

“SPA-DET” Approach for Quantities and Qualities (Q&Q) of Faecal Sludge

Dr. Linda Strande





Dr. Linda Strande February 2019

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METHOD

Introduce the newly developed “SPA-DET” approach to data collection and analysis

RESULTS

India, Tanzania, Uganda, Vietnam
(next year: Nepal, Zambia)



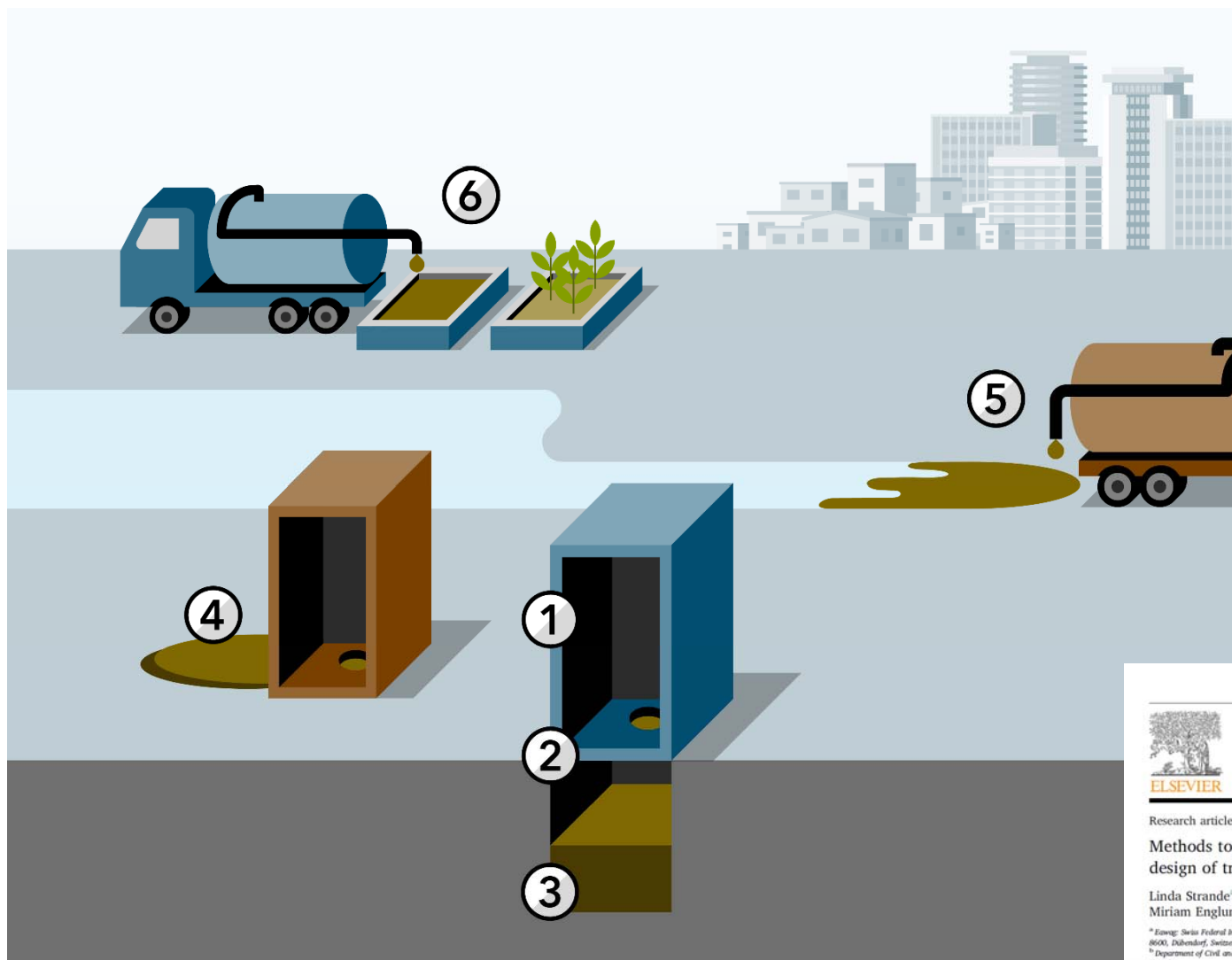
Methods for Faecal Sludge Analysis

BILL & MELINDA
GATES foundation

Konstantina Velkushanova • Linda Strande • Mariska Ronteltap
Thammarat Koottatep • Damir Brdjanovic • Chris Buckley



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Research article

Methods to reliably estimate faecal sludge quantities and qualities for the design of treatment technologies and management solutions

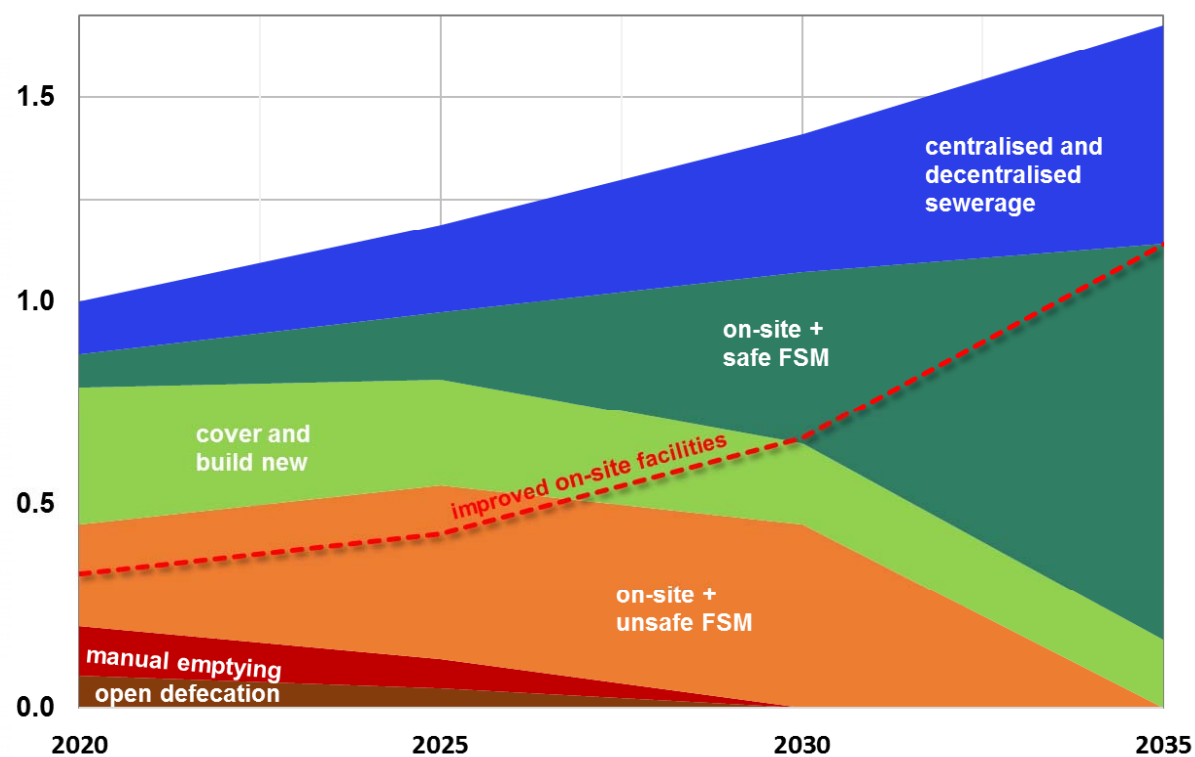
Linda Strande^{a,*}, Lars Schoebitz^b, Fabian Bischoff^b, Daniel Ddiba^b, Francis Okello^b, Miriam Englund^a, Barbara J. Ward^b, Charles B. Niwagaba^b

^a Eawag: Swiss Federal Institute of Aquatic Science and Technology, Department of Sanitation, Water and Solid Waste for Development (Sundec), Überlandstrasse 133, 8600, Dübendorf, Switzerland

^b Department of Civil and Environmental Engineering, College of Engineering, Design, Art and Technology (CEDAT), Makerere University, P.O. Box 7062, Kampala, Uganda

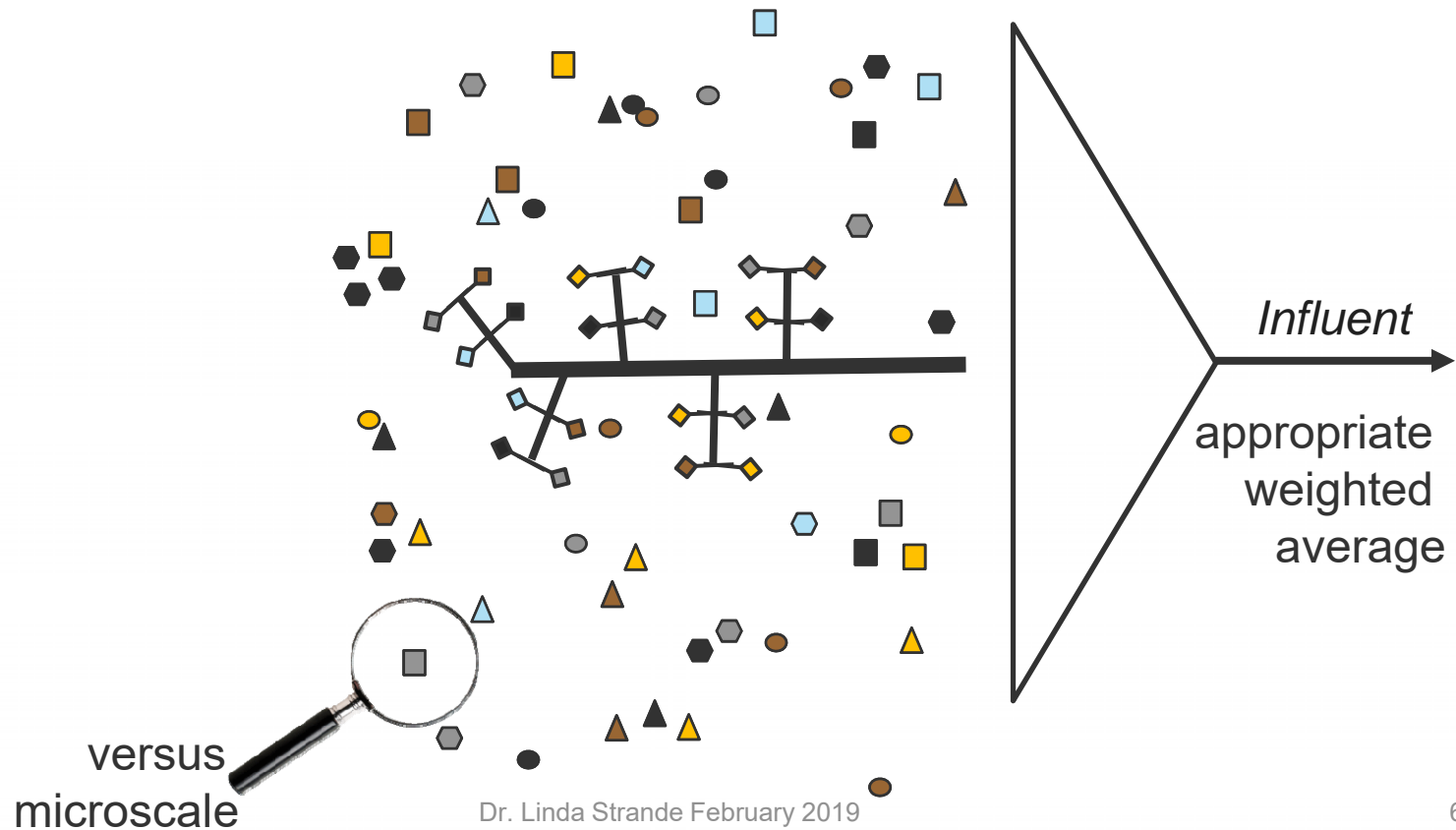
Importance of Q&Q

SanMix Time-Technology Diagram



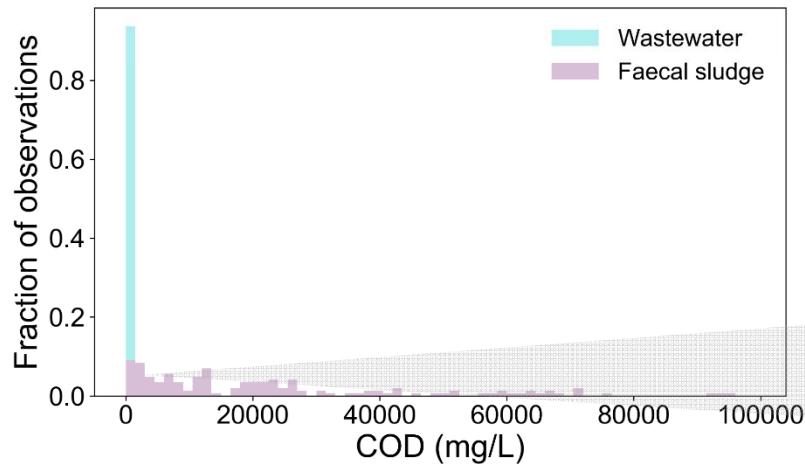
Reference:
Peter Hawkins

Predicting what is delivered to treatment?

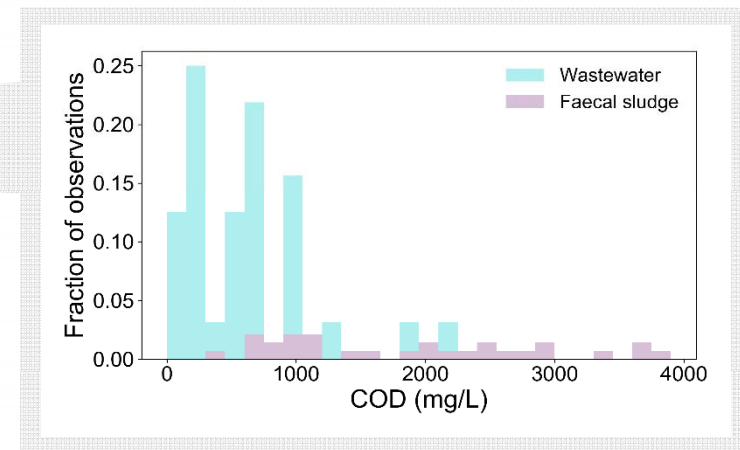


Distribution of data?

Lubigi wastewater and faecal sludge treatment plant



ave = 23,550 mg/L COD
stdev = 23,433 mg/L
-> predicts 16% negative values



Strande, L., Englund, M., Carbajal, J.P. Quantities and Qualities (Q&Q) of Faecal Sludge for Planning and Management. Methods for Faecal Sludge Analyses, in preparation as chapter in Velkushanova, K., Strande, L., Ronteltap, M., Koottatep, T., Brdjanovic, D., Buckley, C. (book editors) Methods for Faecal Sludge Analysis, in preparation as IWA publication

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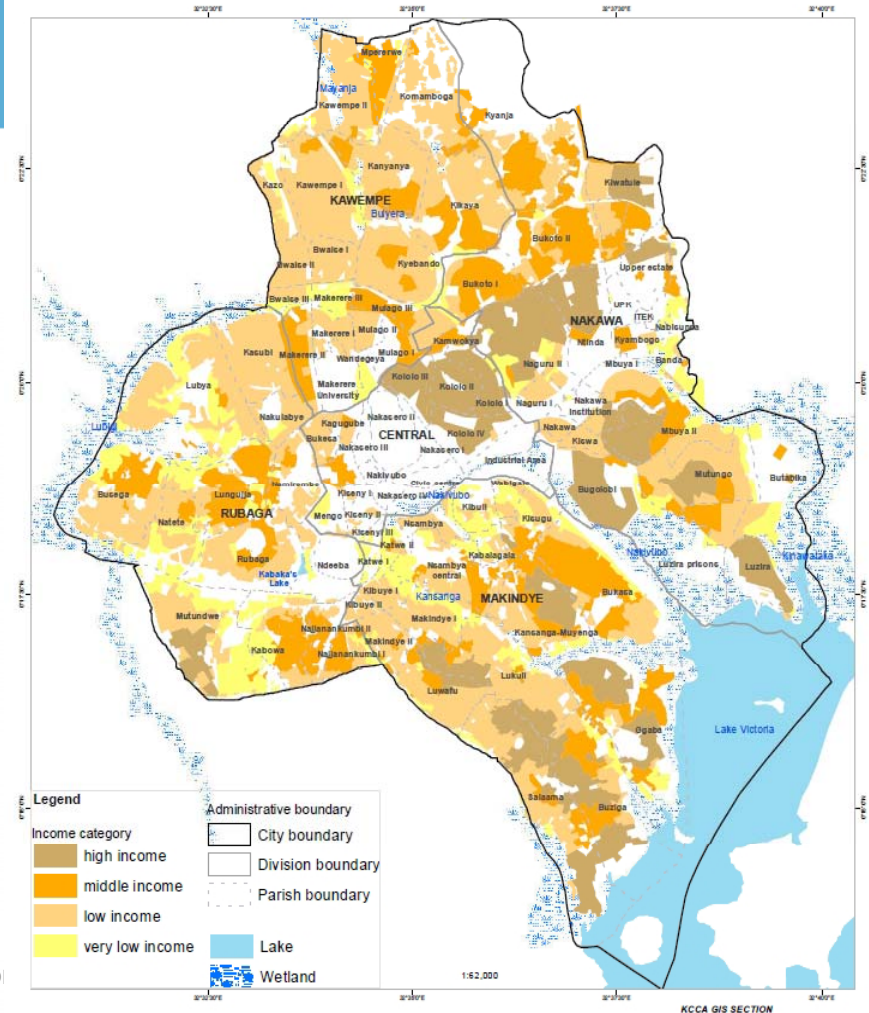
What is “SPA-DET” data?

Spatially analyzable (SPA)

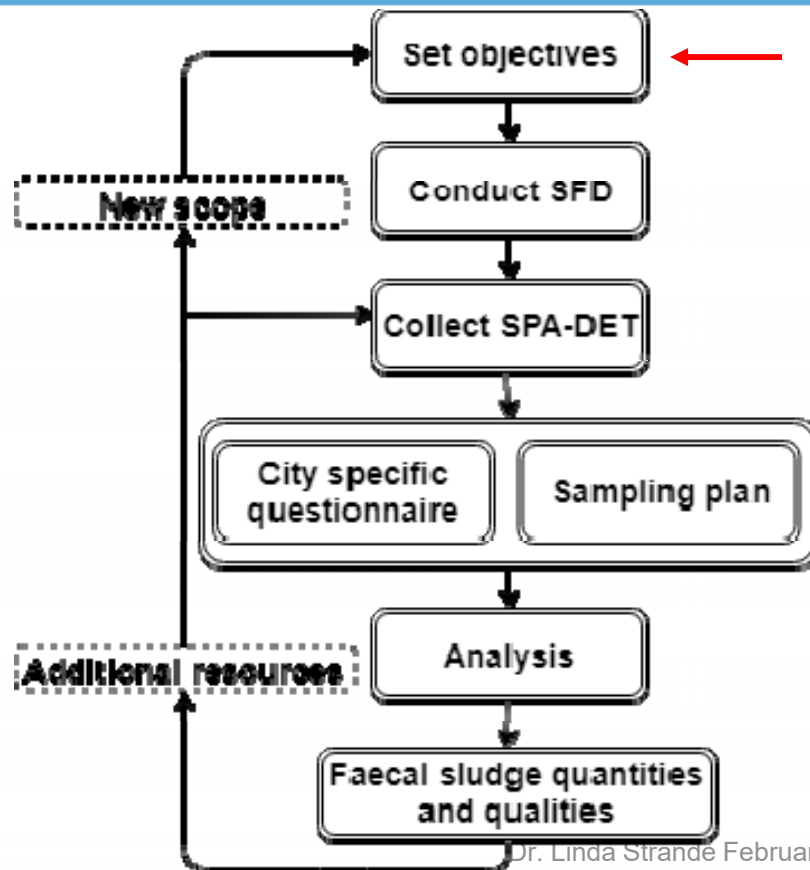
- (DET)
- Demographic
(e.g. income level,
population density)
 - Environmental
(e.g. groundwater, elevation)
 - Technology
(e.g. septic tank / pit latrine,
emptying frequency)

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KAMPALA CAPITAL CITY : INCOME CATEGORIES



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Objectives!

Affect what, how and where you sample

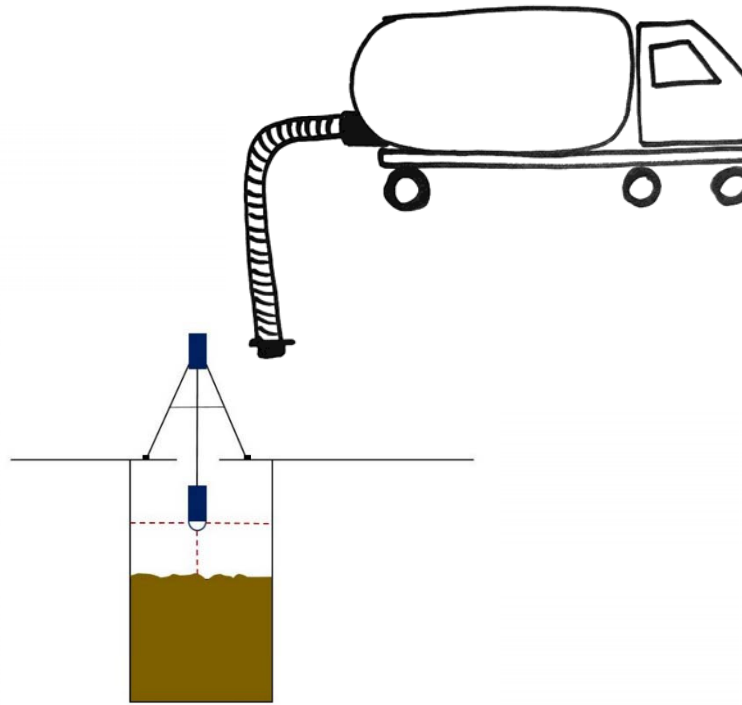
- Sludge accumulation rate?
- Delivered to treatment?
- Regularly scheduled emptying?
- Pumpability?

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How to measure accumulation rates?



*Field testing the Volaser
Sircilla, India*

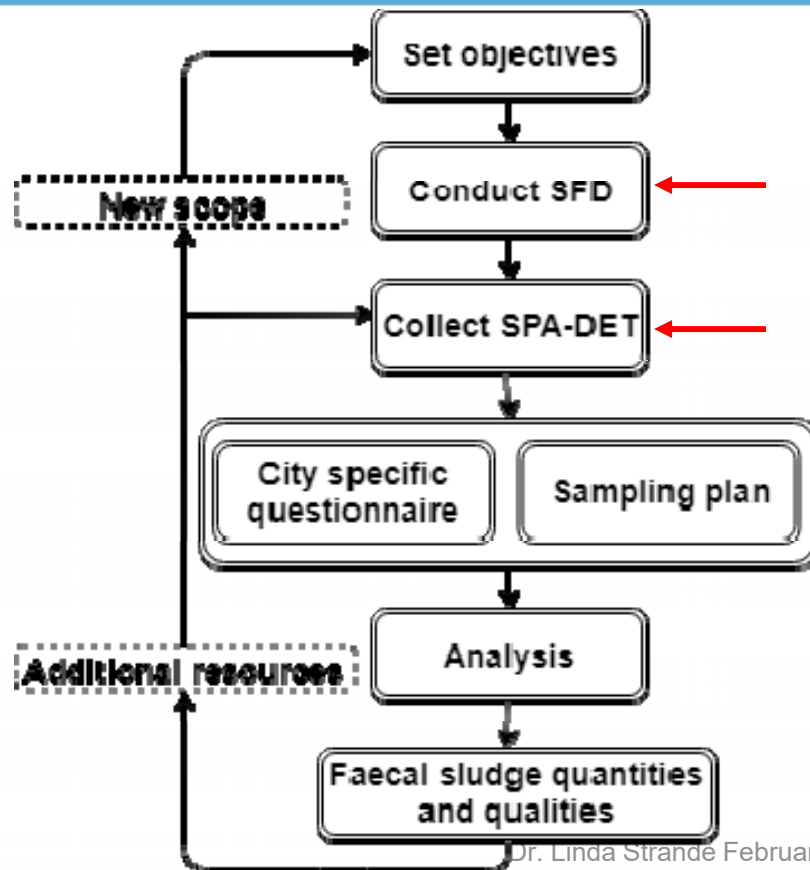


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*Emptying service providers
Lusaka, Zambia* ¹⁰

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Where to get “SPA-DET” data?

Existing sources (e.g. census, call center, municipality, university,...)

Data collection (e.g. questionnaire during emptying,...)

Future sources? (e.g. remote sensing data?)

*Only 3% of Africa
mapped 1:25,000*



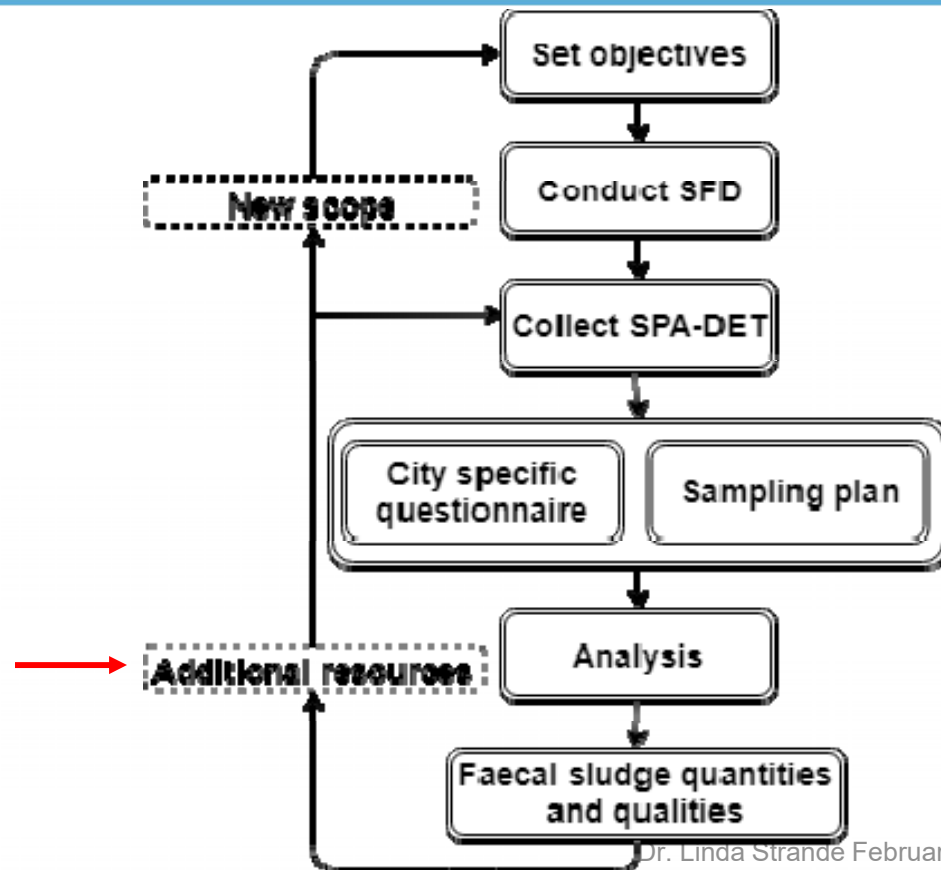
Lusaka, Zambia



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“SPA-DET” approach for Quantities and Qualities (Q&Q) of Faecal Sludge

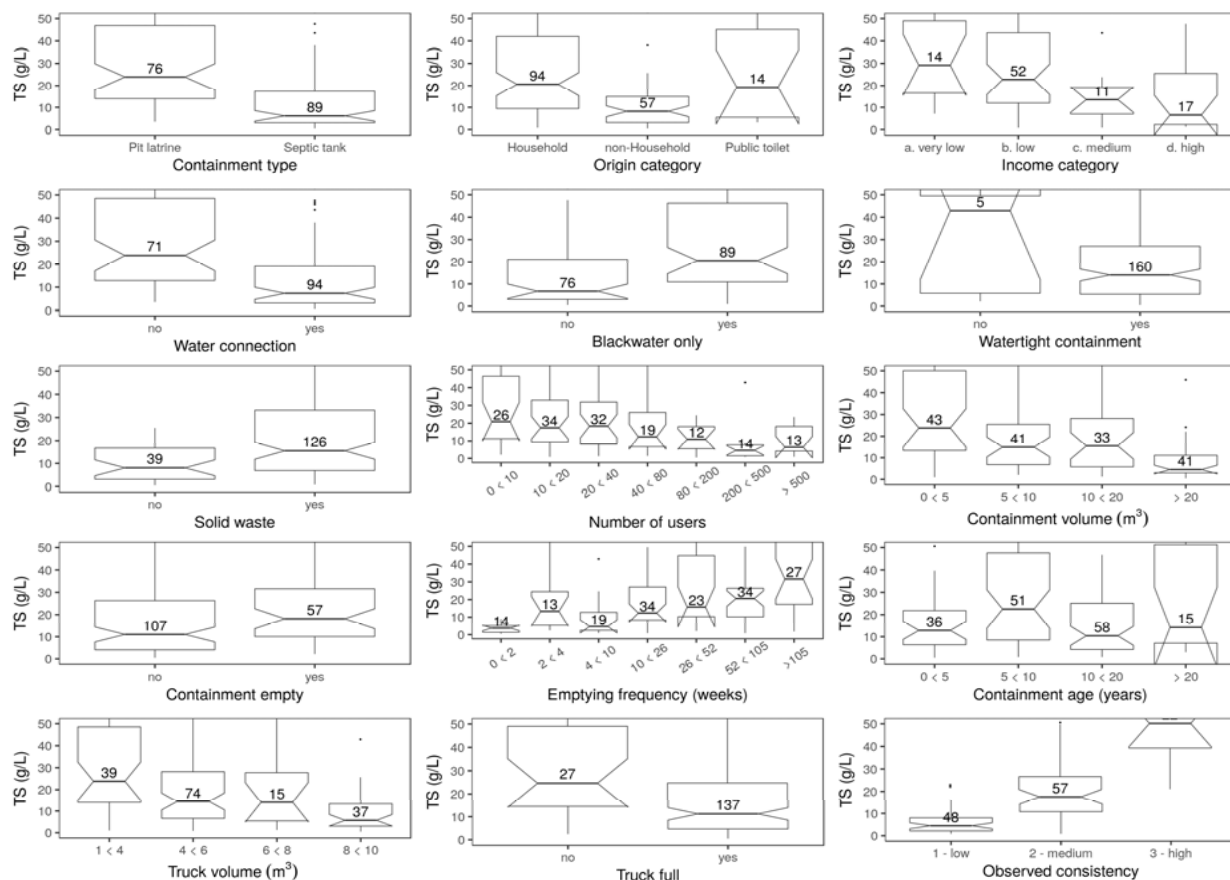


Iterative based on available resources

- Start with one neighborhood, add more each replication
- Start with one category of income level, then extend to other socio-economic groups
- Student projects / research collaborations

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Results: Total solids Kampala, Uganda



specific for Kampala!

Journal of Environmental Management 223 (2018) 898–907

Contents lists available at ScienceDirect



Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

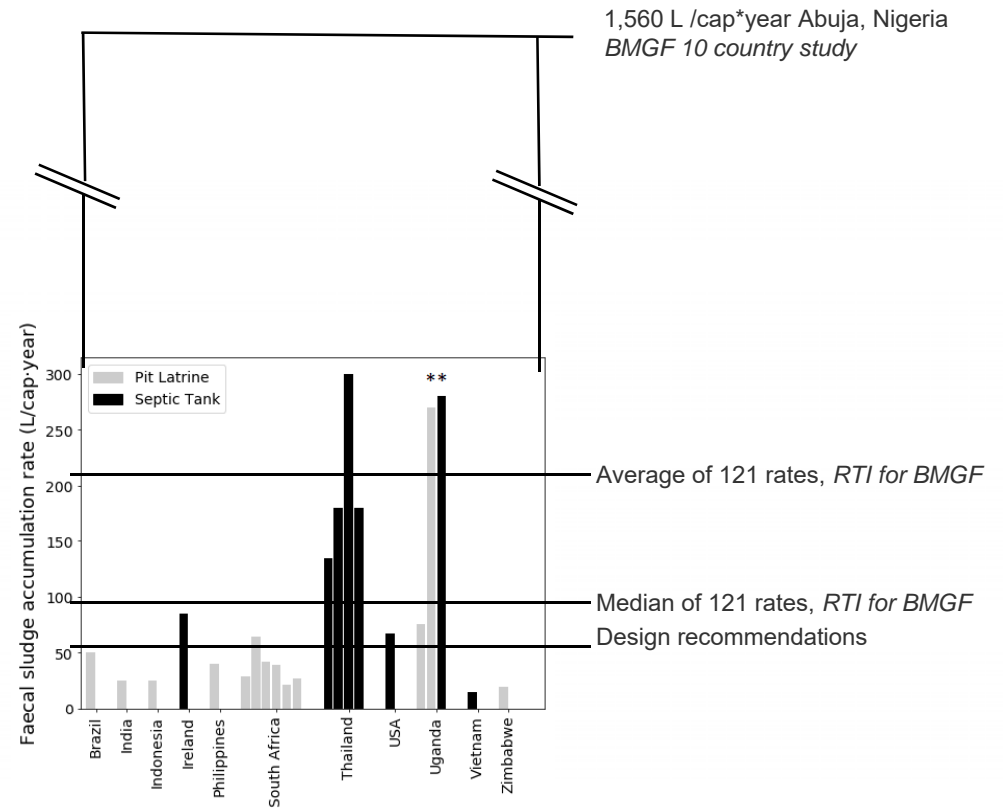
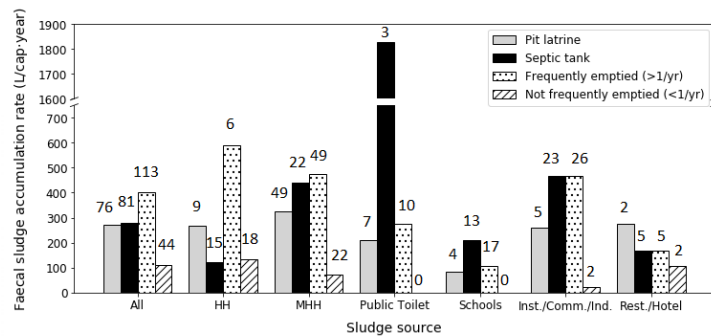
Methods to reliably estimate faecal sludge quantities and qualities for the design of treatment technologies and management solutions

Linda Strande^{a,*}, Lars Schoebitz^a, Fabian Bischoff^a, Daniel Ddiba^b, Francis Okello^b, Miriam Englund^a, Barbara J. Ward^a, Charles B. Niwagaba^b

^a Eawag: Swiss Federal Institute of Aquatic Science and Technology, Department of Sanitation, Water and Solid Waste for Development (Sandec), Überlandstrasse 133, 8600, Dübendorf, Switzerland

^b Department of Civil and Environmental Engineering, College of Engineering, Design, Art and Technology (CEDAT), Makerere University, P.O. Box 7062, Kampala, Uganda

Results: accumulation rates Kampala, Uganda



1,560 L /cap*year Abuja, Nigeria
BMGF 10 country study



Research article

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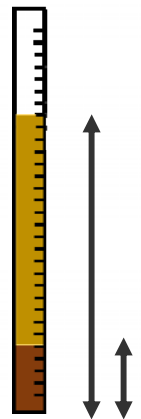
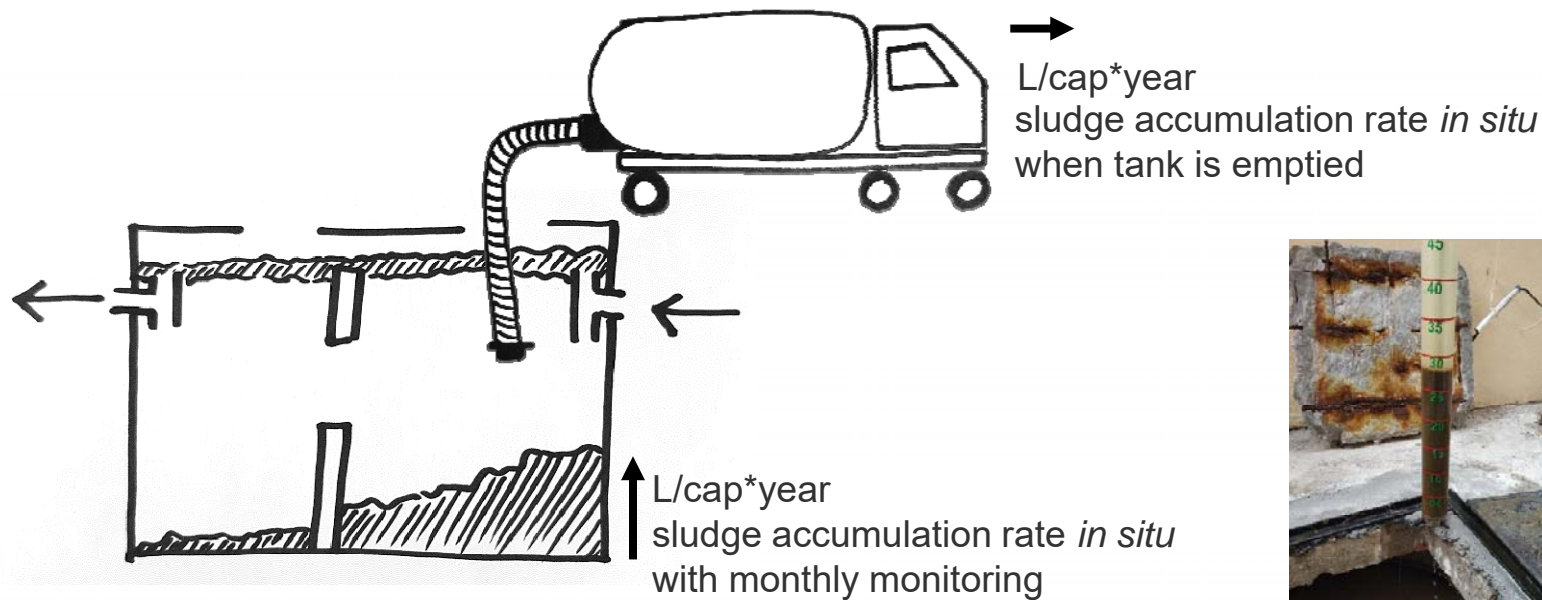
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Preliminary results: Sircilla, India



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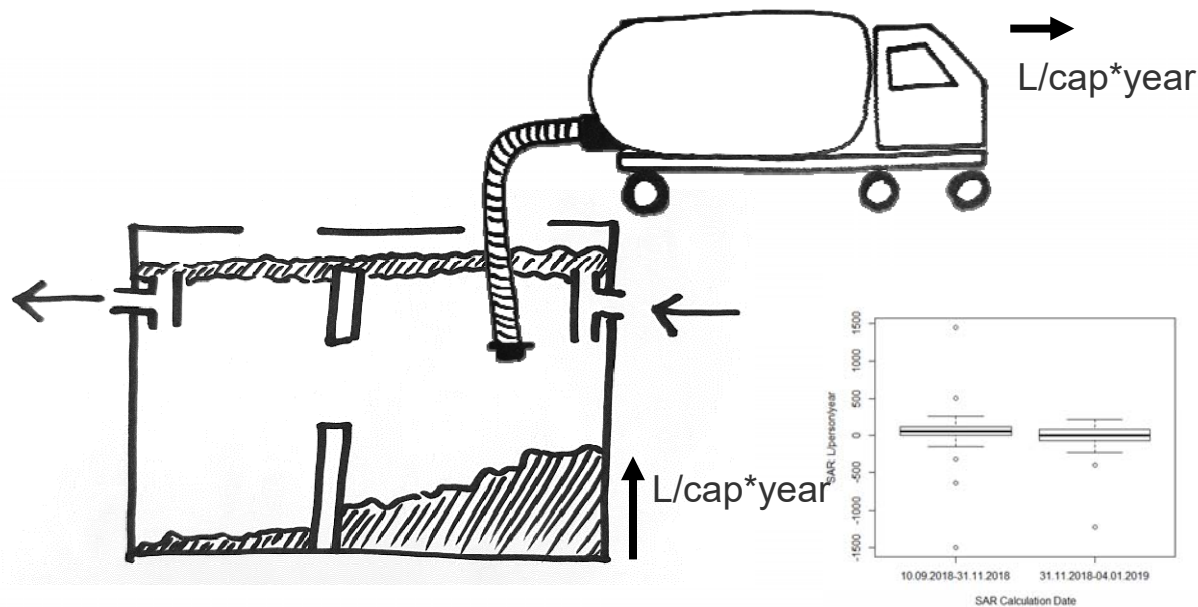
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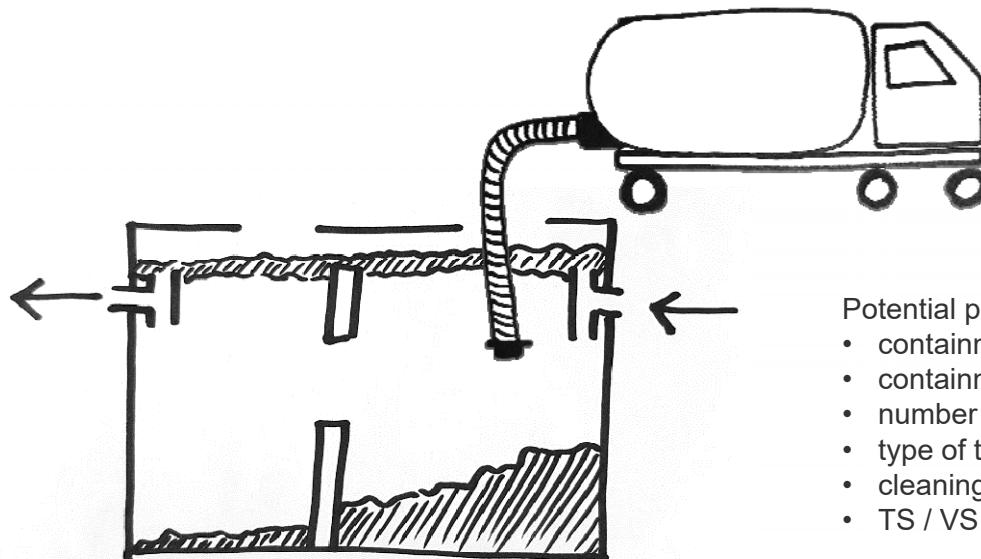
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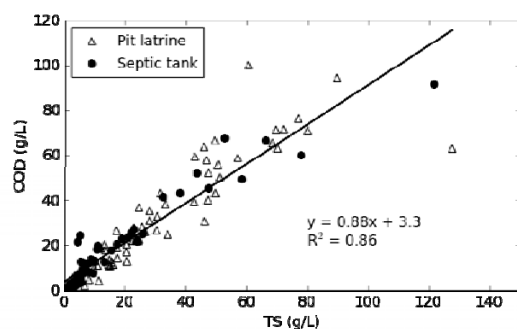
Potential predictors of characteristics?

- containment age
- containment shape / type / volume
- number of toilets
- water supply source
- "slum" / non-"slum"

Potential predictors of accumulation rates?

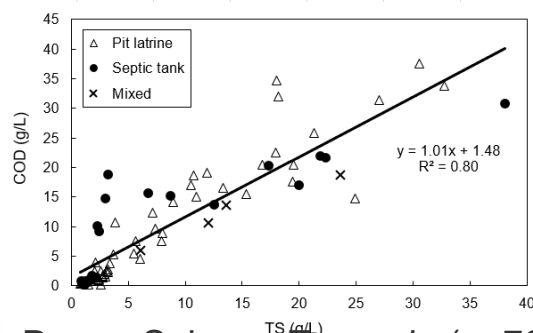
- containment age
- containment shape / type / volume
- number of toilets
- type of toilets / flush volume
- cleaning frequency
- TS / VS / COD

Results: COD:TS in 6 cities



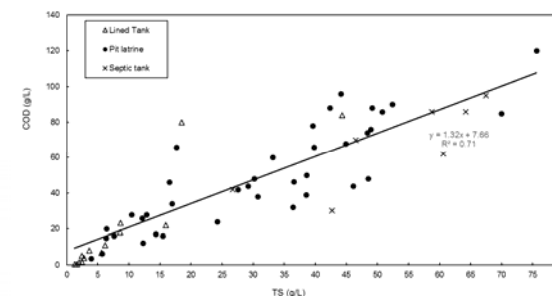
Kampala, Uganda (n=180)

Strande et al. 2018



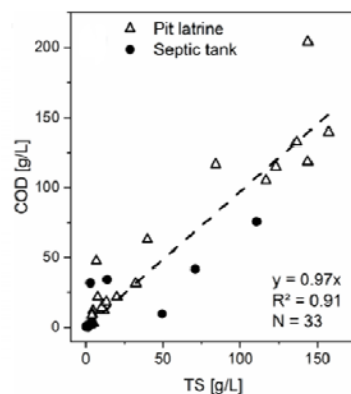
Dar es Salaam, Tanzania (n=76)

Moto, Marwa, Esanju 2017-2018, UDSM Master's Theses



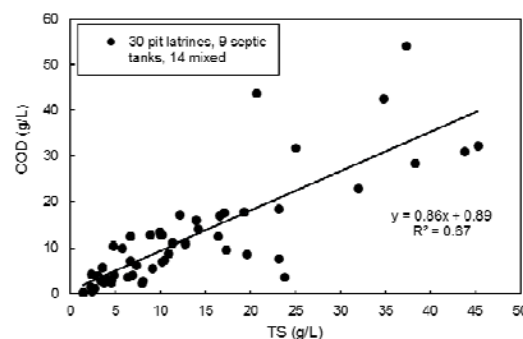
Sircilla, India (n=55/180)

CDD – Eawag collaborator in process



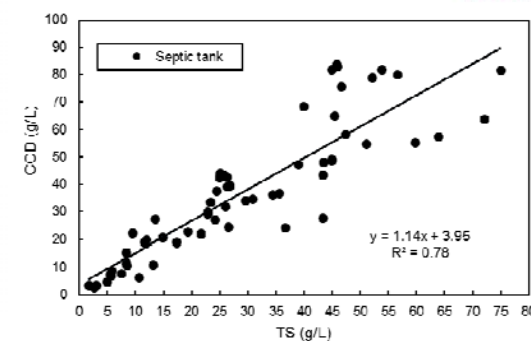
Blantyre, Malawi (n=33)

Freihardt 2018, ETH Master's Thesis



Ougadougou, Burkina Faso (n=53)

Bassan et al. 2013



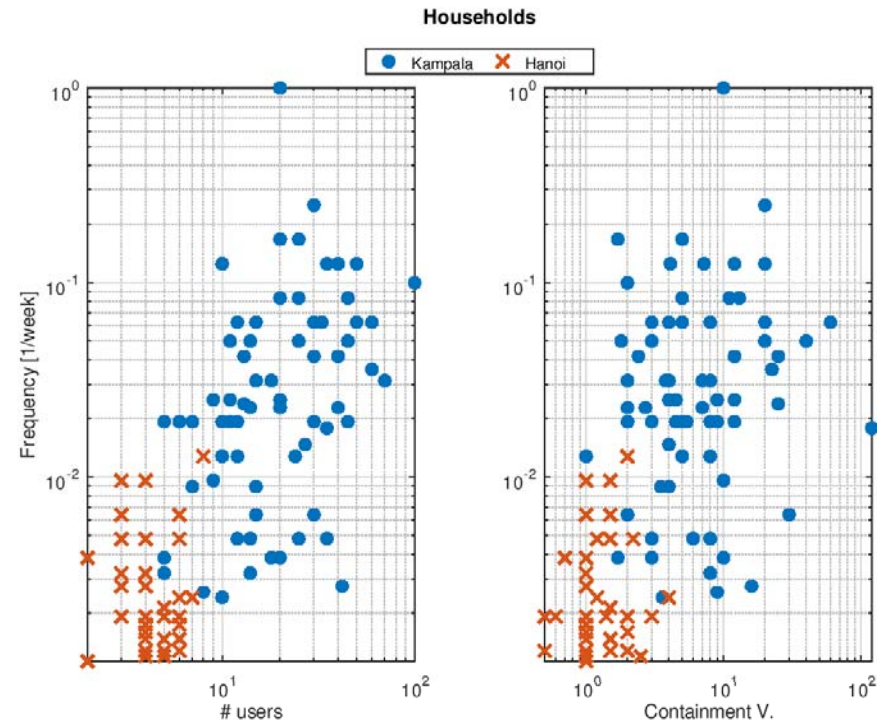
Hanoi, Vietnam (n=60)

Englund et al. Submitted

Results: emptying frequency Hanoi and Kampala

The power of modeling

- simple predictive models for management
- build mechanistic models to understand and direct our research
- GIS models based on SPA-DET for city planning



Englund, M., Carbajal, JP, Ferré, A, Hoa, AVi, Nguyen, VA, Bassan, M, Strande, L. (submitted) Modelling quantities and qualities (Q&Q) of faecal sludge in Hanoi and Kampala for improved management solutions

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CONCLUSIONS

using statistical relationships can improve usefulness and reduce costs of collecting data

data collected in this fashion, can improve estimates of Q&Q, and predictive models for improved management solutions

with more data we could develop mechanistic relationships to help lead to universal understandings of FSM



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Website: www.sandec.ch/fsm_tools

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MEWS team: **M**anagement of **E**xcreta, **W**astewater and **S**ludge



Funding:



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Confederación Suiza

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