

Relevance of the Clean and Green framework in rural Bolivia: Potential and options for reusing water, nutrients and organic matter

Background

In the sanitation component of the Bolivia WATCH program (<https://www.sei.org/projects/bolivia-watch/#overview>), SEI is planning a feasibility study to investigate the relevance of a “Clean and Green” approach to rural sanitation in the Potosi region in Bolivia. Clean and Green is an implementation framework developed for rural sanitation with the aim to address sanitation and hygiene related risks while also promoting the safe reuse of nutrients, water and organic matter in local waste flows (<https://www.sei.org/projects/clean-and-green/#highlights>). Technical options and practices to enhance sanitation circularity have existed for decades and have been implemented in different projects in Bolivia, mainly at pilot scale. However, a systems approach for implementation of such green sanitation has been lacking that is not “technology prescriptive” (e.g. pushing a single technology) and that also includes the safe and productive management of all relevant local waste flows (e.g. human excreta, animal excreta, greywater, organic waste and ash) for greater circularity and impact. The Clean and Green framework has potential to fill this gap but has yet to be adapted and tested in Bolivia.

The Clean and Green framework has been developed and implemented on a pilot scale in Burkina Faso by SEI and WaterAid. To explore the relevance of Clean and Green in the Potosi region in Bolivia, a first step is to understand the current situation of rural households with regards to agricultural activities, WaSH and waste management. This also includes evaluating the quantity water, nutrients (N, P) and organic matter available in local waste flows and identifying potential leverage points in the system that could improve circularity of these resources. A second step would be to identify and compare a range of appropriate options in Bolivia that could improve circularity of key waste flows with focus on human excreta and greywater.

Research questions:

- What is the quantity of water, nutrients and organic matter present in local waste flows on household level in rural Potosi?
- Which are main leverage points to improve circularity in the current system?
- What technologies and practices could be relevant to improve resource circularity?

Proposed data collection and analysis methodology.

Evaluating resource flows:

Two villages will be identified in Potosi, representing different rural settings (likely Oploca village in Tupiza municipality and Sumataya village in Tingipaya municipality). A limited number of households will be selected for data collection (~4-8 households per village).

The quantity of resources (nutrients, water and eventually organic matter) in wasteflows will be evaluated using a combination of household interviews and sampling. Quantification of resources in wastes can be indirect – i.e. inferred from information on water use and the consumption of food and fodder which are often quite well known by the household. Quantification of resources can also be direct, by determining the quantity of waste flows

(through interviews or measurement) and the resource concentration in these waste flows (through literature or sampling). The study will mainly use indirect quantification, but where possible also triangulate by using direct quantification. The results could be displayed in a massflow diagram, i.e. kg of nutrients per person or per household for a given time period (likely year).

Identifying leverage points:

The household interviews combined with direct observation will give information on the current management of waste flows and to what extent potential resources are reused. The discrepancy between actual and potential resource reuse indicates the key leverage points for improved circularity in the system. The interviews with households will also include questions on perceptions and openness to increased circularity and thoughts about potential alternatives to achieve this. All together both the de facto

Identifying and comparing options for improved circularity:

The focus will be on options for managing human excreta and greywater given both the quantity of resources they represent and the risks involved in managing them. Several on-site sanitation options for enhanced circularity will be identified from literature and through interviews with key informants at e.g. UNICEF, SEI and AguaTuya. A multicriteria analysis will be carried out to compare these options from different sustainability dimensions, see eg. Smith (2020) and McConville et al. (2020).

Other aspects that could be useful to investigate (SEI can support with this):

- Legal framework: Policies and regulations on rural sanitation as well as waste reuse/recycling.
- Previous experiences of implementing eco-technologies and lessons learnt (experiences in Bolivia)

Contact: [Elisabeth Kvarnström](#)

Inspiration:

Hellman, J. "Re-sourcing soil fertility -Assessing the soil amendment potential of farm household resources and wastes in Bolo Silasie, Ethiopia" MSc Thesis SLU

https://stud.epsilon.slu.se/15313/11/hellman_j_200210.pdf

McConville, Jennifer R., Elisabeth Kvarnström, Annika C. Nordin, Håkan Jönsson, and Charles B. Niwagaba. "Structured Approach for Comparison of Treatment Options for Nutrient-Recovery From Fecal Sludge." *Frontiers in Environmental Science* 8 (April 17, 2020): 36.

<https://doi.org/10.3389/fenvs.2020.00036>.

Smith, M. (2020). Sustainability assessment of sanitation systems in El Alto, Bolivia: A pre-study. http://www.w-program.nu/filer/exjobb/Malin_Smith.pdf