizations (CBOs), strengthens their capacity and builds partnership between Dhaka Water Supply and Sewerage Authority (DWASA) and the CBOs to secure public water-supply in the slums. The authors were interested in how far the approach relates to the concept of a conventional public-private partnership. Quantitative and qualitative data is collected through nine focus group discussions, semi-structured and 18 structured interviews with slum dwellers, CBO leaders, DWASA officials, local peoples' representatives and related DSK and other civil society representatives.

The authors see substantial benefits to the DSK approach. Over 100,000 slum dwellers received legal water supply through this PPP arrangement. DWASA, being a public utility agency, could change its set rules, regulations and policies to supply water to urban slums. In engaging with the slum dwellers as partners and legitimate clients, DWASA increased revenue collection and reduced system loss, which convinced the policy makers to make necessary amendments to the rules and procedures for extending services to slums. This was a major positive shift in urban water supply governance. CBOs emerged as de facto private sector entities in the urban water supply sector. They gained adequate capacity in dealing with DWASA, complying with policies, exercising financial transactions, carrying out maintenance of facilities, and undertaking development work in the slums. In this the CBOs have earned the trust and confidence of slum dwellers, DWASA and policy makers. The formal partnership amongst the CBOs, facilitating NGO (DSK) and DWASA established a sustainable model for water supply to slums. This model has now been extended to over 100 slums for over 10 years.

Quote

'Our investigations reveal a positive indication about the study hypothesis that the DSK approach has created a nonconventional model of PPP between the slum dwellers' CBOs and DWASA for effectively providing public water supply in the slums. Slums are regular features in developing countries and this is likely to remain so as urban growth continues. Providing water supply in these slums will remain a challenge for the foreseeable future, which requires alternative approaches.' p578.

Hossain, M. S., Johnson, F. A., Dearing, J. A., & Eigenbrod, F. (2016). Recent trends of human wellbeing in the Bangladesh delta. *Environmental Development*, 17, 21-32.

Category 1 Inequality Subcategory 1 National/regional

Method(s) Statistical analysis based on secondary sources

An analysis of the Household Expenditure Survey (HIES) and Demographic Health Survey (DHS) data from 1995 to 2010, to assess human wellbeing and progress toward the MDGs in the south-west coastal part of Bangladesh. Human wellbeing is a subset of economic and social wellbeing factors (OECD, 2013) and has been classified into five dimensions: health, material, security, freedom and social relations (MA, 2005). The human wellbeing indicators include improved/unimproved water and sanitation access. The HIES uses random sampling. 371 households were selected in the year 1995, 1000 in the year 2000, 7400 in the year 2005 and 12,240 in the year 2010.

Improved sanitation access in this part of Bangladesh has risen from 49% in 2000, to 72% in 2005. Access to improved water sources is 90% since the 1990s and has slightly declined over time. Water quality is not sufficiently covered by the dataset.

Quote

'The quality of life in terms of access to improved sanitation facilities and electricity connection has improved, although access to improved drinking water sources has remained not changed significantly since 1995.' p28.

I

Itama, E., Olaseha, I. O., & Sridhar, M. K. C. (2007). Springs as supplementary potable water supplies for inner city populations: A study from Ibadan, Nigeria. *Urban Water Journal*, 4(1), 19-27.

Category 1 Indicator for safe water and basic sanitation Subcategory: Indicator for safe water
Method(s) Multiple methods

An assessment of the quality of twelve spring water sources used by the inner-city populations in Ibadan, the capital of Oyo State in southwest Nigeria. In the absence of a centralised water system, residents rely on springs. Three different polythene bottles were used for collection of samples: one unfiltered sample for physico-chemical parameters, the second for analysis of heavy metals and the third, a pre-sterilized bottle for the bacteriological analysis. Physico-Chemical characteristics included pH, electrical conductivity (EC), total dissolved solids (TDS), and hardness were carried out according to standard methods described by the American Public Health Association (APHA 1998). Heavy metals analysed included lead (Pb), iron (Fe), manganese (Mn) and cadmium (Cd) and were determined using atomic absorption spectrophotometer (Alpha 4, Chemical Technical Model, UK). Two focus groups per spring were conducted on the history, water use pattern, knowledge, attitude and practice of users to water and environmental sanitation.

There is a high risk of water contamination as these springs are not sufficiently protected. Faeces and urine were smelled in the surroundings of six springs: Onipasan (SP1), Oleyo (SP3), Odo-Iye (SP4), Ogodo (SP7), Rogan (SP8) and Odo-Ibule (SP12), and overgrown vegetation and weeds were present in the immediate location of about half of these sources. In terms of the results of the water testing, the yields ranged from 3320 to 8308.8 l for an 8 h period. The physico-chemical quality was in conformity with the recommended standards. The pH values varied between 6.25- 6.89 and 6.34-6.94 and temperature values varied between 26.5-26.6 and 26.43 -26.6 for the rainy and dry seasons respectively. The total dissolved solids varied according to the soil type and terrain. The bacteriological quality needs to be corrected through simple treatment such as filtration and disinfection. The authors conclude that if these water sources are tapped effectively, these will reduce the pressure to extend piped networks and help meet the Millennium Development Goals.

Quote

'The proximity of these spring waters equally affords the women and men a source of ready supply for their daily economic activities, ranging from clothes dyeing, dry cleaning, washing of cars and other community activities.' p26.

J

Jordanova, T., Cronk, R., Obando, W., Zeledon Medina, O., Kinoshita, R., & Bartram, J. (2015). Water, sanitation, and hygiene in schools in low socio-economic regions in Nicaragua: A cross-sectional survey. *International Journal of Environmental Research and Public Health*, 12(6), 6197-6217.

The Sustainable Development Goals will address water, sanitation and hygiene access in public buildings: schools and health centres. The authors analyse the outcomes of a cross-sectional survey of WaSH in 526 schools in 12 low socio-economic status municipalities in Nicaragua conducted by UNICEF Nicaragua and partners.

WaSH coverage was significantly higher in urban than rural areas. Drinking water coverage (43%) was lower than sanitation infrastructure (64%). Eighty-one percent of schools had no hand washing stations and 74% of schools lacked soap. Sanitation facilities were not in use at 28% of schools with sanitation infrastructure and 26% of schools with water infrastructure had non-functional systems. Only 8% of schools had budgets to purchase toilet-cleaning supplies and 75% obtained supplies from students' families.

Quote

Proposed targets and indicators for the Sustainable Development Goals (SDGs) seek universal access to WaSH in non-household settings, such as schools and health care facilities [1,2,3,4]. Inadequate WaSH in schools results in adverse health outcomes among children including infectious, gastrointestinal, neuro-cognitive and psychological illnesses [5]. Inadequate WaSH conditions have been reported to reduce educational outcomes in children by contributing to absenteeism [6,7,8,9] and impaired cognitive abilities [10,11,12]. Bartlett summarized the impact of unsanitary conditions and diarrheal disease on child malnutrition and mental and social development, including IQ, school achievement levels, working memory, and behavioral problems [11]. The quality of sanitation facilities in schools can impact attendance rates of girls, especially once they have started to menstruate [13], while a more recent literature review found inconclusive evidence on the subject [14]. (Introduction article)

K

Kite, G., Manuel Roche, J., & Wise, L. (2014). Leaving no one behind under the post-2015 framework: Incentivizing equitable progress through data disaggregation and interim targets. *Development (Basingstoke)*, 57(3-4), 376-387.

Category 1	Inequality	Subcategory 1	Method
Method(s)	Other		

Currently, there are limited disaggregated data on social and economic disadvantaged groups which complicates measuring progress toward the MDGs. The authors develop a monitoring system which aims 'to leave no-one behind' by collecting disaggregated data as a recommendation towards the SDGs.

The monitoring system developed by the authors departs from the stepping stone equity targets proposed by Watkins (2014). The stepping stone equity targets set intermediate targets for national governments with regards to addressing disadvantaged groups. The authors propose to compare national progress with the progress by advantaged and disadvantaged groups.

Quote

'Equality and solidarity were among the fundamental values underpinning the Millennium Declaration (UN, 2000). However, many have argued that one of the blind spots of the Millennium Development Goals (MDGs) was precisely to ensure that progress would be shared across all segments of society (Minujin and Delamonica, 2003; Kabeer, 2010 among many others). Over the last two decades, the world has witnessed unprecedented progress in reducing multiple forms of poverty and deprivation, but unfortunately, this progress has often been uneven, leaving disadvantaged groups behind.'

Koff, H., & Maganda, C. (2016). The EU and the Human Right to Water and Sanitation: Normative coherence as the key to transformative development. *European Journal of Development Research*, 28(1), 91-110.

Category 1 Inequality Subcategory 1 Human right
Method(s) Literature review

This study examines EU development programmes in the field of water and how these reflect the core norms expressed in the Union's defining treaties. It examines links with the MDGs/SDGs. The method used is document review, including UN policy documents, reports from non-governmental organizations and United Nations databases.

The EU has a long tradition promoting transformative development, which means e.g. that foreign/trade policies should support the direction taken in the development arena and international collaboration. The authors argue that 'the EU has established policies that are congruent with the MDGs, but because they lack normative coherence with the Union's core values, they promote indicator-based development strategies and the privatization of water, rather than transformative development cooperation.' The Human Right to Water should be the basis of international development programmes in this field.

Quote

'In his November 2014 Kapuscinski Lecture for the RISC Consortium/University of Helsinki international conference and doctoral school (Martens, 2015), Martens, Executive Director of the Global Policy Forum, focused on the need for 'universal development' strategies encompassing both wealthy and poor states in the post-2015 development agenda. These sentiments have also been reflected in current global debates on the SDGs, which have included political and academic calls for transformative development characterized by normative commitments to equity, justice, human security and rights. 'Universality' expands and links the geographic and normative scopes of sustainable development discussions.' p106.

L

Laré-Dondarini, A. L. (2015). Analysis of household demand for improved sanitation: The case of green latrines in Dapaong city in Northern Togo. *Canadian Journal of Development Studies*, 36(4), 555-572.

Category 1 Water resource management
Method(s) Survey

Sub-Saharan Africa is lagging behind the rest of the world in reaching the MDG target on sanitation. The Ecosan/green toilet may be a solution to expand sanitation coverage. The author investigates the socio-economic factors influencing the uptake of a green latrine to inform policy decision making. This type of latrine separates and urine and feces and dries the feces. The urine and feces can be used as fertilizers. A survey was conducted in the city of Dapaong, Togo, with a population of 68650 inhabitants. 556 households were selected, using random stratified sampling.

There are number of socio-economic factors influencing the uptake of green latrines in Dapaong, among which: (a) Farmers have a higher probability of choosing a green latrine, because of the agricultural benefits (b) When several households live in the same house, they are less likely to choose a green latrine, because of ambiguous ownership of the dried sludge (c) Well-educated households do not like to handle dried sludge and choose other types of latrines; and (d) Household not currently in possession of an improved latrine are more likely to try out a green latrine than those already equipped with an improved latrine.

Quote

'Access to improved sanitation is a key issue in achieving the MDG, particularly in the fight against poverty and improvement of household health. This is why the green latrine is attracting growing interest among development actors, justifying the analysis of its adoption conditions in the framework of this study.' p567.

Larson, B., Minten, B., & Razafindralambo, R. (2006). Unravelling the linkages between the Millennium Development Goals for poverty, education, access to water and household water use in developing countries: Evidence from Madagascar. *Journal of Development Studies*, 42(1), 22-40.

Category 1	Inequality	Subcategory 1	National
Method(s)	Survey		

Larson et al (2006) analyse the links between poverty, education, water access, household choice of drinking water, and actual levels of water use in Madagascar, to better understand how MDG goals complement each other. The authors suggest that the findings are representative for Madagascar and other developing countries. Yet, the survey that forms the basis for this analysis has been conducted in the city of Fianarantsoa. A two-stage sampling strategy was implemented: six neighbourhoods without public taps and 13 neighbourhoods with public taps were selected in the first stage. At the second stage, 10% of households in each neighbourhood were randomly selected. The target sample size was 570 households, 547 households agreed to participate in the survey.

Households with a higher income are more likely to have a private connection and use more water. Households fetching water use on average 2300 litres per month, whereas those with a private (in house) connection use 14600 litres per month. The authors argue that the quantity of water used by poor families is not enough for them to properly practice personal and household hygiene.

Quote

'Achieving the poverty, education, and drinking water targets to meet the Millennium Development Goals are not independent endeavours. Reducing poverty and improving education will alter household choices related to water access.' p23.

M

Malik, O. A., Hsu, A., Johnson, L. A., & de Sherbinin, A. (2015). A global indicator of wastewater treatment to inform the Sustainable Development Goals (SDGs). *Environmental Science and Policy*, 48, 172-185.

Category 1	Indicator for safe water and basic sanitation	Subcategory 1	Indicator for basic sanitation
Category 2	Water resource management		
Method(s)	Other		

The JMP indicator for basic sanitation does not include wastewater treatment. The authors assess the data availability on global wastewater treatment and make recommendations toward an indicator of global wastewater treatment performance in the context of the formulation of the SDG agenda.

International databases on wastewater treatment are maintained by UNDS (82 countries), OECD (31 countries), the Pinsert Makers Water Yearbook and FAO. These databases have several limitations e.g. data at urban level is used to represent entire countries, definitions vary and inconsistent reporting over time. The authors propose a utility based indicator: the weighted average of volumes of wastewater treated at all utilities in a country, normalized by the population served by a given utility.

Quote

To address the gap in available, comparable national wastewater treatment data, this paper presents the first-ever dataset of a country-level wastewater treatment indicator at the global scale. Our immediate goal was to develop an indicator of water quality to include in the 2014 edition of the Environmental Performance Index (EPI), a biennial global ranking of country performance on a range of environmental issues (Hsu et al., 2014). A secondary objective was to evaluate the global availability of national data to assess wastewater treatment to inform current proposals for a wastewater treatment indicator in the UN SDG process.' p173.

Martínez, J., Mboup, G., Sliuzas, R., & Stein, A. (2008). Trends in urban and slum indicators across developing world cities, 1990-2003. *Habitat International*, 32(1), 86-108.

Category 1 Inequality Subcategory 1 Urban
Method(s) Statistical analysis of secondary sources

Improved information is needed to meet the MDGs. Martinez et al. (2008) analyse trends in the living conditions, including water and sanitation access, of slum and non-slum populations over the period 1990-2003. The data source used for the analysis is the UN HABITAT's Global Urban Indicators Database (UIP-III). 188 cities have been included, though in many cities only partial data sets are available.

There is general improvement in various slum indicators, such as durable structures, access to safe water and access to improved sanitation. Improvement in access to safe water is met through decentralised water systems. A piped drinking water network is often not extended to informal settlements and there is little progress in this area. While the median access to safe water in urban areas remains above 90% between 1990 and 2003, the median connection to piped water fluctuated between 56% and 65% in the same period. Only 20 cities had data on access to piped water. In informal settlements, citizens depend on onsite sanitation e.g. improved pit latrines, septic tanks. The median percentage of households connected to sewers has increased from 44% to 70%. Sub-Saharan Africa is worse off in access to safe water and improved sanitation than other MDG regions, progress has been below other MDG regions. Households connected to sewers only make up for 13% of the population.

Quote

This evidence supports the importance of promoting and adopting large-scale slum improvement programmes and their relevance in the achievement of the MDGs. This sustains the concerns of some researchers (see Satterthwaite, 2003) about ignoring the urban issue when reporting that urban poverty is less serious than rural poverty and that "it has little or no relevance to the achievement of the MDGs" (see Sabn & Stijel, 2003; in Satterthwaite, 2003). It also points to the urgent need to develop and promote innovations in proactive approaches to shelter and servicing that provide accessible alternatives for the world's growing urban population and especially for the urban poor. p104.

N

Ndulu, B. J. (2006). Infrastructure, regional integration and growth in Sub-Saharan Africa: Dealing with the disadvantages of geography and sovereign fragmentation. *Journal of African Economies*, 15, 212-244.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Literature review

The author, a World Bank staff member, makes a case for the expansion of infrastructure in the light of the MDGs, including water supply infrastructure, for economic growth and poverty reduction.

Quote

'Much of the effort to create the conditions for growth in Africa has emphasised how government policy and behaviour has increased risk and barriers to competition—dealing with 'sins of commission.' Governments also have an important role in providing public goods, supporting the provision of infrastructure, and addressing market failures. The under-provision of these can significantly increase costs to firms and make potential opportunities unprofitable— hence, they are 'sins of omission'. The background papers for the Africa Commission correctly identify three fundamental constraints to Africa's future prosperity: geography, market integration and institutions. The papers encourage government action and international support to ameliorate the effects of these constraints.' p237.

O

O'Reilly, K. (2010). Combining sanitation and women's participation in water supply: An example from Rajasthan. *Development in Practice*, 20(1), 45-56.

Category 1 Inequality Subcategory 1 Gender

Method(s) Other

Women participation is seen as integral to meeting MDG 7c. The author studied the way women benefitted from a latrine building project. She researched a German-funded project in rural Rajasthan, India from 1997 to 2005, providing latrines in rural areas with the aim of improving sanitation and hygiene. Because of cultural norms, women in this area are not supposed to relieve themselves during the day out in the open field. Women, who do not possess an indoor latrine, wait until dark.

The project did not have the intended effect. The project did not change the cultural norm. The latrine was built on the premise, near the road. The exposed location was considered unsuitable for women. The latrine was seen as a status symbol, not as a way to promote health. Generally, men and guests used the latrines.

Quote

'Women may be the agents best able to promote sanitation among other women, but a host of other factors (for example, latrines as status symbols) play a role in determining whether women do or do not use latrines.' p53.

Okurut, K., Kulabako, R. N., Abbott, P., Adogo, J. M., Chenoweth, J., Pedley, S., et al. (2015). Access to improved sanitation facilities in low-income informal settlements of East African cities. *Journal of Water Sanitation and Hygiene for Development*, 5(1), 89-99.

Category 1 Inequality Subcategory 1 Urban

Method(s) Multiple methods

Attempts to increase access to improved sanitation as defined by JMP in low-income informal settlements have yielded slow progress. The authors present an assessment of access to sanitation and barriers to household uptake of improved sanitation facilities in low income areas in Kampala (Uganda), Kigali (Rwanda) and Kisumu (Kenya). A household assessment was conducted including 5387 households in the eight settlements of the three cities between May and September 2012. The samples sizes for Kigali (n ¼

1,794), Kampala (n = 1,666) and Kisumu (n = 1,927) were determined using the national statistics. Qualitative data was collected: in total 23 focus group discussions and 97 interviews were held.

The authors found high levels of open defecation in Kisumu (17.3%). Education and property ownership are brought forward as key determinants when it comes to open defecation. The percentage of the population using private toilets without self-reported problems is very low: respectively 7.5% in Kigali, 6.1% in Kampala and 0.1% in Kisumu. In Kigali, 99% of the population does not safely empty the latrine they own, compared to 1% in Kampala and Kisumu. Often latrines are manually emptied and faecal sludge is poured in trenches nearby; in other cases the pit is simply closed. The barriers to access improved sanitation varied between the three cities: Kigali has many unimproved technologies and needs education on appropriate technologies and opening up the market for sanitation service providers like constructors and emptiers; Kampala relies on public toilets that are constructed far from the users' homes; and Kisumu has the highest number of shared toilets that are emptied without consideration for hygiene, high levels of open defecation and hence the need for social interventions.

Quote

'More than half of the respondents (59.7%) reported using sanitation facilities that are included in the WHO/UNICEF Joint Monitoring Programme definition of improved sanitation. However, a high proportion of these facilities did not provide access to basic sanitation. Less than 5% of all the respondents did not report problems related to sustainable access to basic sanitation.' p89.

Onda, K., LoBuglio, J., & Bartram, J. (2012). Global access to safe water: Accounting for water quality and the resulting impact on MDG progress. *International Journal of Environmental Research and Public Health*, 9(3), 880-894.

Category 1 Indicator for safe water and sanitation Subcategory 1 Indicator for safe water
Method(s) Statistical analysis of secondary sources

The authors used RADWQ data to adjust JMP estimates for access to safe water. A Principal Components Analysis (PCA) was used to predict the percentage of piped and of other-improved water supplies that are faecally contaminated; and of these sources, the percentage lacking basic sanitary protection against contamination.

Extrapolating RADWQ data, it is estimated that 1.8 billion people (28% of the global population) used unsafe water in 2010. The JMP estimate is that 783 million people (11%) used unimproved sources in 2010.

Quote

'While these estimates are imprecise, their magnitude and health and development implications suggest that greater attention is needed to better understand and manage the problem of contamination of improved water sources.' p892.

R

Rajaraman, I., & Gupta, M. (2016). Preserving the incentive properties of statutory grants. *Economic and Political Weekly*, 51(9), 79-84.

Category 1 Political and administrative challenges
Method(s) Other

A financial analysis of statutory grants in India: grants transferred from the central government, through states, to local governments, for basic services, such as sewerage, solid waste management, water supply,

road maintenance, in the period 2010-2015. According to the authors, 'local governments are the nodes at which the Sustainable Development Goals for improved sanitation and public health have to be delivered. This is the level at which public finance attention has to be focused.'

The authors draw a number of conclusions. The basic flow is not steady each year. In urban areas, the shortfall peaks at 20%, in rural areas at 15%. Ten of the 28 states did receive their rural basic grant in full every year, as did eight states for the urban basic grant. States must meet certain conditions to be eligible for the performance grant. Two rural and six urban states qualified in an earlier year of the period but not routinely qualify in years following, still received the performance grant. The performance grants do not cover allocations, there an aggregate shortfall of 25%. Six states did not qualify for the rural performance grant in any year and 11 did not qualify for the urban grant. The authors did not find a justification; why these states do not meet the criteria.

Quote

'The key public goods with a local spatial reach - sewerage, solid waste management, water supply, road maintenance - can reliably be supplied by local government only if the funding stream, whether from own revenue or external grants, is steady.' p79.

Rouse, M. (2014). The worldwide urban water and wastewater infrastructure challenge. *International Journal of Water Resources Development*, 30(1), 20-27.

Category 1 Political and administrative challenges

Method(s) Literature review

The author discusses what is needed to achieve water and wastewater infrastructure coverage in the context of the post-2015 SDG's.

Universal access to water and wastewater networked infrastructure is affordable, according to the author, as the costs of not having access are greater than the investment required to achieve it. The author stresses the importance of maintenance, cost recovery, strategic planning, innovation and regulation.

Quote

'Achieving universal access to water and sanitation services of a required standard will take time. It is a matter not only of financing and building the infrastructure but also of the need for improved governance, capacity building and training to achieve effective operations and maintenance for sustainability.' p24.

S

Santos, M. E. (2013). Tracking poverty reduction in Bhutan: Income deprivation alongside deprivation in other sources of happiness. *Social Indicators Research*, 112(2), 259-290.

Category 1 Inequality Subcategory 1 National

Method(s) Statistical analysis of secondary sources

This paper focuses on multidimensional poverty reduction in Bhutan, based on the 2003 and 2007 Bhutan living standard survey. The method used captures the proportion of weighted deprivations that the poor experience in a society out of all the total potential deprivations that the society could experience (Alkire and Foster, 2007 and 2011). The indicators weighted were: consumption expenditure, education and health of the household, access to clean water and improved sanitation (MDG/JMP indicators) and clean cooking fuel, access to electricity and number of people per room.

Since the late 1980s, Bhutan has established the Gross National Happiness Index (GNH) based on four pillars: (1) sustainable development, (2) preservation and promotion of culture, (3) conservation of the environment and (4) good governance. Within this approach, the Millennium Development Goals (MDGs) have become core development priorities in the country. The analysis shows that poverty has reduced significantly from 2003 to 2007. Progress has made in several areas: access to roads, electricity, water, sanitation, and education. According to the authors, it seems likely the above may be attributed to Bhutan's pro-poor policies.

Quote

Fourthly, we consider the MDG 7: ensure environmental sustainability. Two of the considered indicators within this goal are usual MDG indicators: access to clean water and improved sanitation. Bhutan has progressed significantly in increasing access to both, yet much more progress can be made.' p266 and 267.

Sanusi, Y. A. (2010). Water, sanitation and human development in urban fringe settlements in Nigeria. *Theoretical and Empirical Researches in Urban Management*, 8(8), 14-29.

Category 1 Inequality Subcategory 1 Urban
Method(s) Multiple methods

Against the background of MDG 7c, the authors assess the state of water supply and sanitation in five fringe settlements of Minna, Nigeria. 75 household surveys were conducted in the settlements unserved by the formal water utility. The Questions were posed on sources of water supply, location, adequacy, coping mechanisms to water inadequacy, water quality and treatment, as well as water fetching practices. Furthermore, the survey included questions on type of location and conditions of toilets, waste water disposal, solid waste type and disposal, and knowledge of sanitation campaign. In addition, focus groups were held to gain insight into challenges faced by women.

The settlements Dama (550 inhabitants), Jatapi (600 inhabitants), Gidan Kwano (700 inhabitants), Epigi (450 inhabitants) and Lunko (500 inhabitants) depend on wells, streams and boreholes for drinking water. Households treat the water by boiling (17%) and adding alum (89%). In all settlements, the water quantity is less than 10 liters per person. The water sources are affected by the seasonal variations: during heavy rains the water is reported to be polluted, while the sources dry up in the dry season. Women and children must walk longer distances in order to fetch water. 68% of the population practices open defecation, 31% uses pit latrines. 95% of the population wishes they had better sanitation.

Quote

The present state of water and sanitation in these settlements connote low human development and stand at risk to the health of the people. The danger of serious impact on health with current urbanization of these settlements calls for re-evaluation of a laissez-faire approach that leaves the residents to informal adjustment.' p14.

Satterthwaite, M. (2014). On rights-based partnerships to measure progress in water and sanitation. *Science and Engineering Ethics*, 20(4), 877-884.

Category 1 Inequality Subcategory 1 Human rights
Method(s) Other

A short commentary describing the work of the Equity and Non-Discrimination Working Group (JMP END Working Group), one of the four working groups developing post-2015 targets and indicators for the water and sanitation sector in 2012. The working group is led by UN Special Rapporteur on the Human

Right to Safe Drinking Water and Sanitation, Catarina de Albuquerque. The author served as a Rapporteur for the END group.

The indicators proposed by the END group depart from the core Human Rights principles: equality and non-discrimination. Following these principles, the END group proposed SDG targets and indicators. The group recommended to collect disaggregated data on rich/poor groups, urban/rural, slums/formal urban settlements, disadvantaged groups/general population. The progress of the worst-off and the better off is calculated and translated into a 'disparity in use' index; the gap between percentages of the better off and worst-off using the services under each target.

Quote

'The debate over post-2015 goals, targets, and indicators related to water and sanitation has been the locus for a meeting of minds among human rights lawyers, development practitioners, and economists. The water and sanitation sector, represented by major UN agencies, development partners, and implementing NGOs has embraced the right to water and sanitation and has worked to operationalize the rights-based approach through discussions about the post-2015 development framework.' p879.

Satterthwaite, D. (2016). Missing the Millennium Development Goal targets for water and sanitation in urban areas. *Environment and Urbanization*, 28(1), 99-118.

Category 1	Inequality	Subcategory 1	Urban
Category 2	Indicator for safe water and sanitation	Subcategory 2	Indicator for safe water and sanitation
Method(s)	Statistical analysis of secondary sources		

A review of progress towards the MDG 7c for water and sanitation in urban areas, including informal settlements from 1990-2015. This article fits within different categories as it criticizes JMP methods of measuring access to water and sanitation, including the indicator for safe water and improved sanitation.

JMP provides insufficient data to assess sustainable access to water and sanitation. The water sources and sanitation facilities represent a large spectrum in terms of quality. From the way JMP measures access to water and sanitation, it is unclear if water is suitable for drinking and if latrines are emptied and sludge treated. According to JMP, 95% of the urban population has drinking water from an improved source. 75% is connected to a piped network. Zooming in on the least developed countries, only 32% of the urban population had piped water on premises in 2015. In Sub-Saharan Africa only 33% of the urban population had piped water on premises in 2015 compared to the 43% in 1990. 57 countries missed data on improved sanitation and could not be assessed. Based on JMP data, the proportion of the urban population with improved sanitation increased from 79% to 82% between 1990 and 2015; for low- and middle-income nations, it went from 69% to 77%, and for the least developed countries, from 37% to 47%. There is no data on sewage connection and treatment. Current types of sanitation e.g. pit latrines, seen as improved sanitation, are unsuitable for the densities of urban areas and may lead to groundwater contamination. The author questions the drop in slums in urban areas, this may be attributed to the fact the definition of a slum is, among other criteria, based on JMP's definition of improved water and sanitation. JMP's definition is less strict than UN-Habitat previous definition of access to water and sanitation.

Quote

'Any sanitation intervention that is not connecting toilets to sewers needs to take account of the collection, disposal and treatment of the faecal matter. If toilet wastes are going to a septic tank, is this actually working? Many simply push their untreated liquid wastes into local and often open drains. For pit latrines of various kinds, can they be emptied easily? And is there a local treatment plant that can treat the wastes? Usually not. Conventional pit-emptying trucks are often of no use in informal settlements because there is no road access or

roads are too steep or muddy. Cheap yet effective systems for disposing of waste are difficult in urban contexts. The journey time between latrines or septic tanks and the treatment plant has to be short, and often it is not. This raises costs. Another concern is that toilet wastes in pit latrines may well be contaminating groundwater sources. In many urban contexts, toilets are shared by two or three adjoining households. Community-managed public toilets and washing facilities are often the most appropriate solutions that can be practically implemented, yet these are considered 'unimproved' by the JMP.' p101.

Schaub-Jones, D. (2010). Should we view sanitation as just another business? The crucial role of sanitation entrepreneurship and the need for outside engagement. *Enterprise Development and Microfinance*, 21(3), 185-204.

Category 1 Political and administrative challenges Subcategory 1 Privatisation
Method(s) Other

The MDG target on sanitation lags well behind others. In low and middle income countries, the sanitation sector consists of a large number of private providers. The author discusses ways to strengthen the sanitation market. The paper is based on professional experience and literary sources.

There is a lack of data on the sanitation sector in terms of type of clients served by small-scale providers and the affordability of the service to low-income groups. Schaub-Jones sees room for intervention for 'outsiders': the public sector, donors, NGO's and CBO's. These interventions are categorized in the following way: (1) to expand the sanitation market to reach poorer households; (2) to encourage sanitation markets to be more efficient; and (3) to regulate unsanitary practices that impact public health.

Quote

Providers of services range from the masons that build household latrines to the entrepreneurs that build and run toilet blocks, from manual pit emptiers to privately-run vacuum trucks. Customers for these services are perhaps even more diverse, from pay-and-go users of toilet blocks to landlords letting out accommodation, from homemakers making home improvements to tenants emptying a shared latrine. Most sanitation transactions taking place in this context have little direct involvement of public authorities.' p188.

Shelus, V., & Hernandez, O. L. (2015). The usefulness of a handwashing indicator in large household surveys. *Journal of Water Sanitation and Hygiene for Development*, 5(4), 565-573.

Category 1 Indicator for safe water and basic sanitation Subcategory 1 Indicator for basic sanitation
Method Statistical analysis of secondary sources

The post-2015 SDG agenda may include indicators for hygiene. The aim of this study is to test the usefulness of a proxy for handwashing: the presence of functional hand washing stations. A multivariate analysis is used to see if there is link between this specific proxy for hand washing and child diarrheal disease. The analysis is based on the Demographic Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS) data from five sub-Saharan African countries: Ethiopia, Ghana, Malawi, Sierra Leone, and Zimbabwe.

The study 'presents limited to moderate evidence supporting the potential usefulness of an Indicator for tracking hand washing practices: the presence of a functional HWS with needed supplies.'

Quote

Low handwashing rates worldwide, and especially in low and middle income countries, call for programs to promote good hygiene. In such programs it is crucial to track the effectiveness of efforts to change practices. This

requires reliable measures of the practice. However, tracking handwashing practices is difficult; self-reports may not be reliable. Because handwashing is a socially acceptable practice (even where prevalence is low) study participants may over-report this practice, resulting in 'respondent bias'. Manun'Ebo et al. (1997) detected over-reporting of handwashing before food preparation and eating, and Danquab (2010) found over-reporting of handwashing with soap after defecation. Thus, alternative methods for tracking handwashing practices are needed.' p566.

Snehalatha, M., & Anitha, V. (2012). India's Total Sanitation Campaign: Is it on the right track? Progress and issues of TSC in Andhra Pradesh. *Journal of Rural Development*, 31(2), 173-192.

Category 1 Political and administrative challenges

Method(s) Multiple method(s)

The Total Sanitation Campaign (TSC) is set up in India to increase access to improved sanitation and meet MDG7c. The authors present an evaluation of the TSC based on data from the online TSC monitoring website, from Department of Drinking Water Supply (DDWS), including budget documents. In addition, field data from IRC's WASHCost study were utilized. One of the authors works for IRC. The study focuses on India and the state Andhra Pradesh. The Total Sanitation Campaign was launched in 1999 and set targets until 2012. The program included the construction of 69 million Individual Household Latrines (IHHL), School Sanitation and Hygiene Education (SSHE), 25769 community sanitary complexes, 1,33,114 Anganwadi toilets.

From 2000-2010, 'it could be seen from Fig.1 that the targets reached in the last 10 years is below 56 % in IHHL for BPL though it is 79% in school toilets and 68% in Anganwadi toilets for all India, while the achievement per cent for Andhra Pradesh is 62.' Later, on the authors state, 'at all India level, the achievement targets of IHHL (35.34 %) was much lesser as compared with the achievements of school toilets (69.75 %) and anganwadi toilets (63.46%).' Less than 35% of the budget latrines was spent as intended, except for school sanitation and anganwadi toilets. The panchayats (traditional local governments) did not receive the grants or decide to spend it where they see the need. Information, communication and education are important components in a country where 74% of the rural population considers open defecation acceptable. Though this component was included in the TSC, in reality the budget was spent on infrastructure. The sanitation built remains often unused because of cultural norms.

Quote

'Village Water and Sanitation Committees (VWSC) do not exist in the villages and the water and sanitation component is given least priority by the Panchayat.' p190.

Sorenson, S. B., Morssink, C., & Campos, P. A. (2011). Safe access to safe water in low income countries: Water fetching in current times. *Social Science and Medicine*, 72(9), 1522-1526.

Category 1 Inequality Subcategory 1 Gender

Category 2 Indicator for safe water and basic sanitation Subcategory 2 Indicator for safe water

Method(s) Statistical analysis of secondary sources

An analysis of gender differences with regard to water fetching, based on the MICS-3 survey in 44 countries, used by the JMP. The authors disagree on the indicators currently used and make recommendations for new indicators.

In most households, women are responsible for water fetching (58.7%), followed by men (30.7%) and children (9.1%). There is a positive association between women fetching water and access to unimproved sources ($r=0.35$). The association is higher when the improved source is not on the premise ($r=0.43$). Currently, UNICEF considers an improved source to be a source at 1 km distance. According to JMP, to provide for the minimal daily needs of one person, the water fetcher would carry a container for 0.62 miles, obtain about 5 gallons of water, and walk back 0.62 miles bearing roughly 44 pounds of water. The authors propose other indicators that account for water fetching: time spent, caloric expenditure and opportunity costs.

Quote

Women and children are the most common water carriers, and they spend considerable time (many trips take more than an hour) supplying water to their households. Time is but one measure of the cost of fetching water; caloric expenditures, particularly during droughts, and other measures that affect health and quality of life must be considered. The full costs of fetching water must be considered when measuring progress toward two Millennium Development Goals - increasing access to safe drinking water and seeking an end to poverty.’ p1522.

T

Tukahirwa, J. T., Mol, A. P. J., & Oosterveer, P. (2013). Comparing urban sanitation and solid waste management in East African metropolises: The role of civil society organizations. *Cities*, 30(1), 204-211.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Category 2 Urban Subcategory 2 Inequality

Method(s) Multiple methods

Sanitation and wastewater services have received attention as a result of MDG7c. These services are to a large extent delivered by NGO’s and CBO’s in low and middle income countries, yet not much is known about the result. The authors present a comparative analysis of NGO/CBO waste collection and sanitation services in Kampala, Nairobi and Dar es Salaam based on interviews, direct observations and a survey in informal settlements. The survey was conducted with 337, 206 and 200 households for Kampala, Nairobi and Dar es Salaam respectively. Questions were asked regarding respondents’ characteristics, their access to NGO/CBO services, as well as their experiences and opinions regarding services of NGOs/CBOs. The theoretical point of departure is institutional pluralism. The term ‘refers to situations where individuals or organizations act within multiple institutional spheres. Individuals and organizations are then confronted with two or more sets of ‘rules of the game’ at the same time, and hence are subject to and have to cope with multiple regulatory regimes and multiple normative orders.’

‘Institutional pluralism’ is a way of describing how sanitation and solid waste is managed in Kampala, Nairobi and Dar es Salaam: ‘the three cities consist of plural systems with a multitude of institutions, both formal and informal.’ According to the authors this has been accelerated by the government’s incapacity to provide those services as by the neoliberal (donor) policies that facilitated privatization of most public service. Almost all, private and public, organizations rely on donor funding. All three cities rely to a large extent on NGO’s and CBO’s for the provision of sanitation in low income areas. In Kampala, these organizations are recognized by the government, who set up the Uganda Water and Sanitation NGO network. In Dar es Salaam and Nairobi there is limited cooperation between NGO’s, CBO’s and the government. 50% of the respondents were satisfied with the services delivered by NGOs and CBOs. Unsatisfied respondents often mention the poor maintenance of sanitation facilities when asked for an explanation.

Quote

Nonetheless, the contribution of NGOs/CBOs to sanitation and solid waste service delivery to the urban poor across the three cities is significant (see Tukahirwa, Mol, & Oosterveer, 2011; Tukahirwa et al., 2010; Ministry of Water and Environment, 2010; Schouten & Mathenge, 2010; ILO, 2007; Kassim & Ali, 2006; Karanja, 2005; Ikiara, Karanja, & Davies, 2004). Except for sanitation in Kampala, the contribution of these organizations to serving the poor is higher than that of governmental and private sector institutions.’ p208.

V

Van den Broek, M., & Brown, J. (2015). Blueprint for breakdown? Community Based Management of rural groundwater in Uganda. *Geoforum*, 67, 51-63.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management

Method(s) Multiple methods: Ethnographic fieldwork, surveys and interviews

According to the authors, the belief that groundwater in rural areas is best managed according to the Community Based Management (CBM) model is the dominant paradigm across Sub-Saharan Africa. While donors and governments focus on increasing water access in the context of the MDGs and SDGs, a third of hand pumps are non-functional. The authors investigate the Community-Based Management of hand pumps, financed by a donor and implemented by an NGO, across Masindi and Kiryandongo districts in rural mid-west Uganda. Their study is based on ethnographic fieldwork, surveys and interviews.

Communities in Uganda are reluctant to pay water fees regularly to the water user commission in charge, as a result there are no funds for maintenance. Some water user commission members are threatened while trying to collect the fees. Water commissions were unable to enforce the lower grades of sanctions, such as public shaming and confiscation of jerry cans, on community members for non-payment. Top down CBM does not seem to work in Uganda.

Quote

‘The solution to the effective maintenance of handpumps is proving a formidable challenge, and central to achieving the sixth post-2015 Sustainable Development Goal are questions over who should finance the running costs of rural water points. It has been demonstrated conceptually and empirically that there are problems with commodification and within grassroots approaches, and collectively the CBM model is undermined once the voluntary service of the WUC moves towards commodification. Reforms within the CBM paradigm do not offer any guarantee of improved outcomes - they do not overcome the central failings of willingness to pay and to participate. In sum the CBM model has turned out to be a blueprint for breakdown.’ p61.

W

Welle, K. (2014). Monitoring performance or performing monitoring? Exploring the power and political dynamics underlying monitoring the MDG for rural water in Ethiopia. *Canadian Journal of Development Studies*, 35(1), 155-169.

Category 1 Political and administrative challenges

Category 2 Indicator for safe water

Method(s) Multiple methods

The author demonstrates the limitations of performance monitoring, ‘most prominently exemplified in the MDGs’. The case study focusses on the political dynamics behind diverging figures on water access in Ethiopia’s Southern region in 2008. Methods include document reviews, participant observation, and semi-structured interviews. For data analysis, the process tracing method was employed, a research methodology that traces the micro-steps and links that lead to a specific outcome (Bennett and George 2005a, 2005b). The findings in this article are based on document reviews, participant observation, and semi-structured interviews. For data analysis, the process tracing method was employed, a research methodology that traces the micro-steps and links that lead to a specific outcome (Bennett and George 2005a, 2005b).

In 2007, the regional Bureau of Water Resources reported access for the region as 69%, the zonal sector department reported it as 27%, while Woreda sector offices in the zone (lowest level) provided a figure of 12-15%, based on different information sources. Conflict arose in the same year, when the region was tormented by a drought. More than 50% of the population were judged to be in urgent need of water. Emergency reports and response operations that tankered water to communities in need contradicted the water access figures reported by the regional Bureau of Water Resources. The Minister visited the area to review the situation. Despite the critical situation, the Minister decided upon the method that delivered the highest access figures, as this reflected well on his own performance.

Quote

‘This article highlighted that monitoring processes can involve contestations over data and calculation methods; for example, the case of regular reporting in the Southern Region, the intervention of the Minister to impose his interpretation on the WRI results, and rows over internationally reported JMP figures versus national figures reported by MoWR. This emphasises the political nature of monitoring processes and the wider governance debates surrounding them. p165.’

Welle, K., Schaefer, F., Butterworth, J., & Bostoen, K. (2012). Enabling or disabling? Reflections on the Ethiopian national WASH inventory process. *IDS Bulletin*, 43(2), 44-50.

Category 1 Political and administrative challenges
Category 2 Indicator for safe water and basic sanitation
Method(s) Multiple methods

An analysis of the National WASH Inventory (NWI) in Ethiopia, through the lens of political economy. Observations, documents, training and workshops form the basis for this study. The authors investigate why the NWI remains underutilised.

The NWI is funded by international donors and financial institutes: UNICEF, the World Bank/Department for International Development (DFID) and the African Development Bank. It is in their interest to document the performance of government interventions. The Ministry of Water and Energy (MoWE) has a stake in the NWI ‘to assert its authority over the official progress achieved in the sector.’ The MoWE has repeatedly had differences over official water supply access figures with regional water offices but also with the Central Statistical Agency (CSA). The data collection has been done at regional level, using temporary staff rather than Water Officers who would stay on the job. The data collection is planned to be at Woreda level. However, not all woreda’s are well-equipped. Woreda’s without donor funding lack the resources to collect data.

Quote

One issue that emerges from the analysis is the mismatch between the clear bias in both the design and implementation of the NWI process towards interests at the central level, namely sector donors and the Federal Government, and the responsibilities for implementing WASH services in Ethiopia which are decentralised to the Woreda level. p49.

Wilbers, G. -, Sebesvari, Z., & Renaud, F. G. (2014). Piped-water supplies in rural areas of the Mekong delta, Vietnam: Water quality and household perceptions. *Water (Switzerland)*, 6(8), 2175-2194.

Category 1 Indicator for safe water
Method(s) Multiple methods

The focus of this study is the effectiveness of piped-water supply stations in the rural Mekong Delta, Vietnam, built to meet MDG 7c. The results are obtained through testing of water supplied by 41 facilities and 542 household interviews throughout the study region.

39% of the households interviewed had potential access to piped water. More than 50% of the respondents with access to a piped-water supply did not use this supply as a source of drinking water. The reasons for rejecting pipe water were high connection fees, the preference for other water sources and perceived poor quality and/or quantity. The water quality was lower when stations used ground water compared to stations that used surface water, in some cases both exceeded WHO drinking water standards. Management strategies should be developed to prevent (ground) water sources being polluted as well as improve water treatment.

Quote

'Although piped-water is considered to be a safe and clean water source by the national government, WHO and Vietnamese drinking water guidelines are exceeded at water supply stations in the selected study sites of the Mekong Delta in Vietnam for pH, turbidity, Cl, NH4, Fe, Hg, E. coli, and total coliforms (among the investigated parameters in this study). Furthermore, the quality of piped-water varies depending on location and intake source. Some piped-water supply stations that use groundwater resources were found to exceed drinking water guidelines for Cl, although this was not observed for supply stations using surface water. Due to overexploitation of groundwater resources in the MD for drinking, domestic and irrigation purposes, groundwater levels continue to drop which increases saline intrusion. Therefore, piped-water stations that use groundwater have a risk of becoming unsuitable, since desalination techniques are too expensive for this developing region.' p2190.

Z

Zaki, S., & Amin, A. T. M. N. (2009). Does basic services privatisation benefit the urban poor? Some evidence from water supply privatisation in Thailand. *Urban Studies*, 46(11), 2301-2327.

Category 1 Political and administrative challenges Subcategory 1 Privatisation and community based management
Category 2 Inequality Subcategory 2 Urban
Method(s) Survey

According to the authors, 'improving water and sanitation access has become a key global focus since the adoption of the MDGs'. Against this background, the authors study the effect of water supply privatization contract between the PWA (public authority) and the PTW (concessionaire) on water provision in low-income urban areas in Thailand. They present the analysis of a questionnaire survey of 212 urban households in Pathumthani municipality, Bangkok Metropolitan Region, of which 86 in informal communities. The questionnaire addresses water access, quality and price in 1998 and 2003, before and after the privatization.

Access to water by income-poor households throughout the municipality has increased from 50% in 1998 to 88.6% in 2003. In informal settlements water access has increased from 28 to 84% over the same period. The water was perceived to be of better quality after the privatization in terms of clarity, taste and turbidity. In informal settlements 95.5% of the respondents reported spending less or equal to 375 baht per month

in 1998, compared to 74% in 2003, a negative change of 21.5%. The negative change in the statistics on Income-poor households is 16.1%: declining from 91.7% to 75.6%.

Quote

The positive outcome of the scheme presented in this paper, in the form of improvement in access and quality, especially for the urban poor, seems to have resulted from a mix of market- and welfare-oriented policies. Instead of following a generalised neoliberal dictate, the scheme was structured and implemented by: divesting key components of the water supply service except tariff setting, which allowed the application of a crosssubsidy to avoid any potential adverse effect to the poor from privatisation; ensuring that, instead of a single large contract, the privatised components were unbundled and contracted separately for varying durations, which effectively mitigated the risk of privatising a natural monopoly such as water supply; and, motivating the company (PTW) to expand coverage to seek profit.'

Zawahri, N., Sowers, J., & Weinthal, E. (2011). The politics of assessment: Water and sanitation MDGs in the Middle East. *Development and Change*, 42(5), 1153-1178.

Category 1	Political and administrative challenges	
Category 2	Indicator for safe water and sanitation	Subcategory 2 Indicator for safe water and sanitation
Method(s)	Literature review	

The authors compare JMP figures on water and sanitation access in the Middle East and North Africa (MENA) region with participatory assessments, reports from other UN agencies, donor projects, domestic ministries and agencies and academic research.

The data sources offer a different picture than JMP of water and sanitation access in the MENA. JMP data collection in the MENA is based on outdated administrative boundaries instead of densities. Governments prioritize urban areas inside these administrative boundaries (UNDP and INP, 2004). Sanitation coverage is very low in informal areas (World Bank, 2008). The Palestinian refugee and Bedouin population is often not included in the equation. The water quality of improved sources is insufficient. This is backed by the 2008 Environmental Performance Index (EPI) for the MENA and the RADQW survey in Jordan. The EPI reveals that none of the MENA states achieve a score of more than 70, where 100 is classified as meeting international standards for water quality. Syria, Yemen, Algeria and Lebanon were not included, suggesting a lack of monitoring systems or data submission. In absence of water provided by the government, private providers in Lebanon and the West Bank deliver water against higher prices and without being subject to regulation. In rural and informal urban areas, the population often depends on septic tanks. The contents of the septic tanks are disposed nearby, threatening human health by contributing to water pollution and contamination. In Jordan the entire population in rural areas is not connected to a sewage system. Water treatment facilities have limited capacity in e.g. Jordan, secondary cities in Egypt and the Gaza strip.

Quote

Local and contextual factors that determine whether coverage is meaningful (Is water potable? How is sewage disposed of? Are sanitation networks maintained?) may drop out entirely. The result is assessment techniques that fail to capture the original MDG objectives to improve potable water and sanitation services.' p1170.

Zheng, Y., Hakim, S. A. I., Nahar, Q., van Agthoven, A., & Flanagan, S. V. (2013). Sanitation coverage in Bangladesh since the Millennium: Consistency matters. *Journal of Water Sanitation and Hygiene for Development*, 3(2), 240-251.

Category 1 Inequality Subcategory 1 National
Method(s) Statistical analysis of secondary sources

The authors look at progress towards the MDG's target for sanitation in Bangladesh, based on DHS and MICS surveys between 1994 and 2009 in urban and rural areas, and urban slums. The surveys used different definitions. The authors applied WHO and UNICEF Joint Monitoring Program's 2008 definition for open defecation and improved/unimproved sanitation facilities to identify trends.

Bangladesh has increased sanitation coverage. 30% of the population had access to improved sanitation in 2006, the number increased to 57% in 2009. Open defecation has declined from 30% in 1994 to 6.8% in 2009, primarily due to progress in rural areas. Access to shared sanitation facilities increased from 13% in 2006 to 24% in 2009. The authors criticize JMP's decision to exclude shared facilities, which may be suitable in dense urban areas. Shared improved latrines are only slightly less clean than individual ones. Least progress is seen among the poorest quintile, this group relies on shared latrines. Open defecation among this group has declined from 60%, in 1997 to 20% in 2007.

Quote

'Re-analysis of household survey data of Bangladesh after applying a consistent definition for sanitation facilities as described in the WHO and UNICEF JMP 2008 report has found that Bangladesh is on track to meet its MDG target for sanitation of about 63% for 2015, assuming a more reasonable 1990 baseline value of 25%. However, due to its high population density, progress will likely slow down if improved sanitation facilities that are shared continue to be counted separately by JMP. In densely populated developing countries, the pros and cons of only counting individual household improved sanitation facilities towards the MDG target should be carefully weighed.' p249.