Urban Sanitation in Developing Countries

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Decentralized Wastewater Treatment In Asia

Kazushi HASHIMOTO

Adviser, JSC

There are different types of users & dwellings in urban areas of developing countries

Type of users	Type of dwellings/ buildings	Affordability for sanitation services	Sanitation technology (currently prevailing)
Residential users	Unplanned Settlement	Low	Pit Latrine Septic Tank
	Planned Settlement	Low	Septic Tank Sewerage System
Non-residential users	Institutional Buildings	Low	Septic Tank
	Commercial Buildings (Old)	High	Sewerage System Septic Tank
	Commercial Buildings (New)	High	Sewerage System High performance decentralized wastewater treatment systems (DEWATS aerobic type)

Population living in slums (% in urban population)

World Bank - United Nations Human Settlements Programme (UN-HABITAT) (2018)

Region	%
Sub-Sahara Africa	54
South Asia (India)	38 (35)
East Asia & Pacific (China) (Indonesia) (Philippines) (Cambodia)	26 (25) (31) (43) (45)
Latin America & Caribbean	21
Middle East & North Africa	24
Central Europe and the Baltics	5
World	29

(Source) https://data.worldbank.org/indicator/EN.POP.SLUM.UR.ZS

Affordability to Pay and Willingness to Pay

How much a household must pay for water (water and sanitation)?

	Water	Sanitation	Water Total	% in household income
	US$/month/household			
Kitakyushu, Japan	22.0	20.6	42.6	1.3
Jakarta, Indonesia	6.9	0.9~2.1	7.9~9.0	1.3~1.5
Manila, Philippines	5.3	1.0	6.3	1.3
Kuala Lumpur, Malaysia	6.5	1.5~1.9	8.0~8.5	0.4
Nairobi, Kenya	8.9	6.7	15.6	
Kampala, Uganda	19.7	14.8	34.5	
Kigali, Rwanda	12.5	NA	12.5	
Lusaka, Zambia	6.3	2.0	8.3	
Ouagadougou, Burkina Faso	18.1	2.2	20.3	
Abidjan, Cote d'Ivoire	8.9	1.2	10.1	
Maputo, Mozambique	9.4	1.4	10.8	

(Source: Author [Assumption: water consumption volume20㎥/month/household])

Problems and Countermeasures are different depending on the type of users/dwellings

Users/Dwellings	Issues
Commercial Buildings (New)	Improvement of monitoring of O/M of high performance (aerobic type) decentralized wastewater treatment plants (DEWATS) (If not connected to sewerage system)
Commercial Buildings (Old)	Conversion from septic tanks to high performance DEWATS (If not connected to sewerage system)
Institutional Buildings	Improvement of maintenance Conversion from septic tanks to high performance DEWATS
Residential users in planned settlements	Enforcement of regular desludging obligation Connection to sewerage system
Residential users in unplanned settlements	Conversion from pit latrine to septic tank Access to desludging service providers

Commercial Buildings (New)

Problem

Usually, they are connected to the sewerage system. If not connected, even in developing countries, they use high performance (aerobic type) decentralized wastewater treatment plant (DEWATS).

The problem is that their performance is not monitored properly.

Countermeasure

Strengthening regulation for onsite system. Japan's regulatory frameworks for onsite system (to be explained later) can be a useful reference.

Commercial Buildings (Old)

Problem

Usually, they are connected to the sewerage system. If not connected, some of them are still using septic tanks.

Conversion from septic tanks to high performance DEWATS is slow.

Countermeasures

Strengthening regulation for onsite system. Japan's regulatory frameworks for onsite system (to be explained later) can be a useful reference.

Institutional Sanitation (Public offices, schools, hospitals, etc.)

Problem

If not connected to the sewerage system, many of them are still using septic tanks. Conversion from septic tanks to high performance DEWATS is slow.

Their on-site systems (either septic tanks or high performance DEWATS) are usually not well maintained due to the lack of budget and lack of human resources.

Countermeasures

Strengthening regulation on onsite system. Japan's regulatory frameworks for on-site system (to be explained later) can be a useful reference.

Residential users in planned settlements

Problem

Sometimes, they are not connected to the sewerage system, even if there are sewers nearby.

If not connected, they use septic tanks, which are not regularly deludged, even though desludging operators are ready to do the job.

Countermeasures

Strengthening regulation on sewerage system and on-site system. As for the issue of lack of regular deludge, Japan's regulatory frameworks (to be explained later) can be a useful reference.

Residential users in unplanned settlements

Problem

Pit Latrine (particularly, traditional one) is difficult to desludge (it contains a lot of garbage in it, it will collapse if high pressure vacuum pump is used for desludging).

It is sometimes difficult for vacuum car to access to the houses in unplanned settlements.

Desludging charge is too expensive for the households in slum area.

Countermeasures

Promote conversion from pit latrine to septic tank (Maputo, Mozambique).

Develop technology for mechanical desludging without using vacuum car (Kigali, Rwanda).

Upgrading unplanned settlements under the World Bank financed Urban Development Project (Maputo, Kigali).

Increase entry and competition of desludging operators by various economic, social, regulatory measures (supported by BMGF in Lusaka, Dakar, Kampala).

Japan's regulatory frameworks for onsite system

Problems	Japan's regulatory frameworks
Improper design of the on-site systems	Structural standards, Government approval, Performance testing system of the on-site systems
Lack of monitoring of compliance with the building standards of the on- site system	Building confirmation by the building officials of a local government
Poor installation of the on-site systems	Registration system for the On-sire System Construction Vendors Certification and Examination system for the Installation Workers
Improper disposal of the on-site sludge	Development of the sludge treatment facilities nationwide.
Improper management of the sludge generated by the on-site systems	Enactment of the On-site System Act (Johkasou Act). Regular desludging obligation.
Unregulated Desludging Operators working in the difficult conditions	Approval system of the On-site System Desludging Vendors
Improper operation and maintenance of the on-site systems	Enactment of the On-site System Act (Johkasou Act). Owner's Legal obligation of O/M. Registration system for the On-site System Maintenance Vendors
Lack of human resources for the maintenance work	Training system, Certification and Examination system for the On-site System Operators
Lack of accountability	Legal inspection
Poor operation and maintenance of the large size on-site systems of the commercial users	Monitoring under Water Pollution Control Law (compliance to the effluent standard, measurement ad record obligation, report and inspection)

For more details;

Please read the following paper.

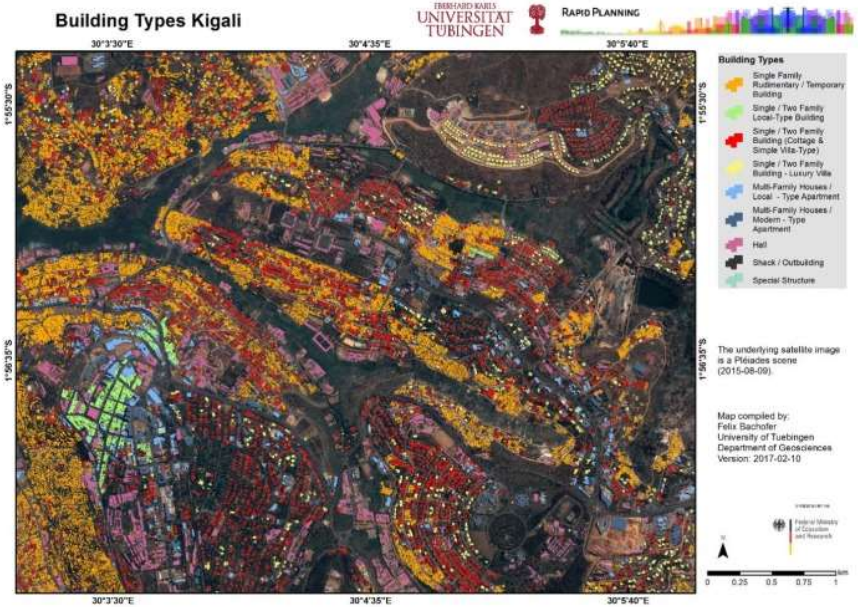
ADBI Development Case Study No. 2021-1 (June)
'Institutional Frameworks for Onsite Sanitation Management Systems'
by Kazushi Hashimoto

Visual images (what are we talking about CWIS?)

(JICA Data Collection Survey on Urban Sanitation, Sewerage and Fecal Sludge Management in Africa)

Central Business District (CBD) and unplanned settlements in Kigali City, Rwanda

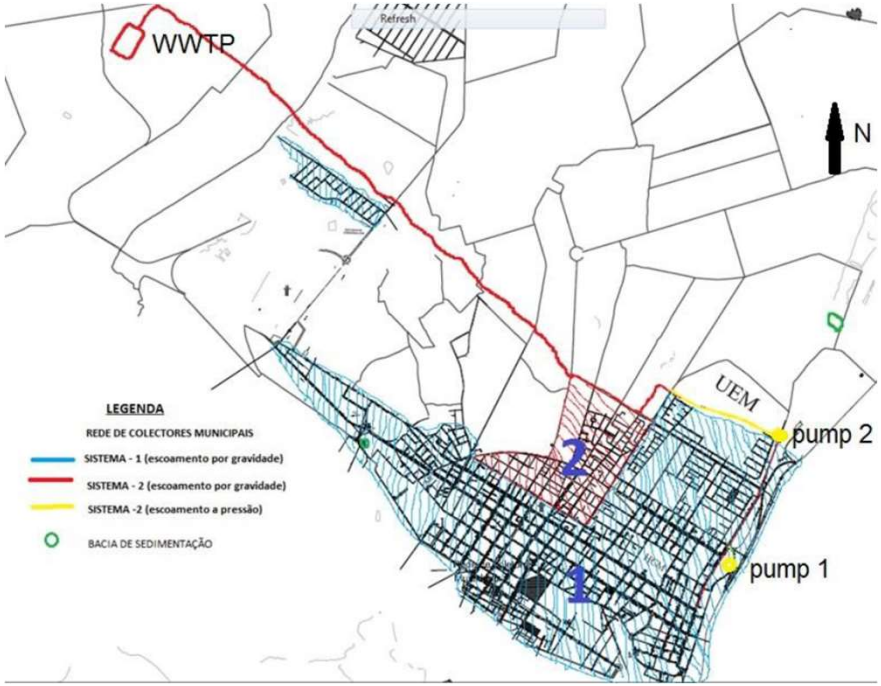
78% of total population lives in unplanned settlements in Kigali City



Visual images

Baixa area, a busy downtown area of Maputo City, Mozambique. Much of wastewater generated in this area is collected by a combined sewer system and discharged to Maputo Bay without proper treatment.

There are two sewerage system in Maputo City. But there is no sewerage system in the northern part of the City which is unplanned settlement where 80% of City population lives.



Visual images

Inside of the unplanned settlements in Kigai City

The sludge from pit latrine contains a lot of garbage.

Visual images

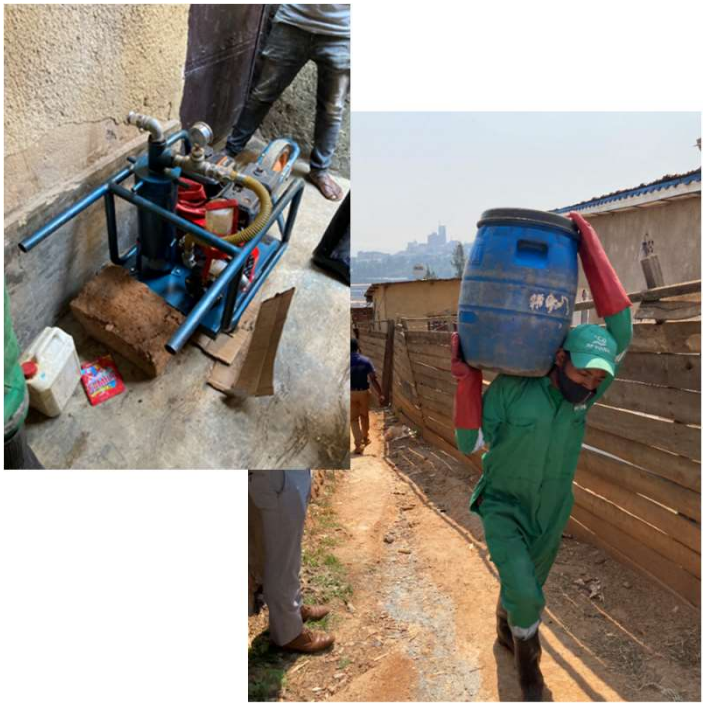
Maputo City, Mozambique, is promoting conversion from pit latrine to septic tank in unplanned settlements where 80% of Maputo population live.

In Maputo City, private desludging operators are very active. Daily, 90 vacuum carloads of on-site sludge is being transported to infulene WWTP. But the system that makes residents in unplanned settlements easily accessible to emptying services seems yet to be established

Visual images

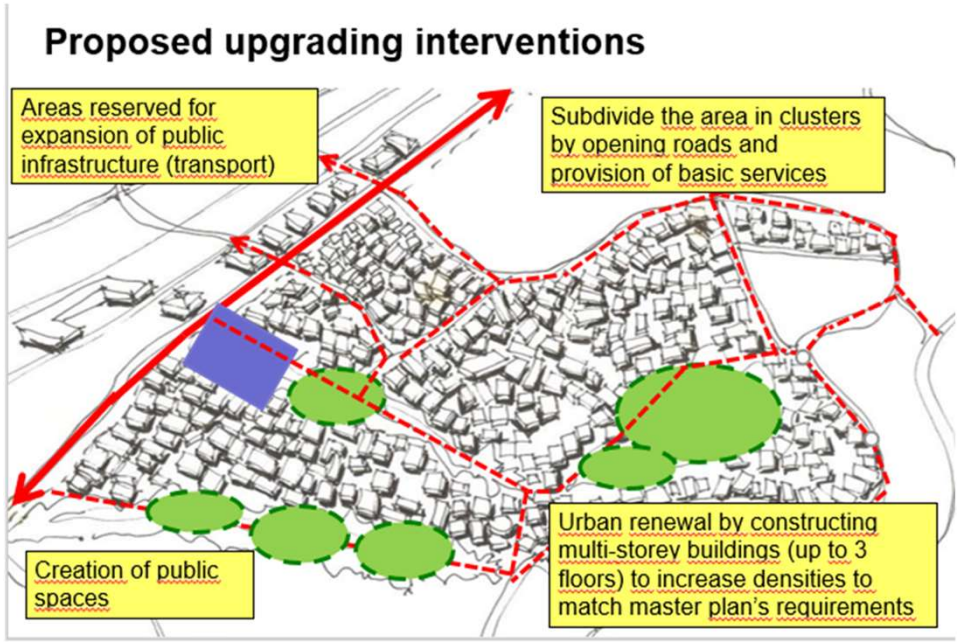
It takes two hours to remove garbage before mechanical desludging of pit latrine starts.

Mechanical desludging without using vacuum car by PIT VIDURA (a private operator in Kigali City)



Visual Images

Concept of the Upgrading of unplanned settlement under the World Bank 'Urban Development Project' in Kigali City, Rwanda



Thank you for your attention!

Kz-hashimoto@yachiyo-eng.co.jp