

IWA World Water Congress & Exhibition

11 – 15 September 2022 | Copenhagen, Denmark

Programme 15 Sept.
13:30 – 15:00 pm



Workshop Sanitation in urban informal settlements



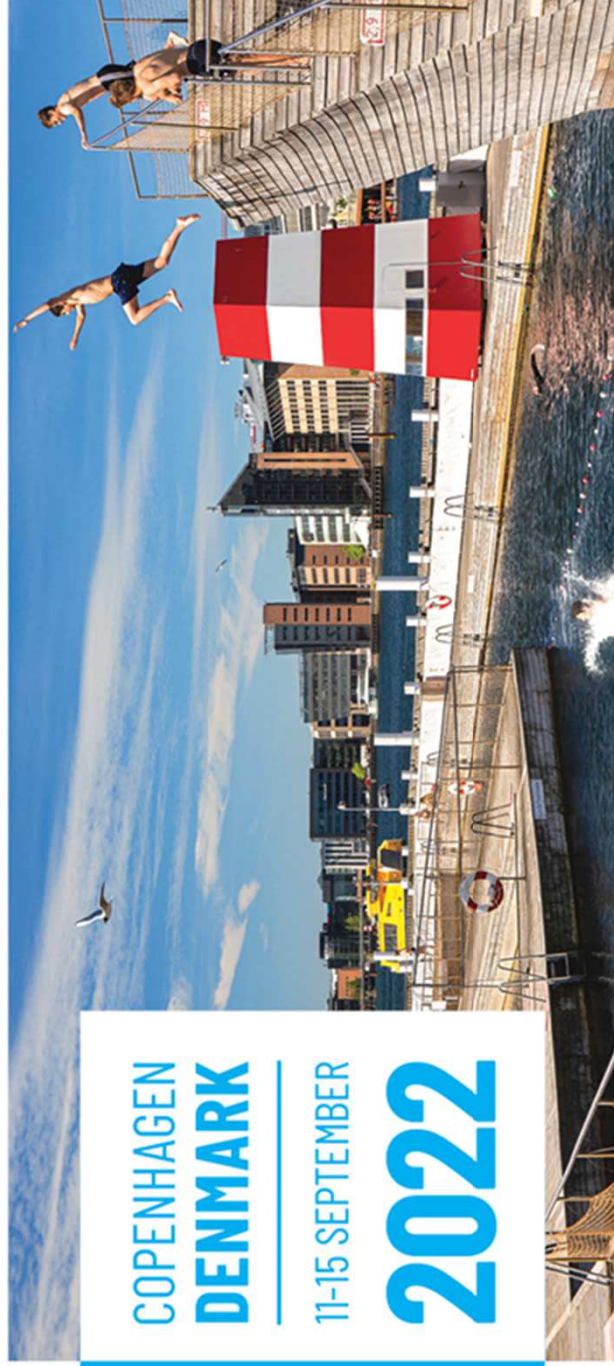
Chair: Bo N Jacobsen, *Engineers Without Borders - Denmark (EWB-DK)*
Co-Chair: Hezekiah O. Pireh, *UN-Habitat, Nairobi, Kenya*



Time	Subject	Speaker
1:30 pm	Welcome and introduction <i>- sharing and transfer of knowledge to dweller communities</i>	Bo N. Jacobsen, <i>EWB-DK</i>
1:35	The SDGs and magnitude of WASH-challenges in urban informal settlements	Hezekiah O. Pireh, <i>UN-Habitat, KE</i>
1:50	Sanitation in Urban Informal Settlements - seen from our side	Yirah O. Conteh, <i>Slum Dwellers International (SDI), SL</i>
2:10 pm	IWA-SG Non-Sewered Sanitation <i>- disrupting the traditional utility service concept</i>	Jay Bhagwan, <i>Water Research Commission, ZA</i>
2:15 pm	IWA-SG Efficient Urban Water Management <i>- From silos to synergies with wider planning of informal settlement improvements</i>	Stuart White, <i>Univ. of Technology Sydney, AU</i>
2:20 pm	IWA-SG Resources-Oriented Sanitation <i>- safe recycling of nutrients and energy recovery</i>	Kai Udert, <i>EAWAG, CH.</i>
2:25 pm	IWA-SG Sanitation and Water Management in Developing Countries <i>- Affordable vs. best available technologies</i>	Markus Starkl, <i>BOKU, AT</i>
2:30 pm	IWA-SG Health Related Water Microbiology <i>- Tools and experiences from monitoring WASH facilities and interventions</i>	James Ebdon, <i>Univ. Brighton, UK</i>
2:30 pm	Panel discussion with all presenters <i>- pointing at realistic solutions based on good experiences / accelerating improvements</i>	Moderator: Bo N. Jacobsen, Rapporteur: Ida Holm Olesen



IWA World Water Congress & Exhibition



COPENHAGEN
DENMARK
11-15 SEPTEMBER
2022



Organised by:



www.worldwatercongress.org
#WorldWaterCongress

World Water Congress & Exhibition 2022

11 – 15 September 2022 | Copenhagen – Denmark



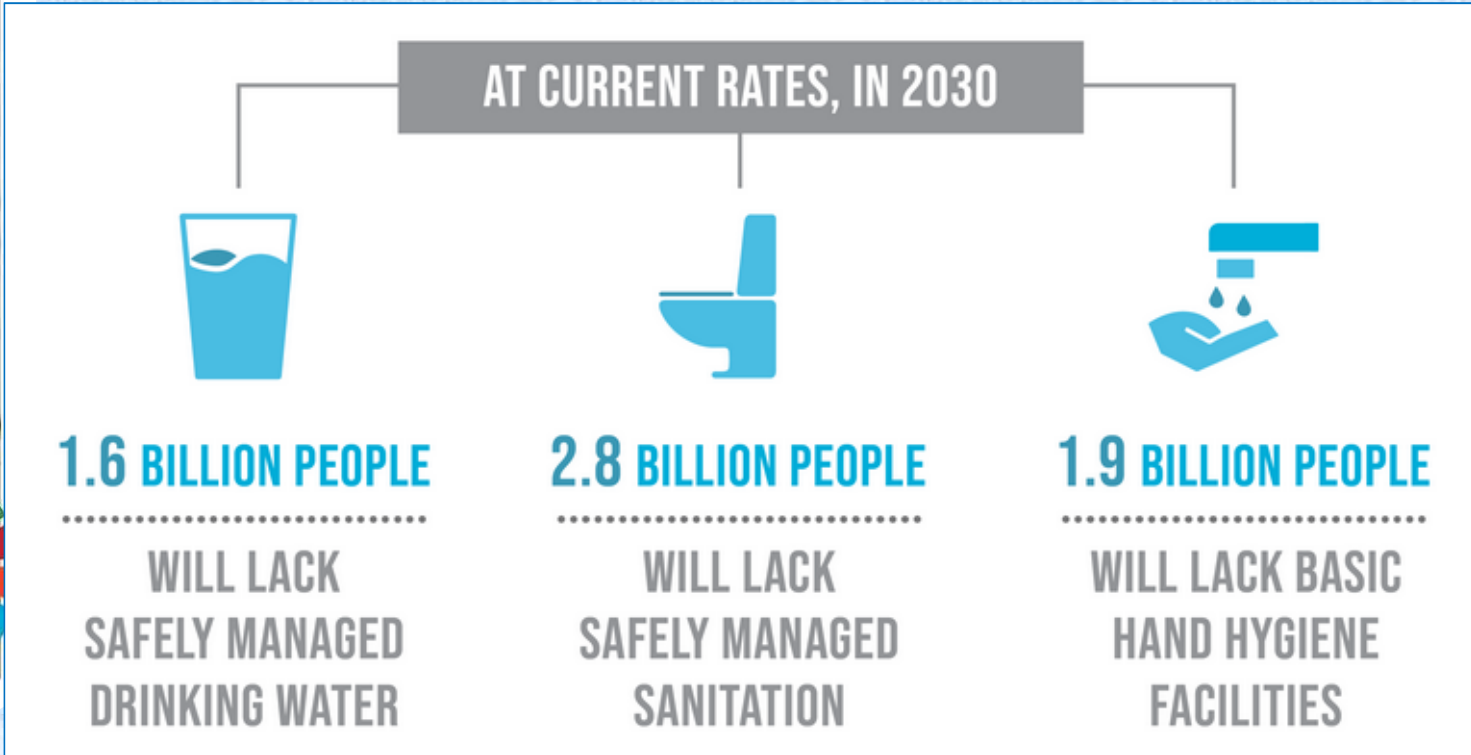
The SDGs and magnitude of WASH-challenges in urban informal settlements

Hezekiah Pireh, WASH Team Lead, UN-Habitat, Kenya





Meeting drinking water, sanitation and hygiene targets by 2030 will require a fourfold increase in the pace of progress



Source: <https://unstats.un.org/sdgs/report/2022/>



Urban WASH – Why does it matter?



8 out of 10 people who lack even basic drinking water service live in rural areas, and about half of them live in LDCs.

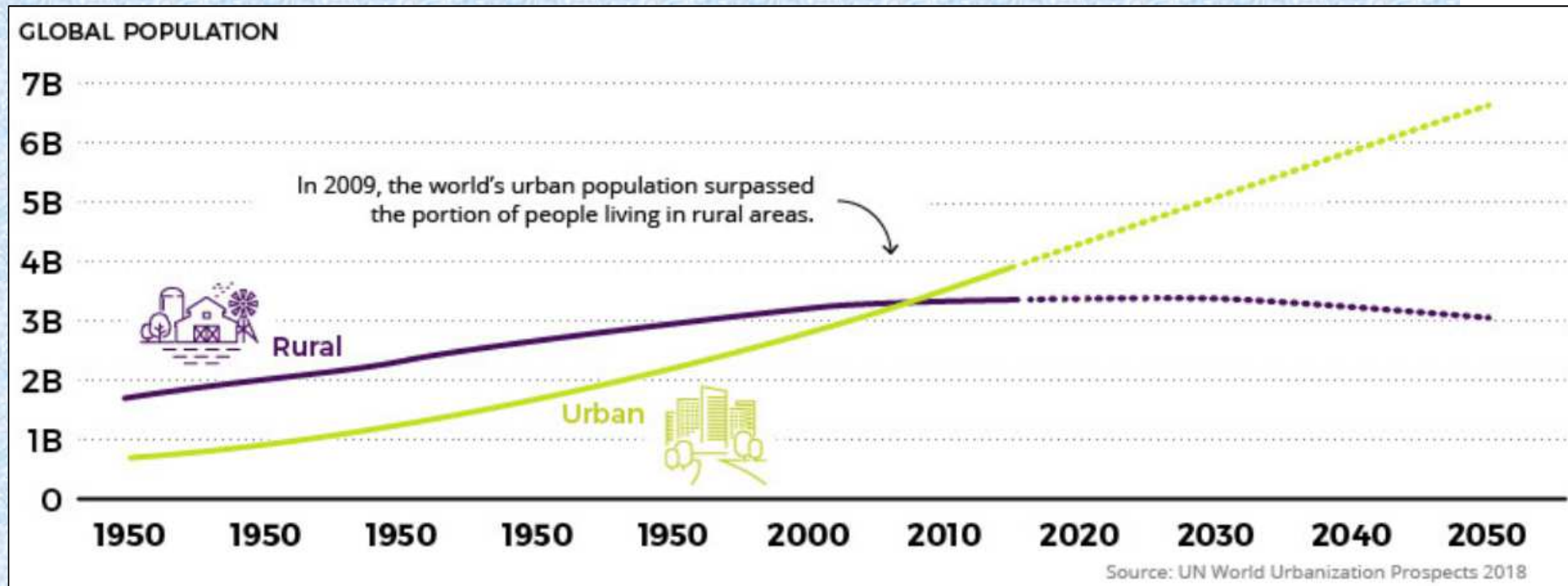
The Sustainable Development Report 2022

Big Question: Why then, does urban WASH matter?



The future of the world's population is urban

LDCs have the fastest urban population growth in the world



- The urban population of the world has grown rapidly since 1950, having increased from 751 million to 4.2 billion in 2018.
- Africa and Asia are urbanizing more rapidly than other regions of the world.



Part of Kibera slum in Nairobi, Kenya © Flickr / tdwsra

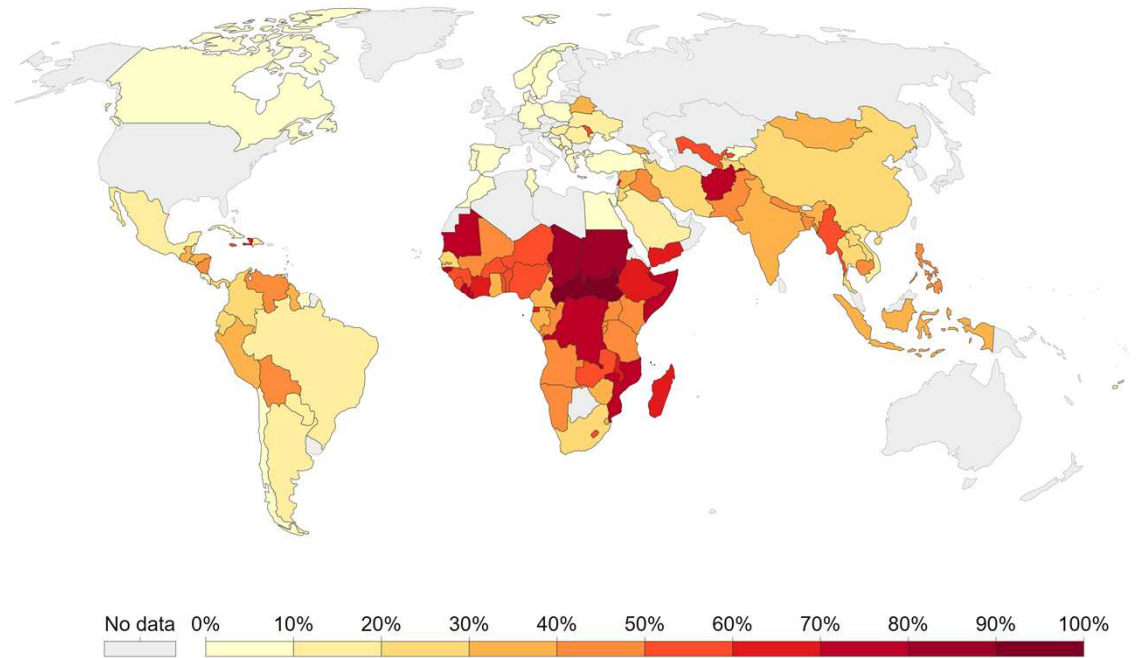
LDCs have a rising number of urban population living in slums or informal settlements



Share of urban population living in slums, 2018

A slum household is defined as a group of individuals living under the same roof lacking one or more of the following conditions: access to improved water, access to improved sanitation, sufficient living area, and durability of housing.

Our World in Data



Source: UN-HABITAT (via World Bank)

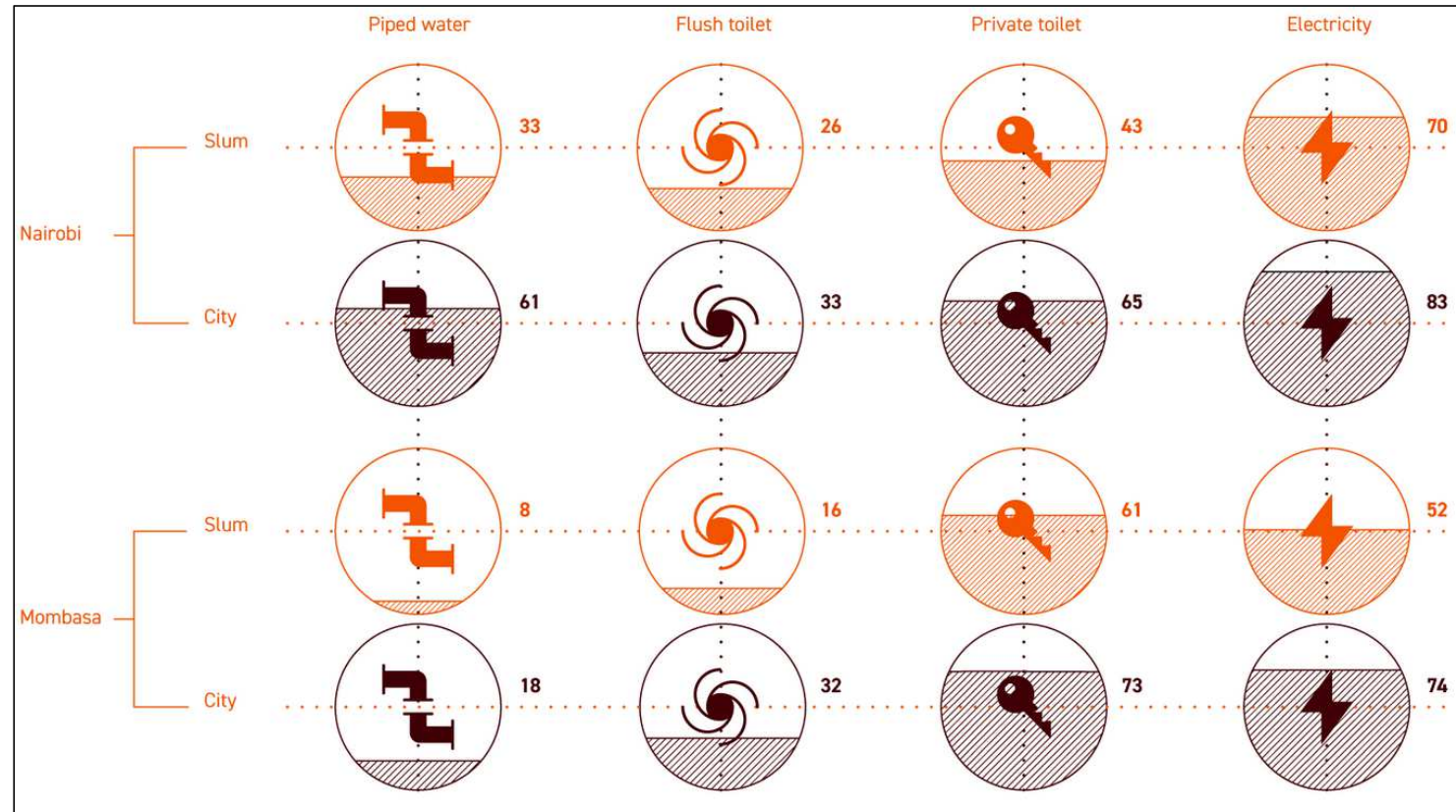
OurWorldInData.org/urbanization • CC BY

<https://unstats.un.org/sdgs/report/2019/goal-11/>





There is a growing WASH service gap in slums



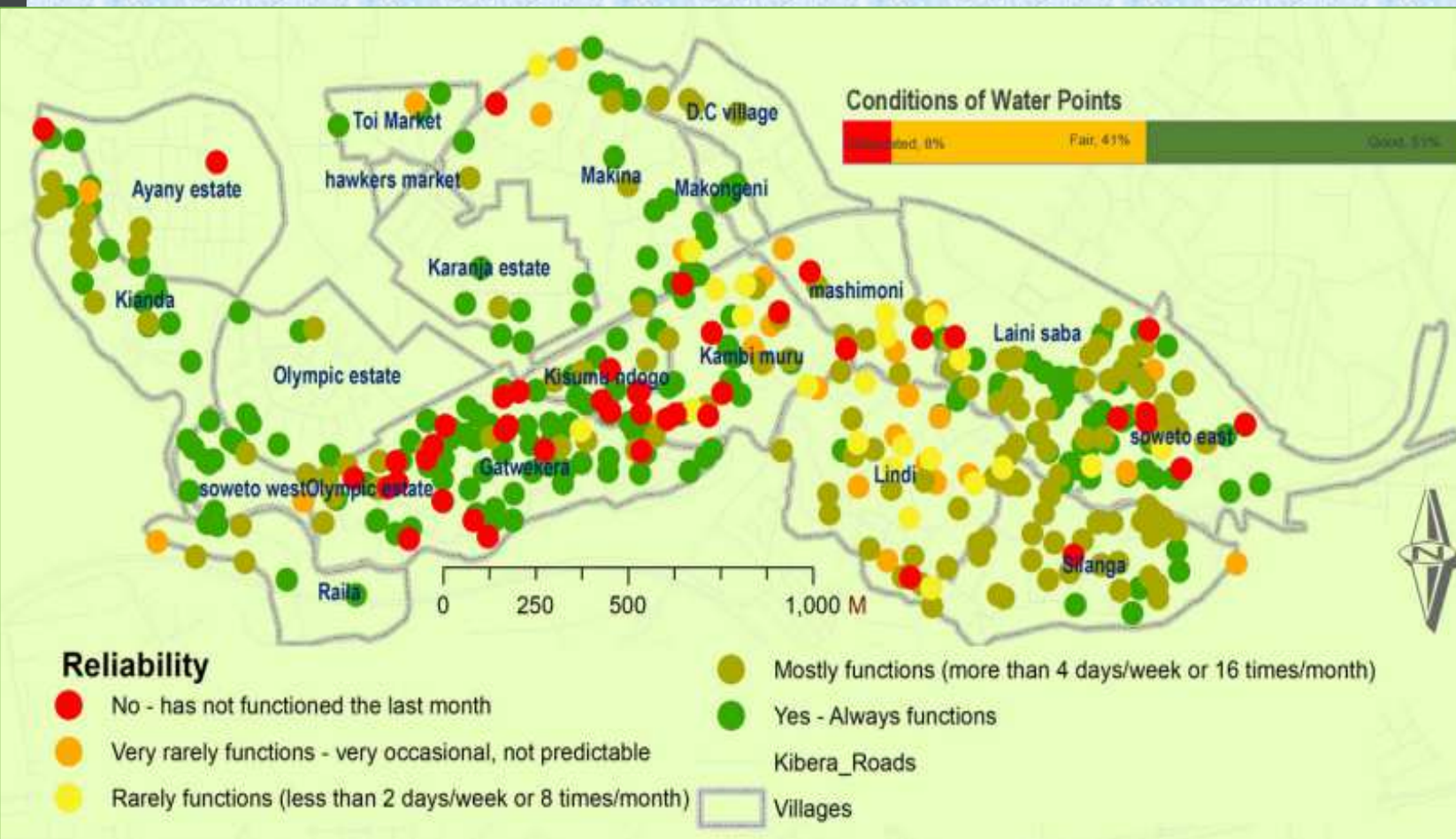
Source: Shohei Nakamura, Bhavya Patiwal, and Nobuo Yoshida, Overview of the Trends of Monetary and NonMonetary Poverty and Urbanization in Sub-Saharan Africa (Washington, D.C.: World Bank, 2018).



Part of Kibera slum in Nairobi, Kenya © Flickr / tdwsra

UN-Habitat Informal Settlements Vulnerability Mapping

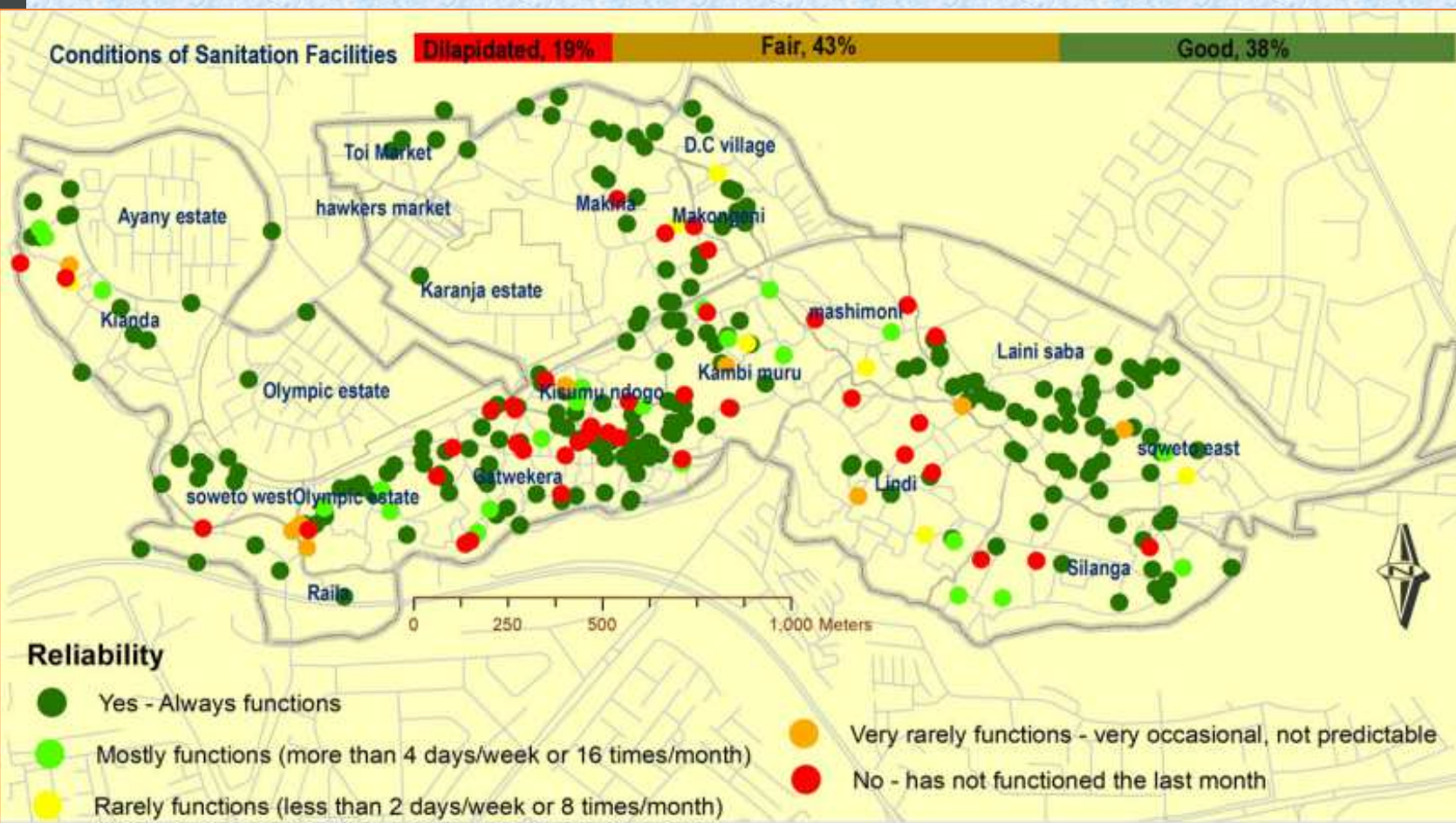
Access and State of Water Facilities – Kibera, Nairobi



- 50% of water points are experiencing rationed supply in at least 3 days a week.
- The existing water points are in fairly good condition, with only 8% being dilapidated.

UN-Habitat Informal Settlements Vulnerability Mapping

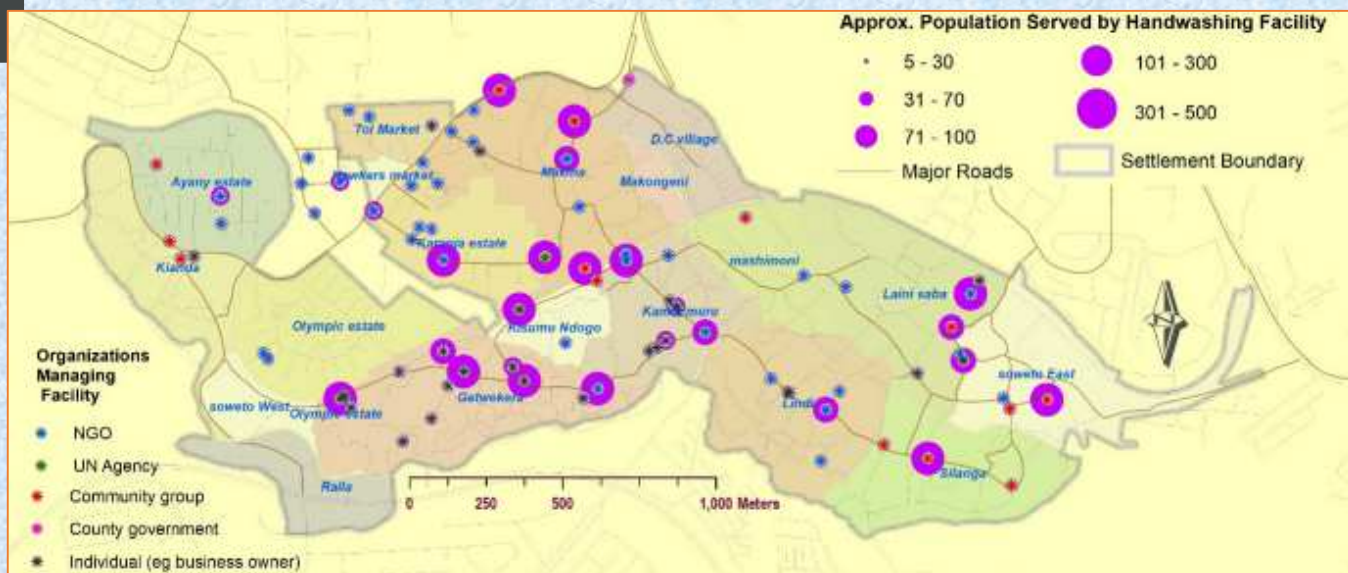
Access and State of Sanitation Facilities – Kibera, Nairobi



While over 80% of sanitation facilities are functioning, only 38% are in good conditions, the rest being in dilapidated to fair conditions.

UN-Habitat Informal Settlements Vulnerability Mapping

Access and State of Handwashing Facilities – Kibera, Nairobi



- Handwashing facilities are generally not connected to piped water supply, with over 70% of them being manually fed.
- Already 20% of the mapped handwashing facilities do not have water throughout the day, and 15% do not have soap throughout the day.

WASH challenge in informal settlements is a challenge of urban governance



- **Urban policies and legislative frameworks rarely prioritize WASH** - The urban development sector in LDCs seldom appreciates the critical role of WASH in improving public health and eradicating poverty and inequality in cities and human settlements. **There is lack of integration between spatial plans and infrastructure and service plans**
- **Lack of a citywide WASH service vision** – WASH sub-sectors and related sectors such as health, education and agriculture are working independently with strategies and programmes shaped by their own priorities and interests.
- **Low government expenditure for WASH resulting in a huge financing gap** - In Africa, for example, total current investments must be tripled to an annual amount of \$114 billion, requiring six times the current rate of national government spending on the WASH sector.
- **Lack of clarity in the mandates, roles, responsibilities and relationships among national and subnational institutions** - Responsibilities for the different elements of the urban water cycle are often spread across a wide range of Institutions.
- **Most public water utilities in LDCs suffer from a wide range of interrelated institutional weaknesses** - Most utilities lack adequate financing and often operate in environments where full cost recovery is not feasible.
- **Inadequate data to guide decision-making** on service delivery, investments, regulation, planning and accountability.

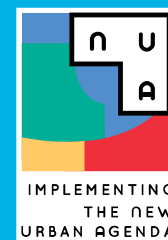
More information available from:

- **The Sustainable Development Goals Report 2022** <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>
- **2018 Revision of World Urbanization Prospects** <https://www.un.org/development/desa/publications/2018-revision-of-world-urbanization-prospects.html>
- **Urban Population Living in Slums by Country or Area 1990 2018 (Thousands)** https://data.unhabitat.org/datasets/cd4e1deb72ea49bd8f3403f8a9edfe6d_0/explore
- **S., Nakamura, B. Paliwal, and Yoshida. N. 2018. Overview of the Trends of Monetary and Non-Monetary Poverty and Urbanization in Sub-Saharan Africa** <https://www.brookings.edu/blog/africa-in-focus/2020/02/27/figures-of-the-week-service-delivery-in-africas-urban-areas/>
- **Informal settlements vulnerability mapping** <https://data.unhabitat.org/pages/slum-data-surveys>

Thank you



UN  **HABITAT**
FOR A BETTER URBAN FUTURE



www.unhabitat.org

World Water Congress & Exhibition 2022

11 – 15 September 2022 | Copenhagen, Denmark

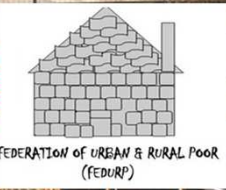
Workshop
Sanitation in urban
informal settlements



Improving Access to Sanitation in Informal Settlements
WATSAN work across the SDI network



Yirah Oryanks Conteh, National Chairperson
Federation of Urban and Rural Poor (FEDURP)



inspiring change

Introduction to Slum Dwellers International - SDI - network

- a transnational social movement of the urban poor and NGO professionals
 - evolved over many years of peer-to-peer exchanges
 - revealing the critical value of a network of community-based organization driven by the poor themselves.
- creates a synergy of professional and community knowledge and resources
- a platform that enhances:
 - productive consultations with local and state, and non-state actors
 - stimulation of decisions and actions for the adoption and implementation of pro-poor policies and practices in community planning and development.

Introduction to SDI (cont'd)

Hubs	Southern Africa	West Africa	Asia	Latin America	East Africa
Countries	Botswana	Burkina Faso	India	Brazil	Kenya
	Malawi	Ghana	Philippines		Uganda
	Namibia	Liberia			Tanzania
	South Africa	Nigeria			
	Swaziland	Senegal			
	Zambia	Sierra Leone			
	Zimbabwe	Togo			
		Benin			

Federation of Urban and Rural Poor (FEDURP) – part of SDI

- vulnerable women, men, youth and children who are mobilized around dynamic saving schemes,
- networked at settlement, city and national levels to drive a collective, bottom-up initiatives influencing change towards inclusive and resilient cities and localities and contributes to national development agenda.
- Centre of Dialogue on Human Settlement and Poverty Alleviation (CODOHSAPA) is the professional support office (PSO) through which programmes and funds are channelled for FEDURP to serve communities and advocate for rights to services and lands and housing.
- FEDURP and CODOHSAPA are therefore, the Sierra Leone alliance of SDI.

Websites

www.codohsapa.org
www.sdinet.org
Knowyourcity.info

Social Media

Twitter: @codohsapasl
Facebook: @codohsapa.sl
Youtube: kyctv.sl

Email info@codohsapa.org

WATSAN Challenges: Water Services



WATSAN Challenges: Sanitation Services



WATSAN Work Across SDI Network

In 2018/19, SDI affiliates provided improved access to water and sanitation services for 248,057 households across the SDI network.

SDI affiliates have explored various means of accessing improved water and sanitation services for slum dwellers, ranging from

- working together with government agencies to access subsidies and construct facilities (for example in South Africa and India)

to using community savings and capital grants from SDI to

- construct household and communal toilets
- using innovative, sustainable technologies such as EcoSan (Malawi, Uganda, Kenya)
- and simplified sewerage technology (Tanzania),

neither of which are reliant on connection to the municipal sewerage lines.

FEDURP in Sierra Leone sourced funding and supported VIP latrines and water tanks.

Different models of community solutions to WATSAN challenges



EcoSan Toilets in Blantyre, Malawi

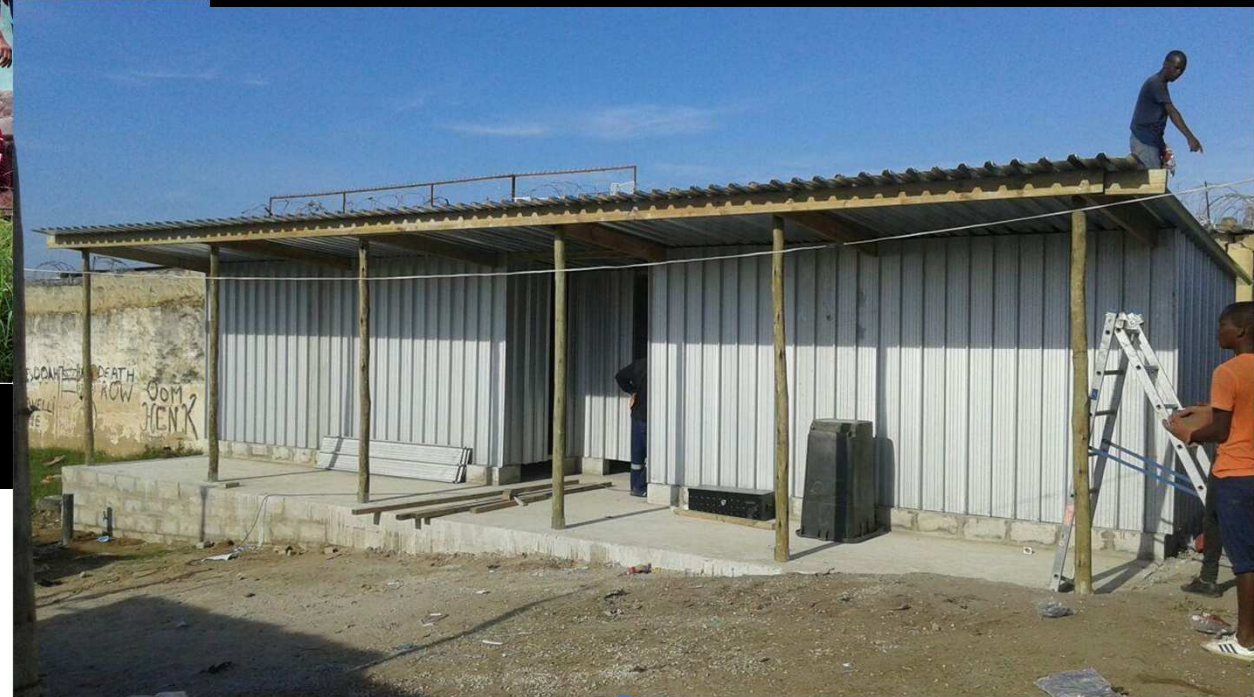
Ventilated Improved Pit (VIP) Latrine, Colbot, Freetown, Sierra Leone



Different models of community solutions to WATSAN challenges



Community Sanitation Facility in Midrand, South Africa



Simplified, Decentralised Sewerage in Vinguguti, Tanzania



Water tank providing water for Oloshoroh, Freetown, Sierra Leone

Websites

www.codohsapa.org
www.sdinet.org
Knowyourcity.info

Social Media

Twitter: @codohsapasl
Facebook: @codohsapa.sl
Youtube: kyctv.sl

Email info@codohsapa.org

Community Actions to address WATSAN Challenges



Women leaders gather at a water project site to discuss actions to self mobilise resources to complete project in Dworzack, Freetown, SL

Communities provide skilled and unskill labour including women to construct Improved Public Sanitation Facilities at Masala Market, Ndola, Zambia



Lessons Learnt

- Establishing women-led committee is a guarantee for sustainability of facilities.
- Involving community members from the onset ensures community participation and ownership.
- Involvement of communities reduces cost as community members can be willing to provide labour and other available local resources free of cost
- Channeling funds and other resources through the SDI PSOs guarantees access to funding for slum dwellers or federations to support and implement their initiatives including WATSAN.

What is needed

- Relevant information on WATSAN funding opportunities or linkages to potential donors/partnerships
- Capacity building and other technical support
- International knowledge exchanges including opportunities to participation in international conferences or seminars

Websites

www.codohsapa.org
www.sdinet.org
Knowyourcity.info

Social Media

Twitter: @codohsapasl
Facebook: @codohsapa.sl
Youtube: kyctv.sl

Email info@codohsapa.org

Expectation from Workshop

- To engage and learn from the experiences and successes of other partners.
- Seek opportunities to build relationship with potential donors
- Gain additional programme development and operational skills on WATSAN initiatives
- Market the general SDI profile and my local affiliate (FEDURP/CODOHSAPA)

Websites

www.codohsapa.org
www.sdinet.org
Knowyourcity.info

Social Media

Twitter: @codohsapasl
Facebook: @codohsapa.sl
Youtube: kyctv.sl

Email info@codohsapa.org

**”TAKE THE SLUM FROM THE PEOPLE
AND
NOT THE PEOPLE FROM THE SLUM”!**

Thank you for your attention!

www.sdinet.org

Websites

www.codohsapa.org
www.sdinet.org
Knowyourcity.info

Social Media

Twitter: @codohsapasl
Facebook: @codohsapa.sl
Youtube: kyctv.sl

Email info@codohsapa.org

World Water Congress & Exhibition 2022

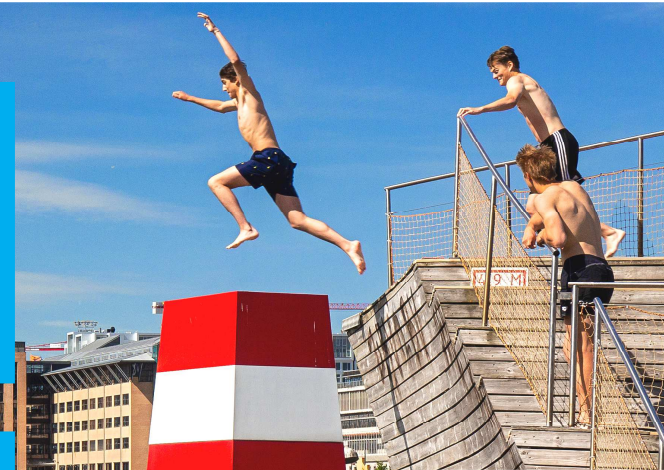
11 – 15 September 2022 | Copenhagen – Denmark



Sanitation Sensitive Design under the framework of CWIS

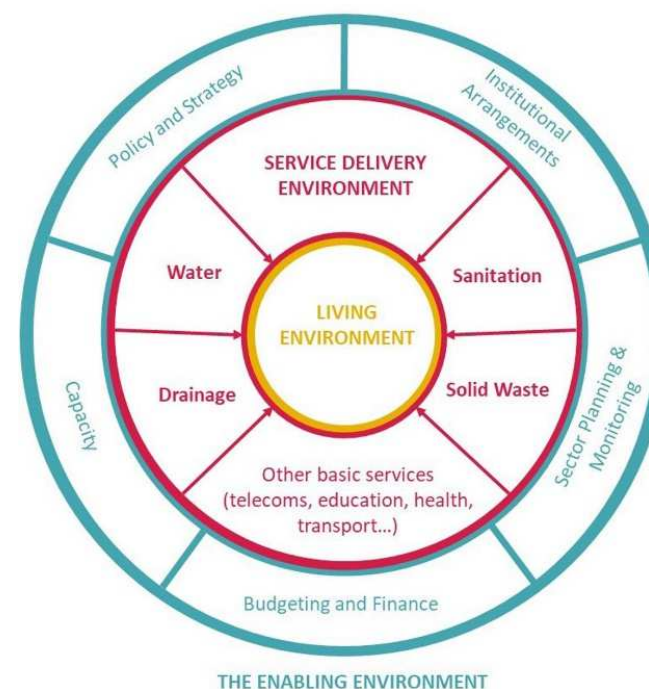
Creating a New Paradigm for Sanitation

Jay Bhagwan, Water Research Commission, South Africa



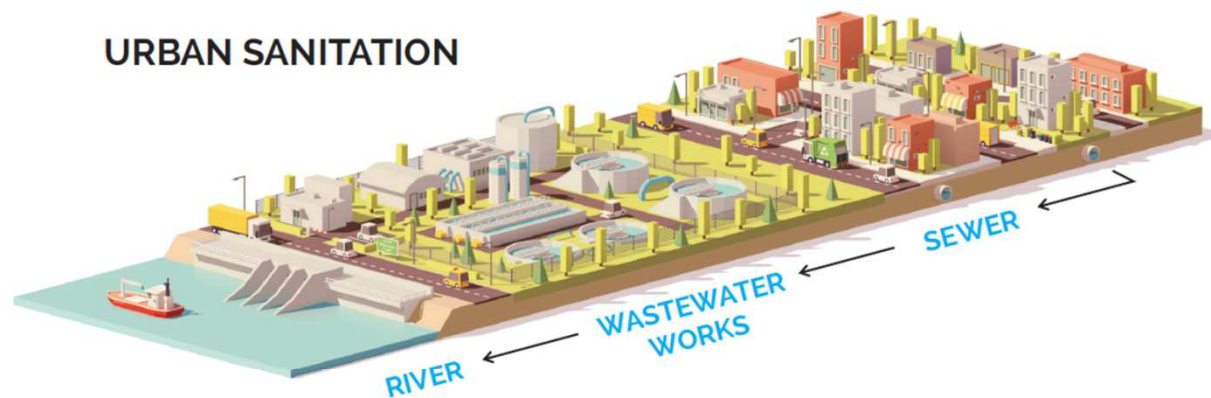
CWIS

- Citywide Inclusive Sanitation (CWIS) is a **public service approach** to planning and implementing urban sanitation systems to achieve outcomes summarized by Sustainable Development Goal 6
- CWIS focuses **on outcomes and system functions rather** than specific system designs. So, sanitation authorities may and must consider the range of possible technologies, service and business models.
- A public service approach to urban sanitation acknowledges the market failures inherent to urban sanitation systems. This approach does not preclude, but rather improves private sector incentives to expand investments and stimulate innovations along all stages of the sanitation value chain.



Source: Front. Environ. Sci., 03 July 2020
Sec. Water and Wastewater Management
<https://doi.org/10.3389/fenvs.2020.00070>

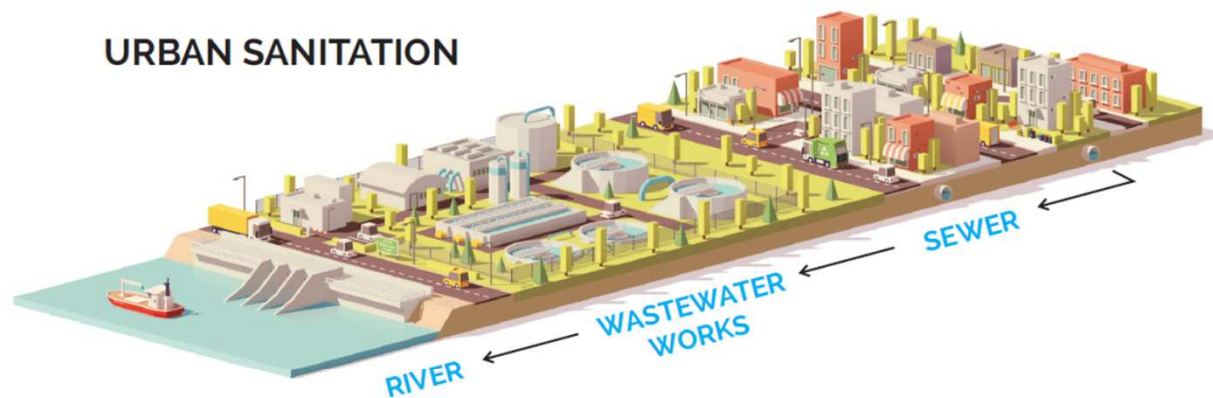
BINARY ENGINEERING APPROACH: FLUSH = "GOLD STANDARD"



INEQUALITIES – where you are born & live determines the toilet you use



BINARY ENGINEERING APPROACH: FLUSH = "GOLD STANDARD"



SANITATION PRESSURES



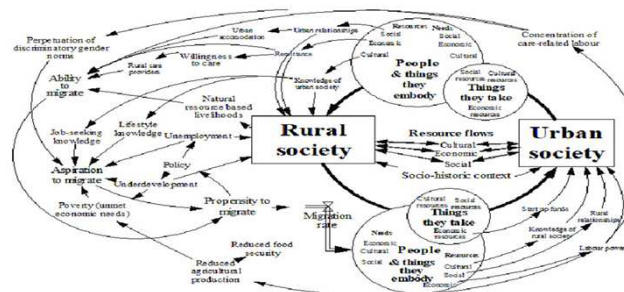
CLIMATE CHANGE



WATER STRESS

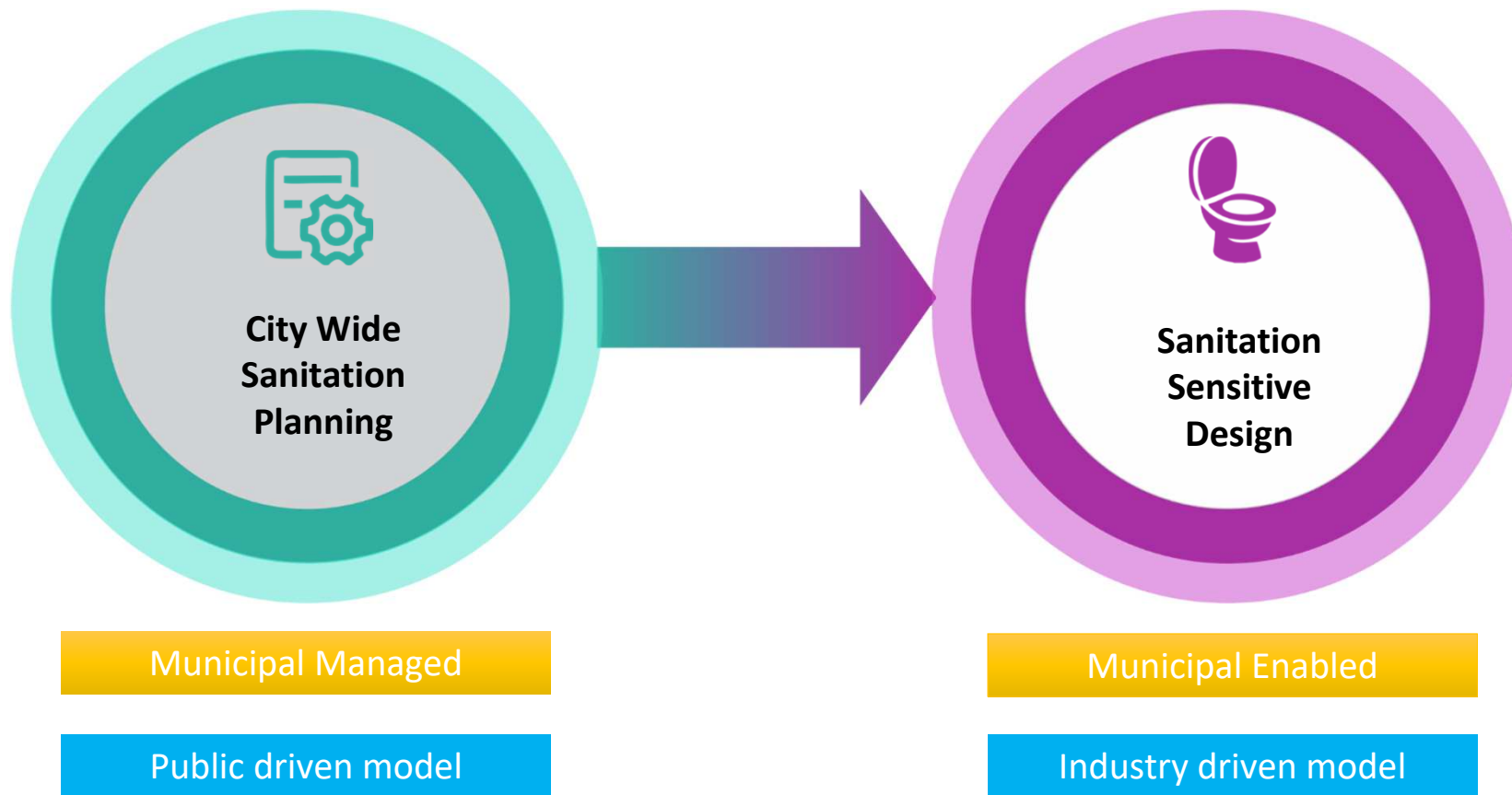


AGEING & UNSUSTAINABLE INFRASTRUCTURE



POPULATION GROWTH AND RAPID URBANIZATION

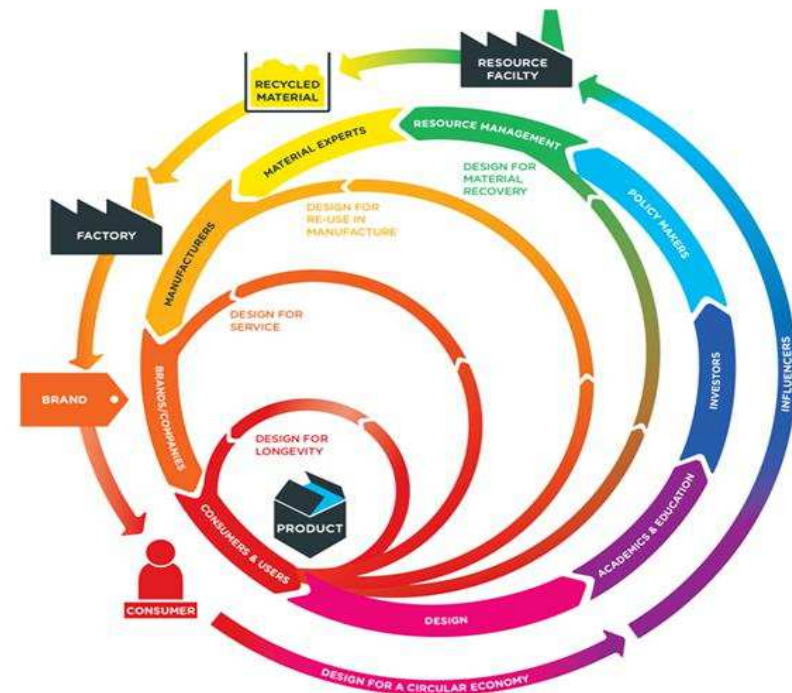
Conceptual framework for Sanitation Sensitive Design



KEY ELEMENTS OF SSD

- DRIVES WATER EFFICIENCY
- OFFERS EQUITABLE SERVICE
- HUMAN WASTE AS A RESOURCE
- MANAGES ENVIRONMENTAL POLLUTION
- OFFERS RIGHT TO ACCESS
- CREATES A NEW SANITATION MARKET AND ECONOMY
- ALIGNED TO TECHNOLOGY DISRUPTION – NON-SEWERED AND OFFGRID SOLUTIONS (GREEN)
- NEW BEHAVIOURS

SUPPORT OUTCOMES

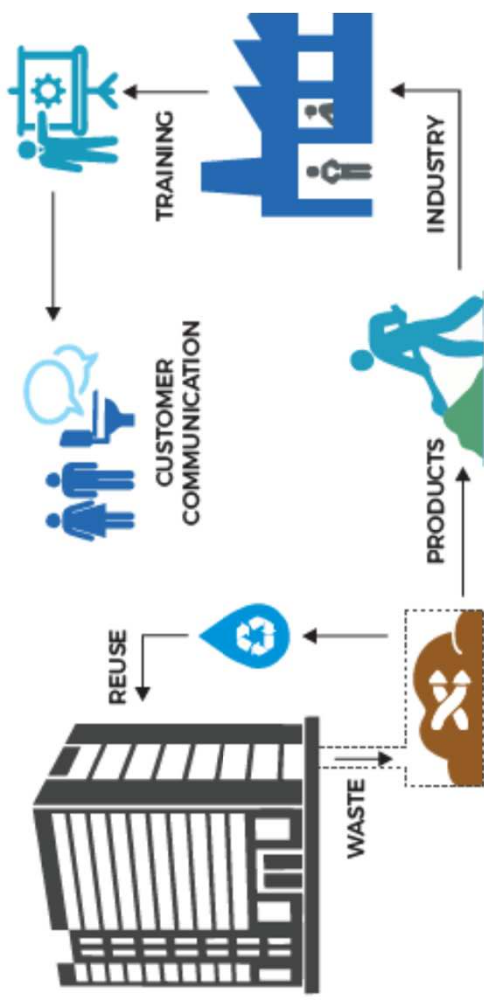


MRW 1347893_circular-economy.png

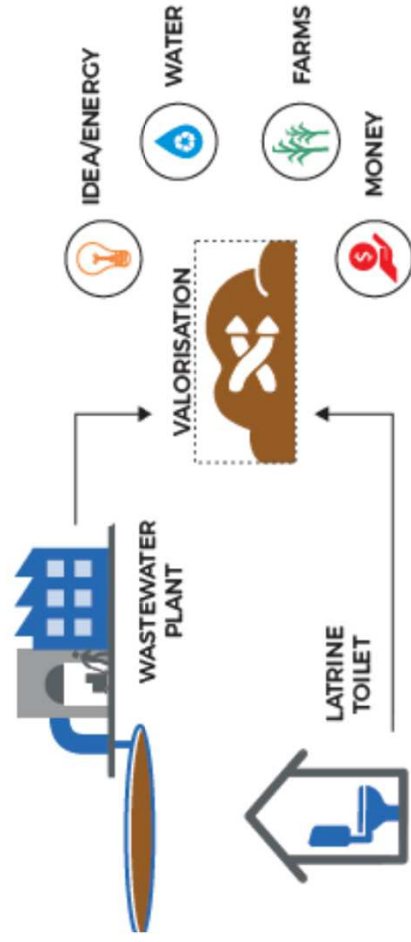
RE-ENGINEERD TOILETS



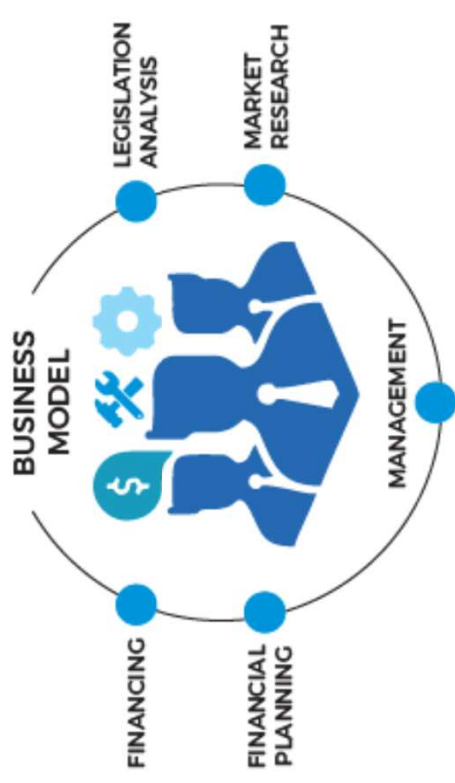
SANITATION-SENSITIVE DESIGN



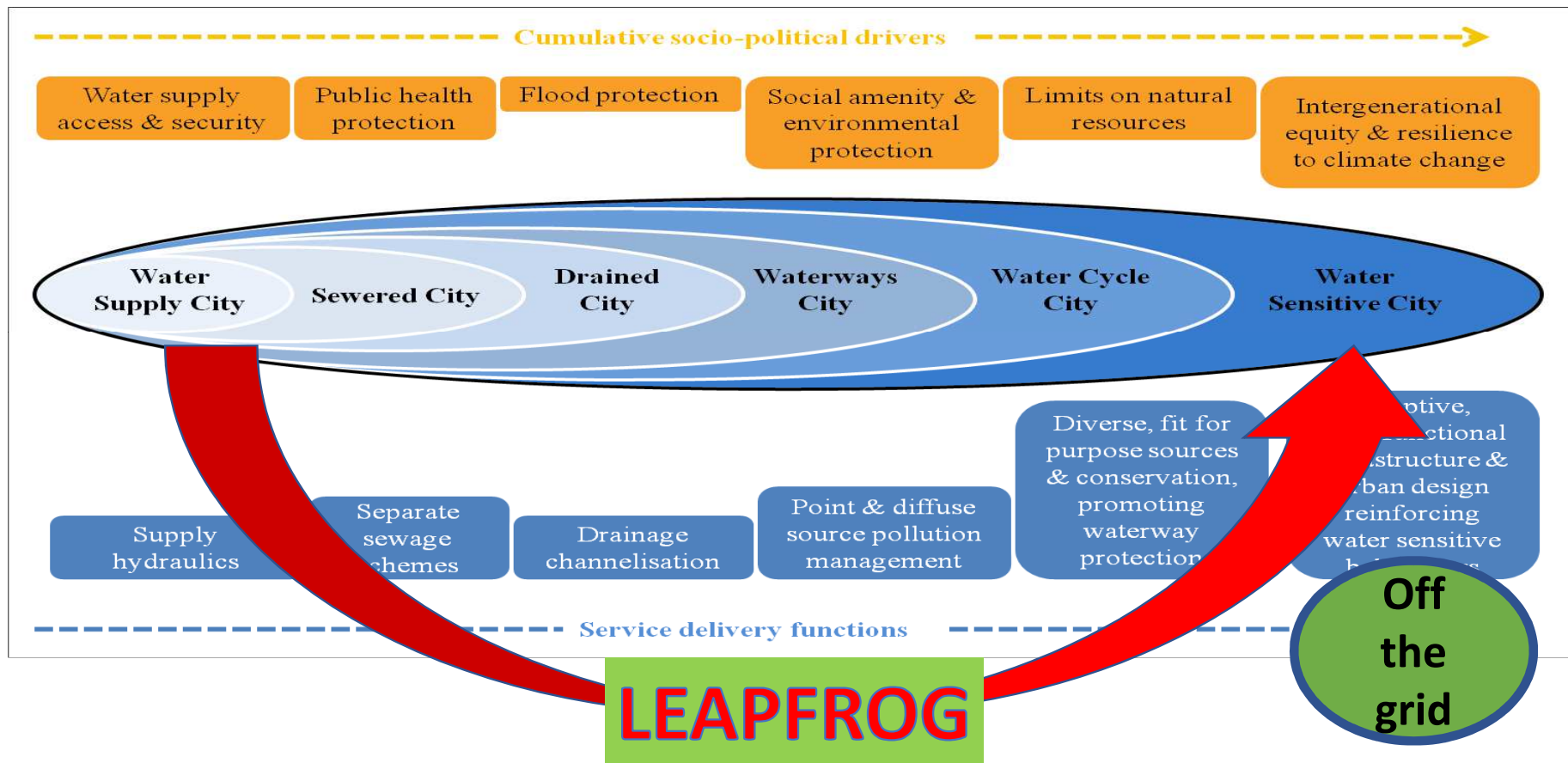
MUNICIPAL SLUDGE VALORISATION



SANIBUS



Sanitation Sensitive Designing for the Developing World





Water and sanitation linkages: the role of water efficiency

Stuart White

Specialist Group on Efficient Urban Water Management

1.30pm Thursday 13 Sep 2022



Introduction to the Specialist Group

The mission of the Efficient Urban Water Management Specialist Group is to encourage the interchange of knowledge, research, best practices and programs regarding **efficient management and use of water in urban zones**. A specific area of interest is exploring and promoting new technological solutions for urban drinking water supply and wastewater sanitation systems.

Topics like **end use efficiency; customer demand management, level of service, network asset management, water losses management, performance assessment, environment impacts, economics, social preferences and involvement, water resource planning, and program design** are all integrated under the Efficient SG umbrella.

Devoted to promoting practical solutions for utilities, the SG also seeks to involve broad stakeholder interests and knowledge. The main forum for the SG is the biennial Efficient Conference, which has been successfully held every two years since 2001.

Sanitation/ water



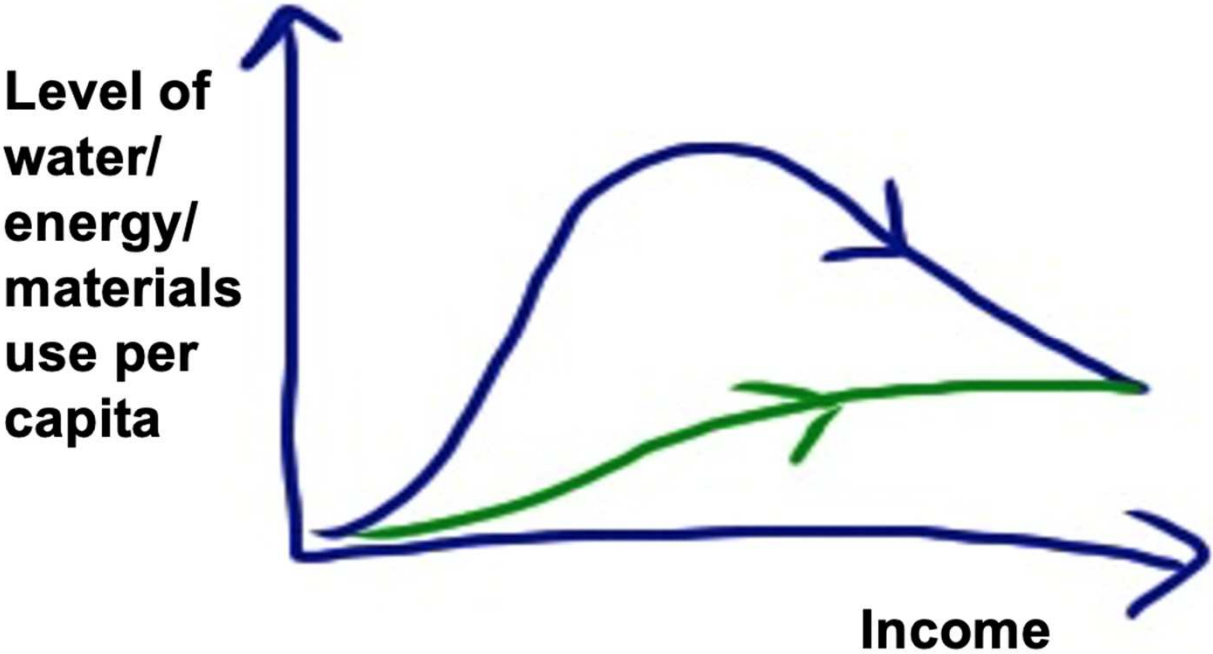
Piped water
drives
wastewater
flows

Complex
mixture of
water end-
uses

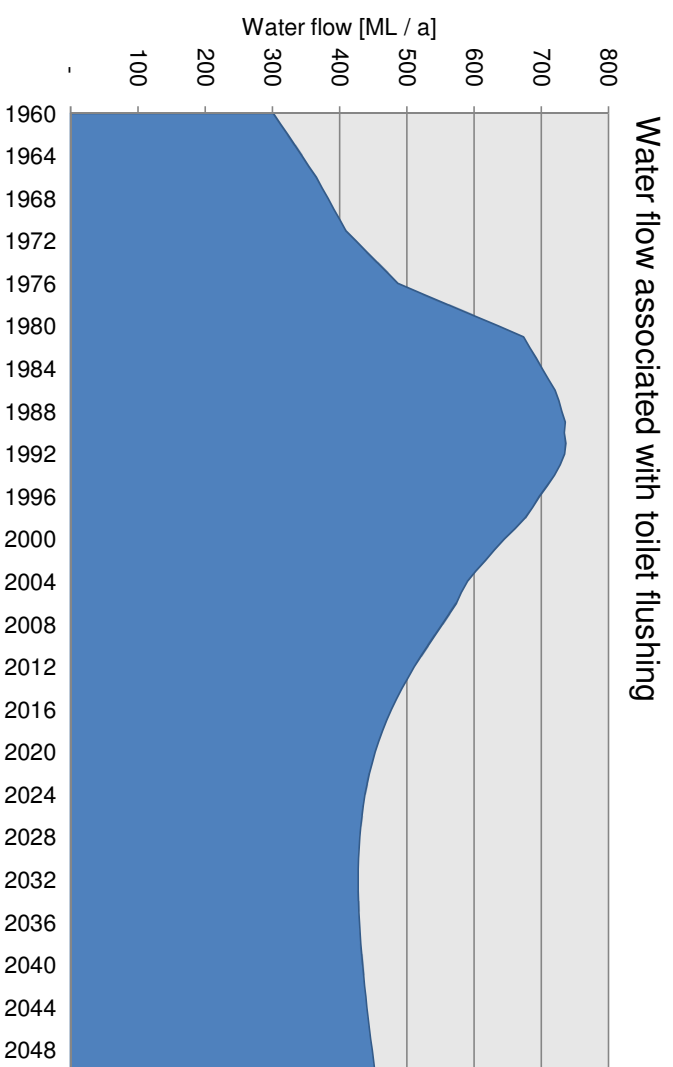
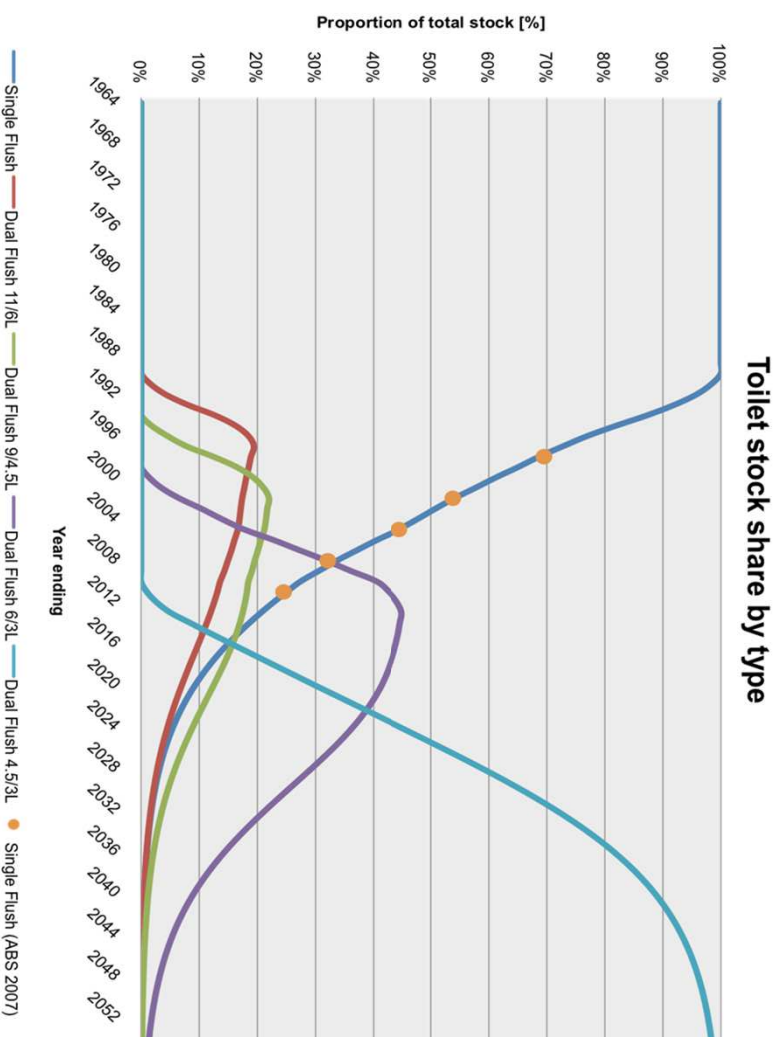
Trend vs
destiny

Management
and losses

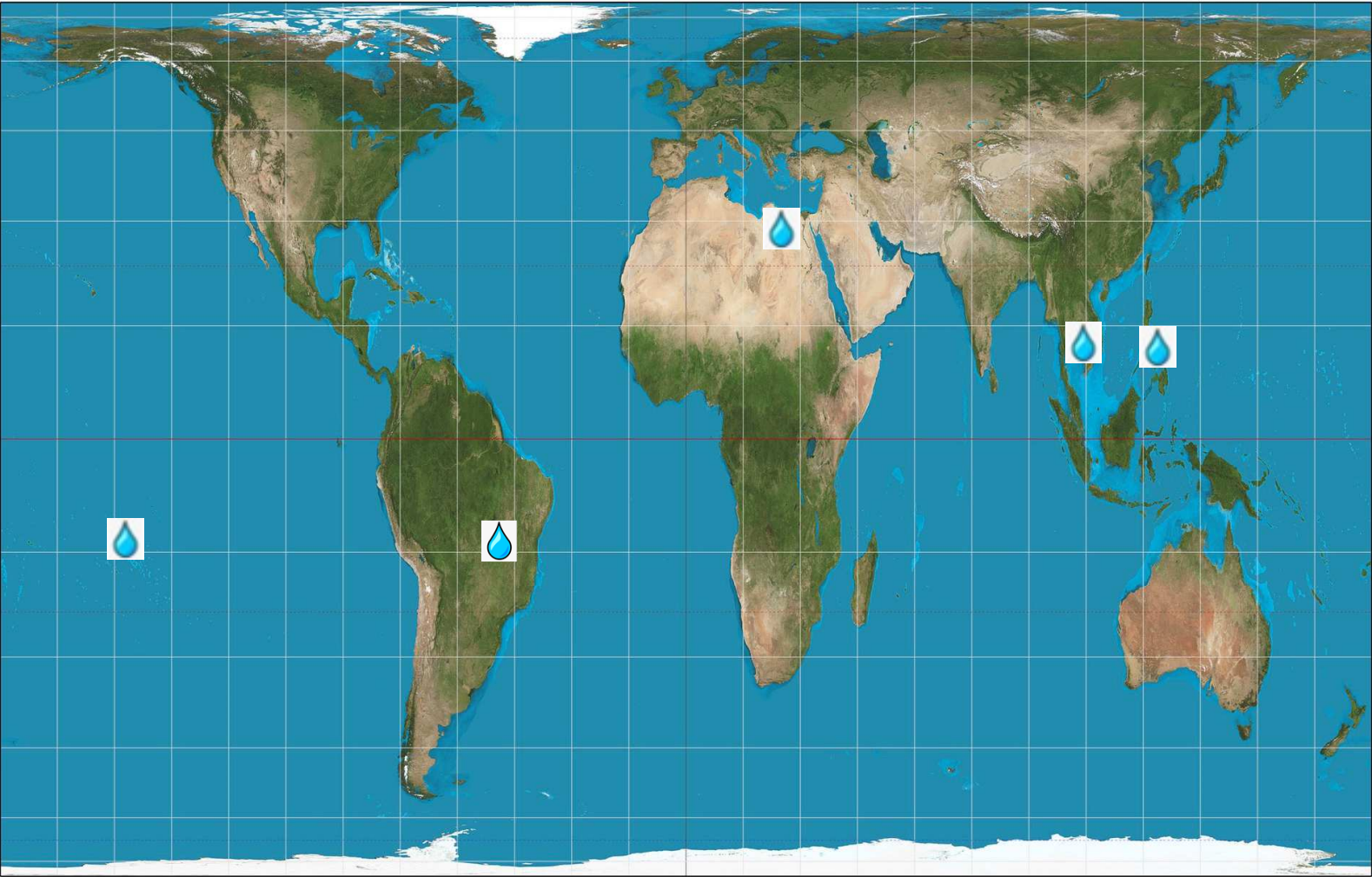
Environmental Kuznets curve for resource use



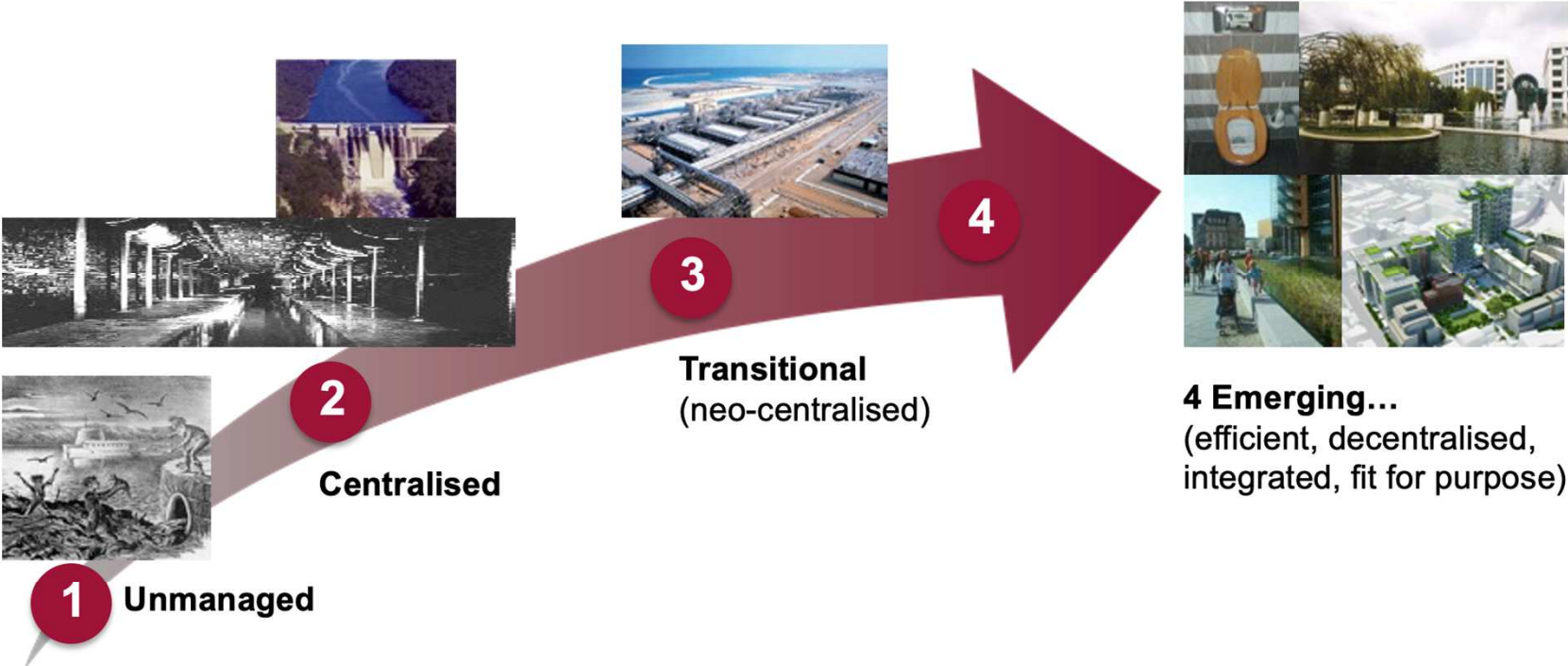
Toilets as an example



Examples...



Four generations of urban water systems



Specialist Group on
Efficient Urban Water Management
International Water Association
<https://iwa-connect.org/>



Institute for Sustainable Futures
University of Technology Sydney
<https://www.uts.edu.au/isf>



Thank you



World Water Congress & Exhibition 2022

11 – 15 September 2022 | Copenhagen, Denmark

Workshop
Sanitation in urban
informal settlements



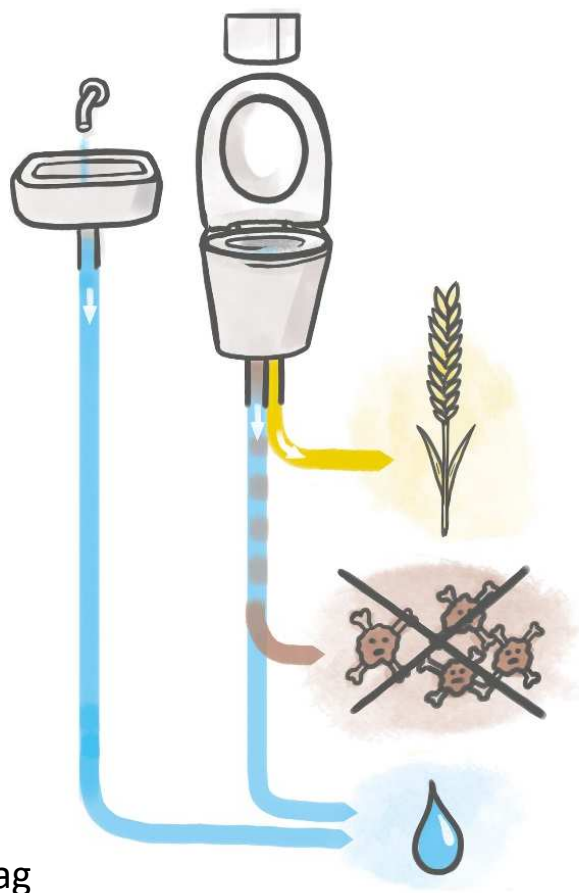
SG-ROS: SAFE RECYCLING OF
NUTRIENTS AND WATER...
...BUT ENERGY RECOVERY?

Kai Udert, Eawag, Switzerland



inspiring change

Source separation



© Eawag

Nutrient recovery from urine

Pathogen removal from feces

Water recovery for flushing and hand-washing

Toilet with on-site treatment



Picture © Lucky Lugogwana and Eawag
Renderings © EOOS NEXT and Eawag



Hand-washing station



Picture © Lucky Lugogwana and Eawag

Water supply onsite, urine and feces collection



Centralized treatment of urine and feces



FURTHER INFORMATION

IWA Specialist Group on Resource-Oriented Sanitation:
iwa-connect.org/group/resources-oriented-sanitation

Blue Diversion Toilet:
www.bluediversiontoilet.com

Blue Diversion Autarky Toilet:
www.autarky.ch

Blue Diversion Business model:
www.eawag.ch/en/departement/ess/projects/business-model-thinking-for-converting-new-technologies-into-poverty-alleviation/blue-diversion-toilet-business-model

Research on resource oriented sanitation at Eawag:
www.eawag.ch/en/research/humanwelfare/wastewater/decentralised-resource-recovery-from-wastewater

World Water Congress & Exhibition 2022

11 – 15 September 2022 | Copenhagen, Denmark

**Workshop
Sanitation in urban
informal settlements**



AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES

Markus Starkl, BOKU Vienna, Austria



inspiring change

IWA-SG on sanitation and water management in developing countries

Main topics dealt with:

- **Water supply and sanitation services and their interrelation with river basin management**
- **Financially Sustainable Urban Sanitation**
- **Decentralized vs centralized sanitation and wastewater systems**
- **Off-grid solutions for sanitation and water management**

Specific topic selected for this workshop:

- **AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES**

AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES



CATNEP vs BATNEEC

- Cheapest Available Technology not Entailing Prosecution vs
- Best Available Technology Not Entailing Excessive Costs

Experience in Global South

- Often CATNEP principle is prevailing and/or technologies fail after some time of operation
- Affordability to pay generally very low for sanitation services

Sustainable Development Goals

Target 6.2: „...Adequate and equitable sanitation...“

-> Focus on solutions which may not be safe nor considered best available technologies



Interpreting best available technologies more flexibly: A policy perspective for municipal wastewater management in India and other developing countries

Markus Starkl^{1,*}, Josephine Anthony², Enrique Aymerich³, Norbert Brunner⁴, Caroline Chubilleau⁵, Sukanya Das⁶, Makarand M. Ghangrekar⁷, Absar Ahmad Kazmi⁸, Ligy Philip⁹, Anju Singh¹



Policy Analysis
pubs.acs.org/est

Why Do Water and Sanitation Systems for the Poor Still Fail? Policy Analysis in Economically Advanced Developing Countries

Markus Starkl,^{1,*} Norbert Brunner,² and Thor-Axel Stenström³



Article

Affordability of Decentralized Wastewater Systems: A Case Study in Integrated Planning from INDIA

Norbert Brunner¹, Markus Starkl^{2,*}, Absar A. Kazmi³, Alvaro Real⁴, Nitin Jain⁵ and Vijay Mishra⁶

AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES

The Role of international standards

- Until recently no international standards existed that were applicable for sanitation solutions with a focus on the Global South
- Often, technologies deployed in the Global South by developers from the North were of „experimental character“, lacking technological maturity.
- The need of developing relevant international standards were identified by the BMGF, ISO and supporters.
- **ISO 30500 published in 2018 and ISO 31800 in 2020**

2015

ENVIRONMENTAL
Science & Technology

Policy Analysis
pubs.acs.org/est

Ensuring Sustainability of Non-Networked Sanitation Technologies:
An Approach to Standardization

Markus Starkl,^{*,†} Norbert Brunner,[‡] Magdalena Feil,[§] and Andreas Hauser[§]

INTERNATIONAL
STANDARD

ISO
30500

First edition
2018-10

INTERNATIONAL
STANDARD

ISO
31800

First edition
2020-08

Non-sewered sanitation systems —
Prefabricated integrated treatment
units — General safety and
performance requirements for design
and testing

*Systèmes d'assainissement autonomes — Unités de traitement
intégrées préfabriquées — Exigences générales de performance et de
sécurité pour la conception et les essais*

Faecal sludge treatment units —
Energy independent, prefabricated,
community-scale, resource recovery
units — Safety and performance
requirements

*Unités de traitement des boues de vidange — Unités préfabriquées et
autonomes en énergie de récupération de ressources à l'échelle locale
— Exigences de sécurité et de performance*

AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES

Conclusions/Recommendations

- Setting global standards for technical maturity of and emissions from sanitation systems will benefit the Global South.
- However, sustainability of sanitation systems (economic, social, institutional aspects) considered equally important, and informative suggestions are provided in those 2 standards. Question: Can it be standardized?
- Uniform global emission standards related to sanitation systems are a highly debated topic and some flexibility (without compromising minimum requirements ensuring safety) to allow for local conditions may be needed (in the meaning of a flexible BAT approach)



ENVIRONMENTAL
Science & Technology

pubs.acs.org/est

Feature

Can International Nonsewered Sanitation Standards Help Solve the Global Sanitation Crisis?

Clément A Cid,* Francine Abiola, and Markus Starkl

International Journal of Standardization Research
Volume 16 • Issue 1 • January-June 2018

Addressing Sustainability of Sanitation Systems: Can it be Standardized?

Markus Starkl, BOKU Wien, Vienna, Austria
Norbert Brunner, CEMDS, Vienna, Austria
Andreas Werner Helmut Hauser, TÜV SÜD Asia Pacific Pvt. Ltd., Singapore
Magdalena Feil, TÜV SÜD Industrie Service GmbH, München, Germany
Hamanth Kasan, Rand Water, Johannesburg, South Africa

AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES

Acknowledgements

Project Saraswati 2.0 supported by the European Commission's Horizon 2020 Programme (Grant Number 821427)

<https://projectsaraswati2.com/>

Link were both ISO standards can be downloaded (if accepting end user license agreement; link last accessed on 22.08.2022)

<https://sanitation.ansi.org/Download>

More information on Specialist Group available at

<https://iwa-network.org/groups/sanitation-and-water-management-in-developing-counties/>

AFFORDABLE VS BEST AVAILABLE TECHNOLOGIES

Links to articles which are open access (Gold or Green):

- Affordability of decentralized wastewater systems: A case study in integrated planning from INDIA: <https://www.mdpi.com/2073-4441/10/11/1644>
- Ensuring sustainability of non-networked sanitation technologies: An approach to standardization: <https://pubs.acs.org/doi/10.1021/acs.est.5b00887>
- Can International Nonsewered Sanitation Standards Help Solve the Global Sanitation Crisis? <https://zenodo.org/record/5997803>
- Addressing sustainability of sanitation systems: Can it be standardized? <https://www.igi-global.com/article/addressing-sustainability-of-sanitation-systems/218520>

IWA World Water Congress & Exhibition

11 – 15 September 2022 | Copenhagen, Denmark

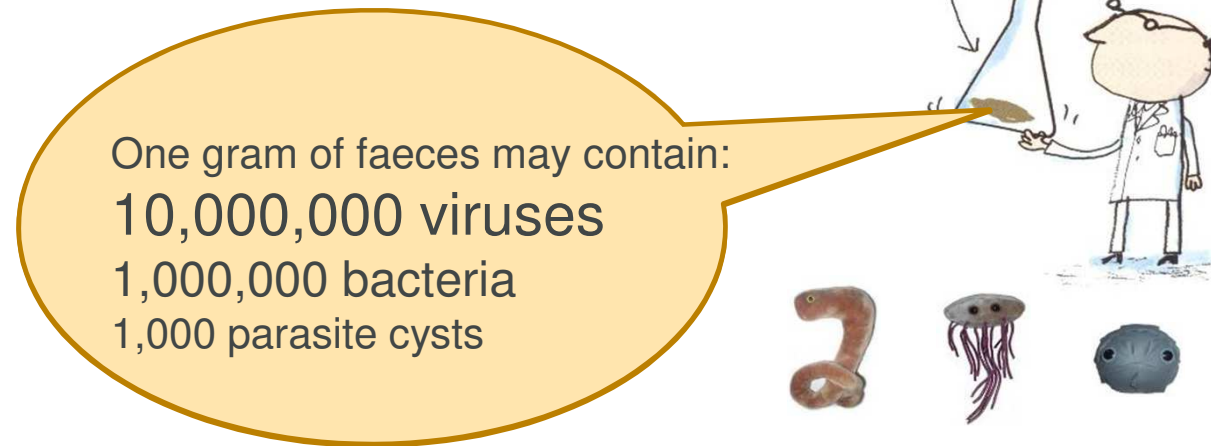
Workshop Sanitation in urban informal settlements

Tools and experiences from monitoring WASH facilities and interventions

James Ebdon (IWA-SG Health Related Water Microbiology)



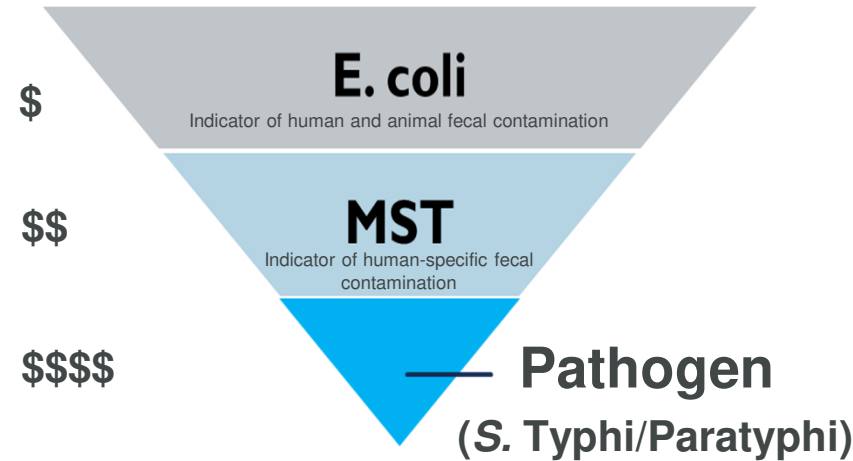
MICROBIOLOGY



Understanding sources is important because:

- It improves understanding of the transmission and risks
- It helps identify origin of inputs and understand responsibility
- It helps assess the effectiveness of interventions (mitigation)
- It helps understand treatment efficacy (removal)

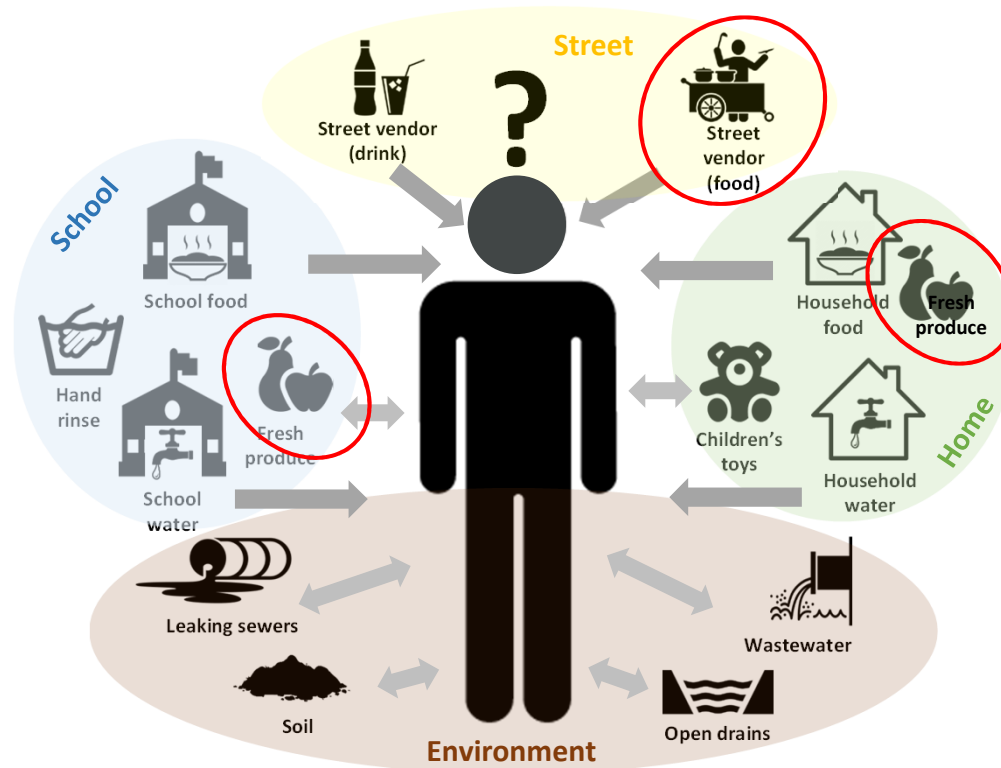
TRACKING TYPHOID TRANSMISSION IN KOLKATA'S URBAN SLUMS



Kapoor, R., Ebdon, J., Wadhwa, A., Chowdhury, G., Wang, A., Raj, S., Siesel, C., Durry, S., Mairinger, W., Mukhopadhyay, A.K., Kanungo, S., Dutta, S., and Moe, C.L. (2021). Evaluation of low-cost phage-based Microbial Source Tracking tools for elucidating human fecal contamination pathways in Kolkata, India. *Frontiers in Microbiology*, Vol. 12, May 2021. Article 673604.



POTENTIAL DISEASE PATHWAYS



Identification of discrete transmission pathways

Sample	Phage detected	
	GB-124 (human-specific)	WG-5 (non-specific)
Wastewater	✓	✓
Raw produce	✓	✓
Soil	✓	✓
Street food	✓	✓
Pooled latrine	✓	✓
Surface waters	✗	✗
Drinking water	✗	✗
Latrine swab	✗	✓

PROTECTING AND CONNECTING THE UNCONNECTED IN RAPIDLY URBANIZING SETTLEMENTS, NEPAL



LOW-COST TREATMENT OF CHOLERA WASTE IN HAITI

Treatment stages



Trajano Gomes da Silva, D, Dias, E., Ebdon, J.E., Taylor, H. (2018). Assessment of Recommended Approaches for Containment and Safe Handling of Human Excreta in Emergency Settings: How Effective Is It? *PLOS ONE*, 1-20. doi.org/10.1371/journal.

Sozzi, E., Fabre, K., Fesselet, J.F., Ebdon, J.E, and Taylor, H. (2015). Minimizing the risk of disease transmission in emergency settings: novel in situ physico-chemical treatment of highly pathogen-laden hospital wastewater. *PLOS Neglected Tropical Diseases*. 9 (6), doi.org/10.1371/journal.pntd.0003776.

PRIORITY AREAS FOR HRWM SG



More information on Specialist Group available at
<https://hrwm-watermicro.com/hrwmgroupp/>