

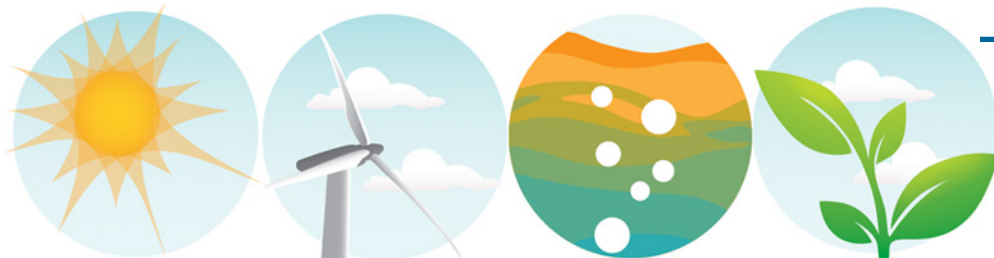
out think the box

Sanitary Compost Preparedness, Response & Service Opportunity

Everyday brilliance for disaster resilience

Oakland, CA, USA
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humanure pathway

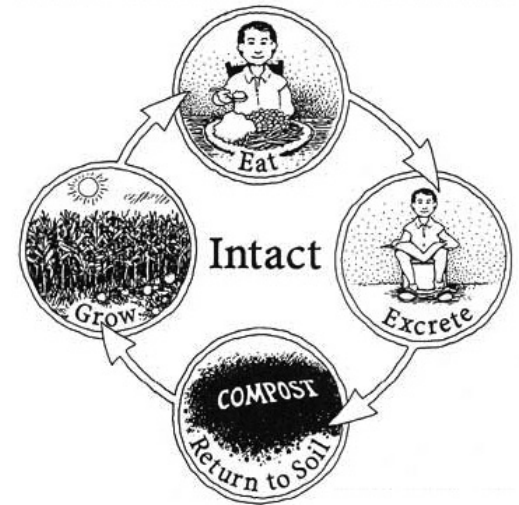
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It's simple—the 4 e's

Eat (human) -> **Excrete** (human) ->
Enrich (soil) -> **Emerge** (plants/food)

Process pathway:

- Human excreta collected
- Thermophilic compost/humus generated (hygienic)
- Humus applied to soil
- Food/Plants propagated
- Food/Plants eaten by humans



Dry/Eco-san toilet adoption problems:

- Mass and energy balance of compost toilet load stream not available [In-progress*]
- Lack of standards [In-progress*, requires AHJ]
- Lack of established design guidelines [In-progress*]
- Disposal and maintenance challenges [Disrupter]
- Monitoring process factors [Guidance is available*]



requirements

5

'Disposal' (Reuse) and maintenance:

- Carbon-based cover material
- Human excreta collection
- Human excreta composted
- Collection toilet manufacture schema



4 problems

6

Dense settlements in highly densely populated areas with homeless populations need to address:

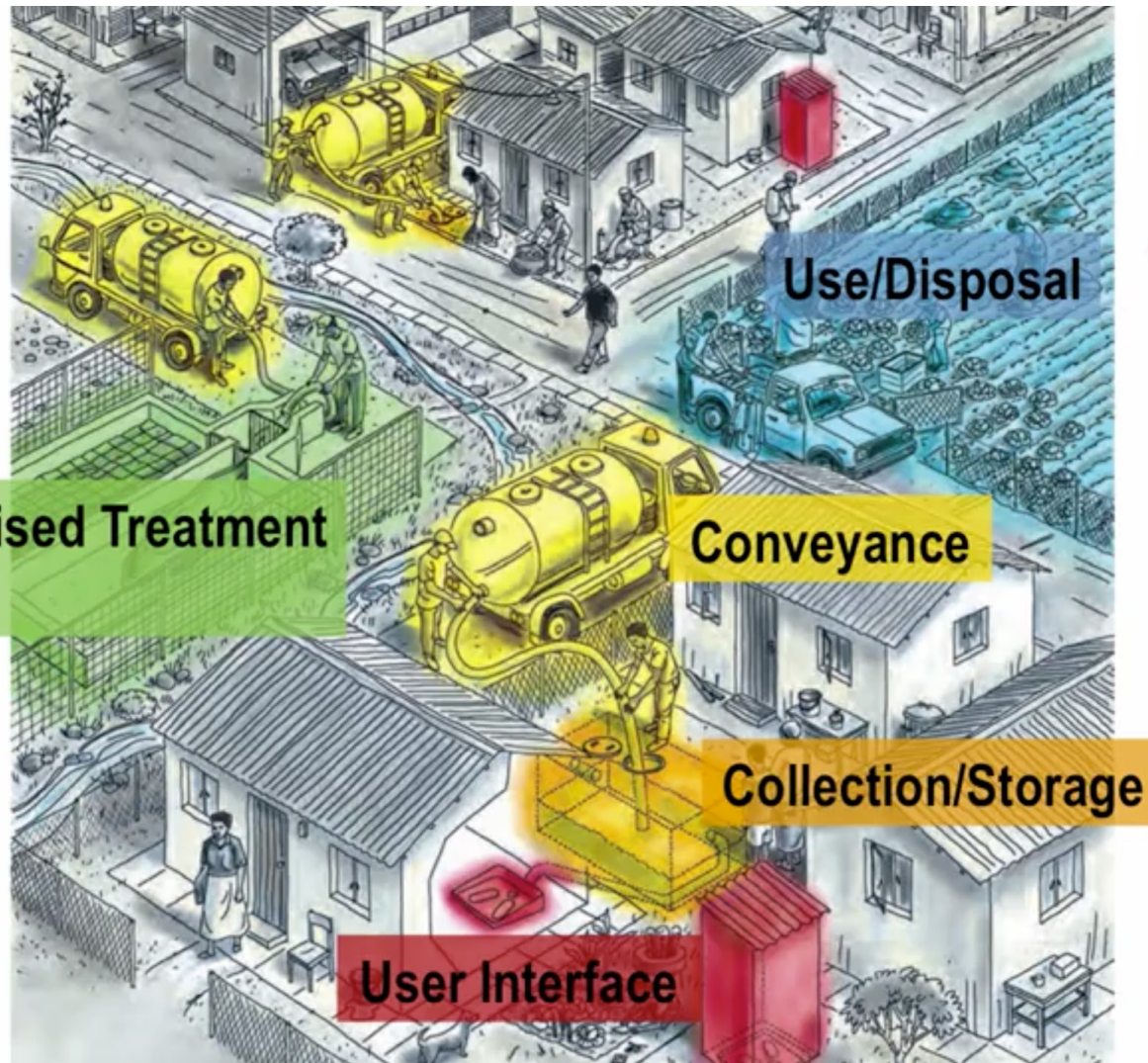
- Deficient environmental sanitation
 - Curbside community inhabitants
 - Tiny house urban agriculture stewards on tax-defaulted lots*
- High level of pollution
- Management of on-site sanitation
- Inadequate water access
 - Requires a more integrated approach
 - EBMUD assistance



* *Land-action.org 100 Micro-farms Campaign*

5 functional groups

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- 5 functional groups used to categorize sanitation technologies

preparedness & response 8

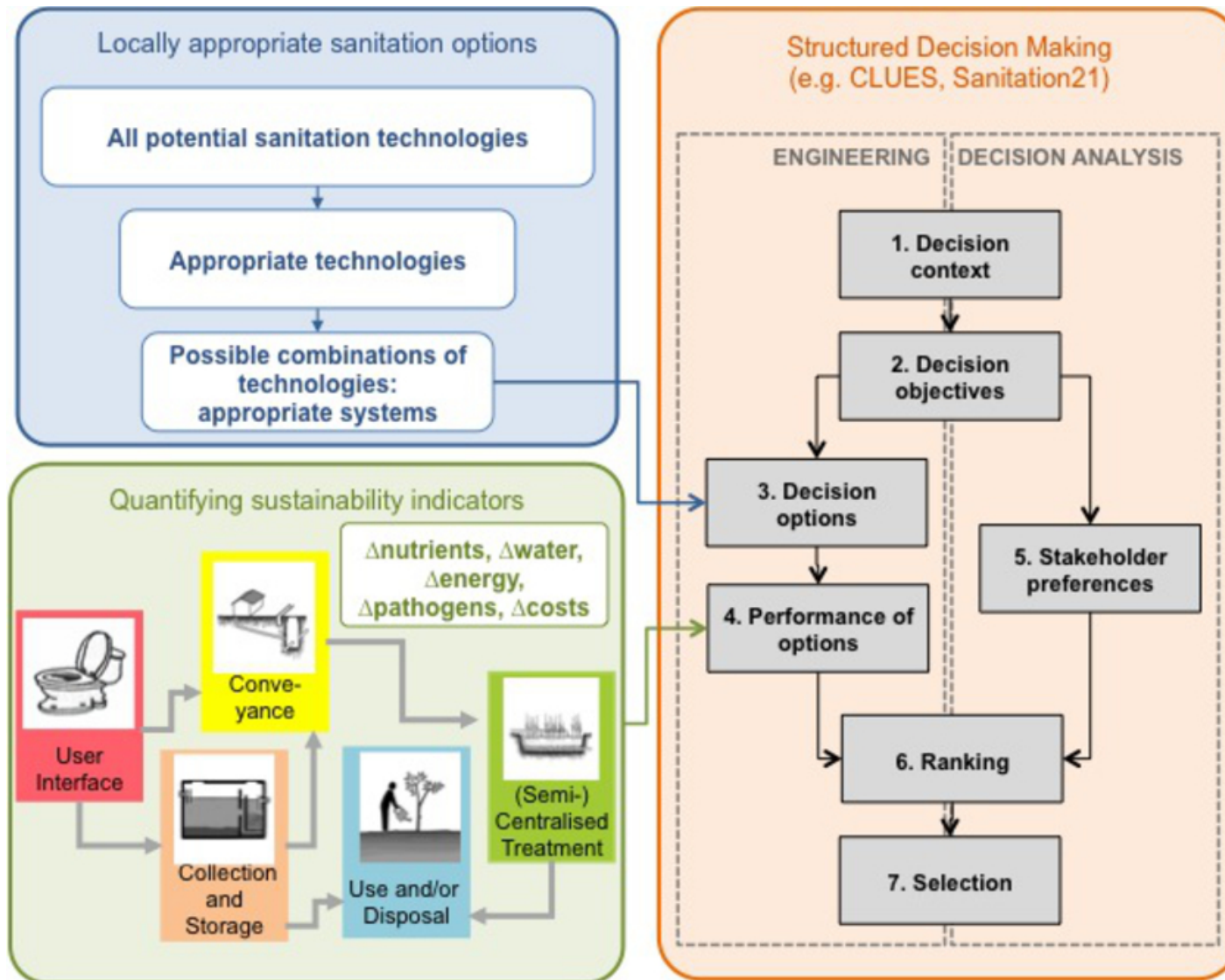
6 major public health response functions requiring extensive planning & thoughtful preparation:

- Preventing epidemics, spread of disease & injuries
- Protecting against environmental hazards
- Promoting & encouraging healthy behaviors
- Disaster response & communities in recovery assist
- Ensuring the quantity & accessibility of health services

This compost sanitation solution offering proposed can address 1-5 and disrupt 4 of the 5 Functional Groups.

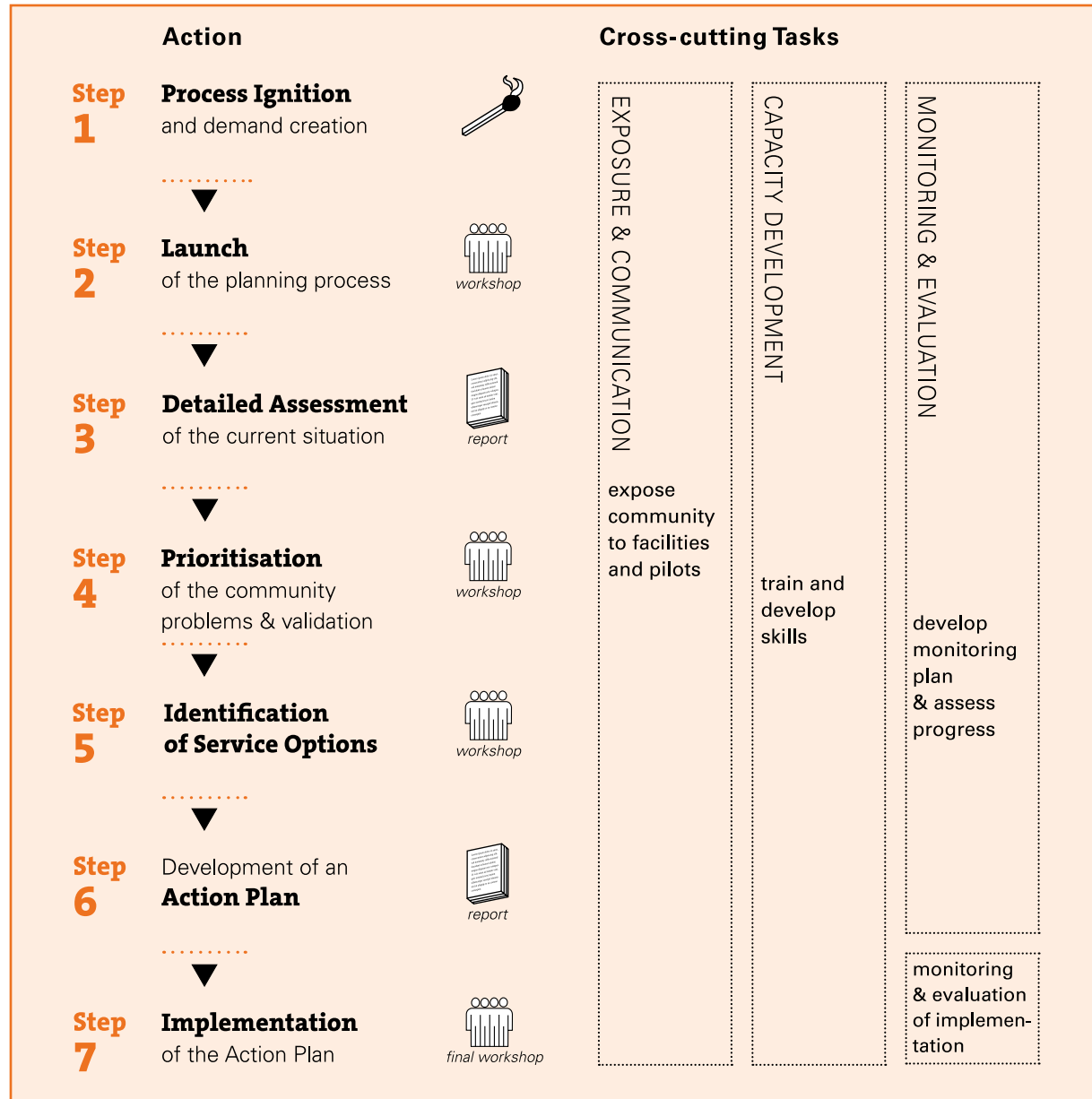
decision framework

9



what is clues?

10



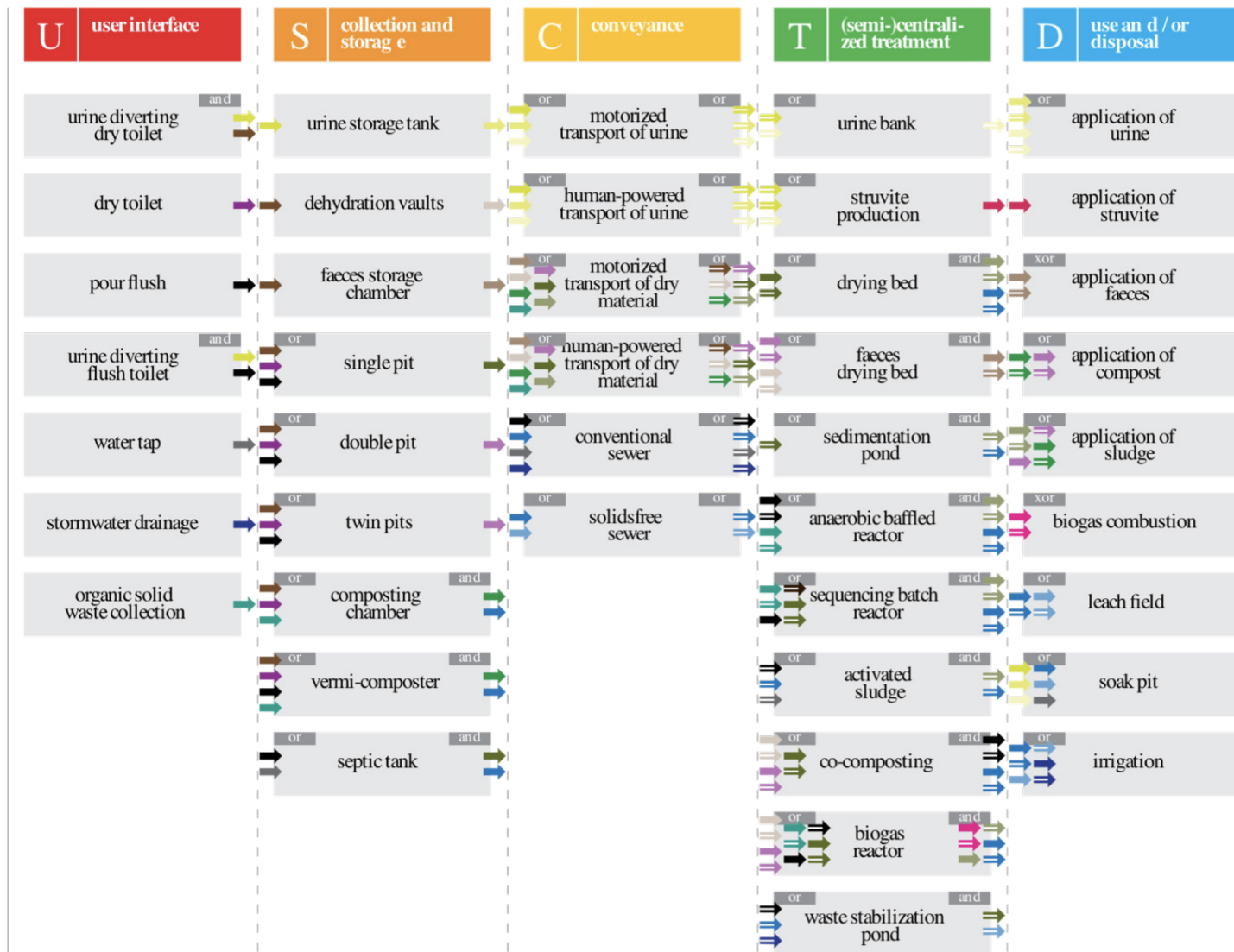
Criteria requiring consideration:

- Health and hygiene
 - Pathogen emissions*
 - Staff exposure
- Technology
 - Spare parts
 - Space requirements*
 - Energy requirements*
- Environmental
 - Nutrients emissions*
 - Resource recovery*
- Financial
 - Construction costs*
 - O&M costs*
- Socio-cultural
 - Odor emissions*
 - Landscape
 - Equity and inclusion*
- Legal and institutional
 - Project duration
 - Compatibility w/current policies

** WHAT THIS SYSTEM WE PROPOSE DISRUPTS*

systems configurations

12



clues procedure I overview 13

Using CLUES Step 5 (Identify Service Options)

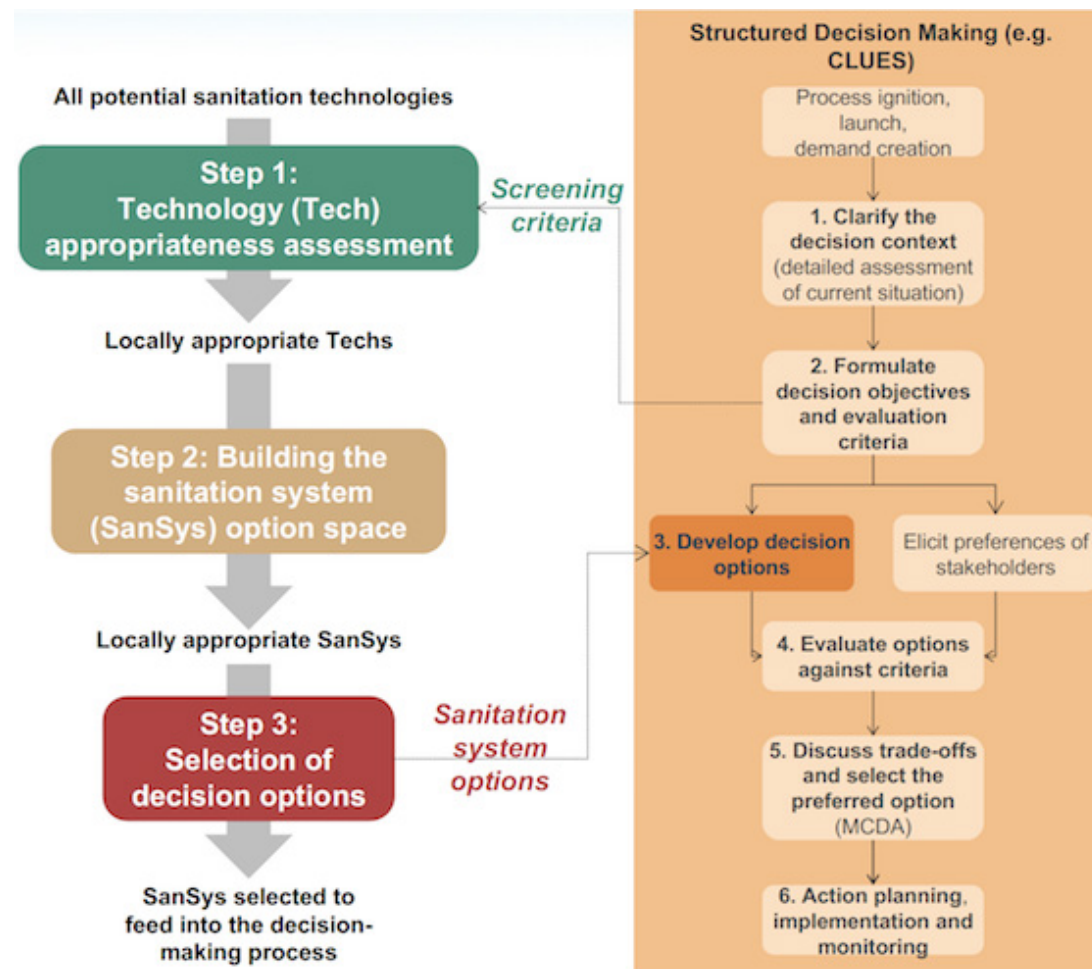
- A pre-selection model to:
 - Generate all possible sanitation system options
 - Quantify N, P, H₂O and Total Solids (TS)
- A procedure to:
 - Quantify appropriateness of the technology options
 - Identify drivers
 - Identify a set of sanitation system options which are locally appropriate and manageable size

Citation for Slides 16, 17, 18: Spuhler, D., Maurer, M. and Lüthi, C. (2018) Generation of sanitation system options for urban planning considering novel technologies.

clues procedure | step 1

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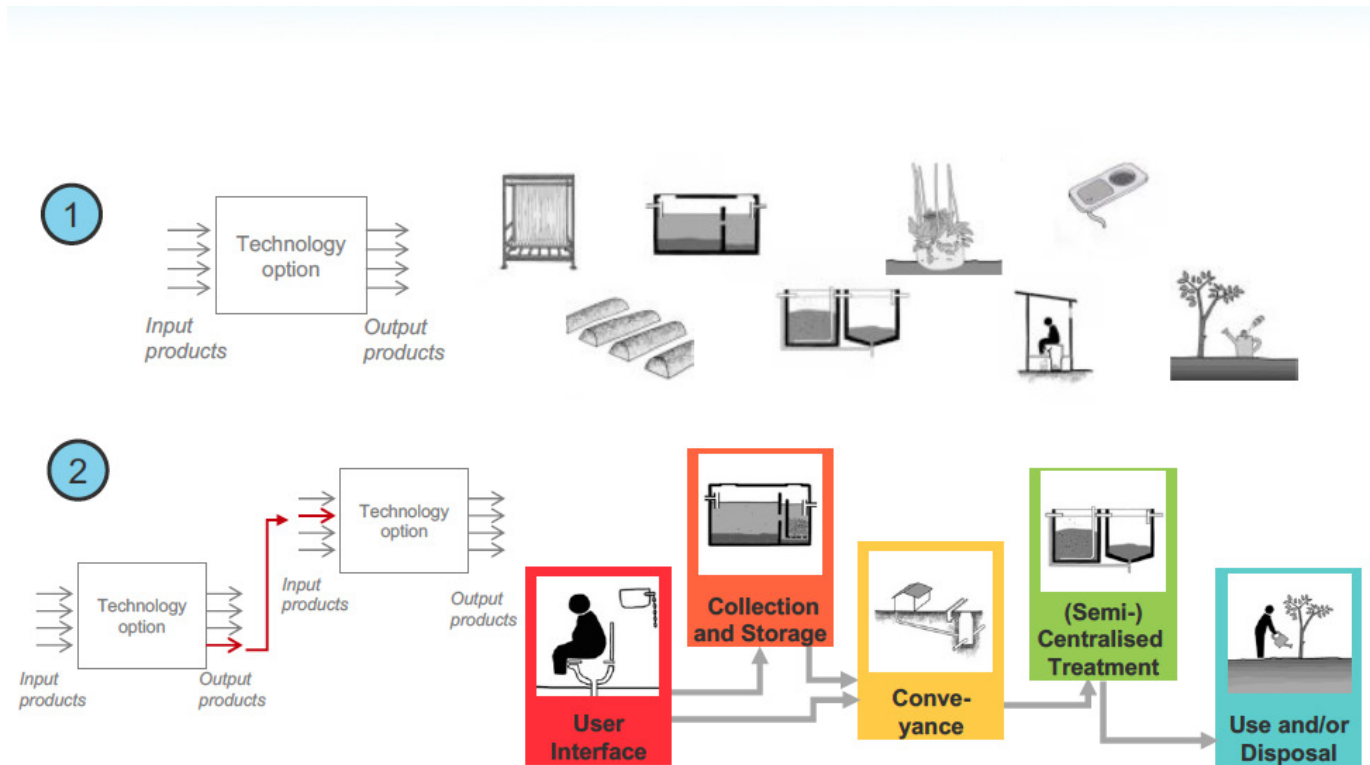
Identify appropriate technology [DONE]



clues procedure | step 2

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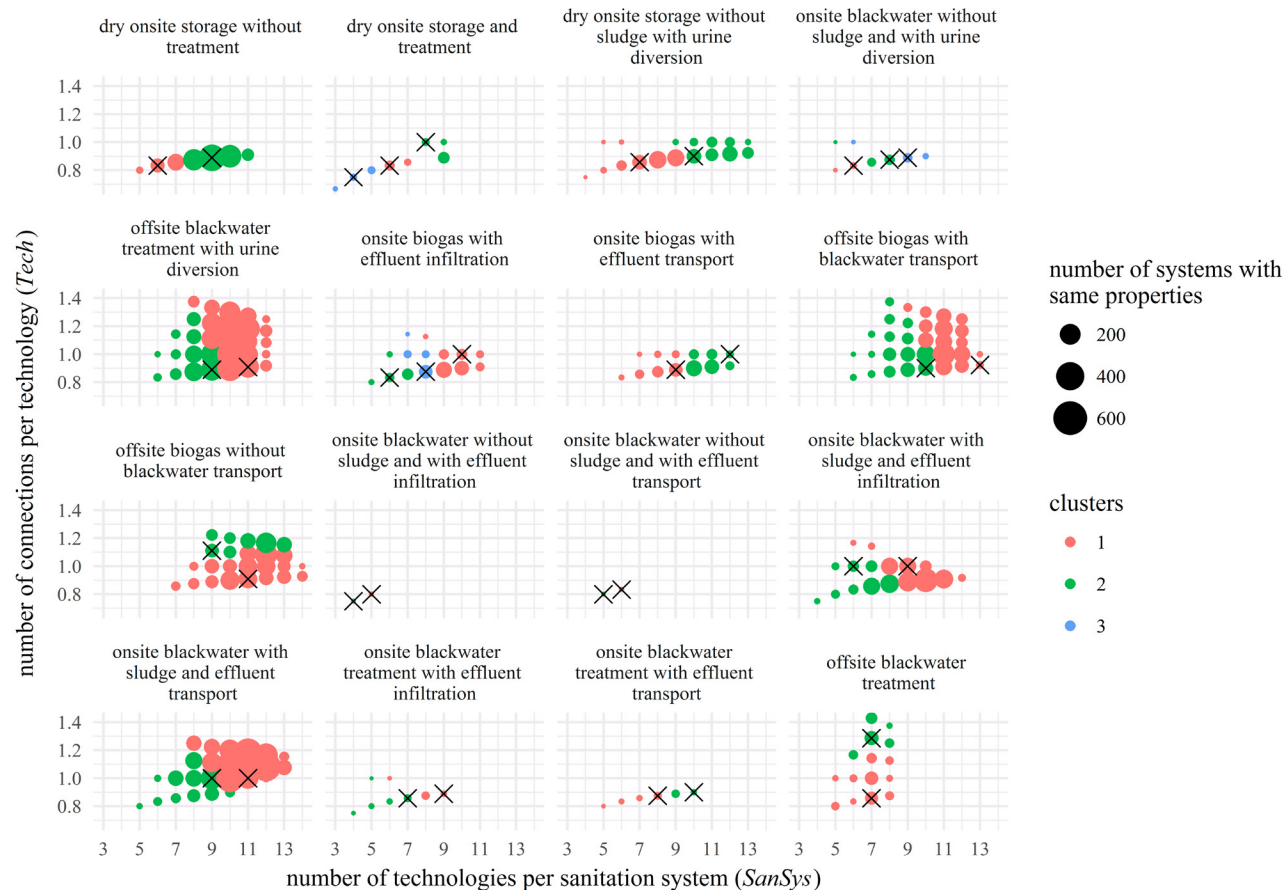
Generating entire systems (Slide 11) [DONE]



clues procedure | step 3

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Selecting sanitation strategy to implement [In-progress]



For urban curb communities and tiny houses:

- Stop defecating in water and compost instead
- Dry/Eco-san toilet manufacturing
- Curbside community inhabitants trained to manage, maintain, and gain transferrable skills
- Sanitary compost/humus management



**First proposed to City of Oakland on 23 May 2016*

On-site compost ecological sanitation (eco-san) recycling opportunities:

- Jobs creation
 - Curbside community inhabitants
 - Tiny house urban agriculture stewards
- Revenue generating streams
 - Dry/Ecosan toilet fee use
 - Dry/Ecosan toilet construction & sales/rentals
 - Compost sales
 - Cover material sales
 - Tipping fees for other organic material e.g. food scraps, etc.

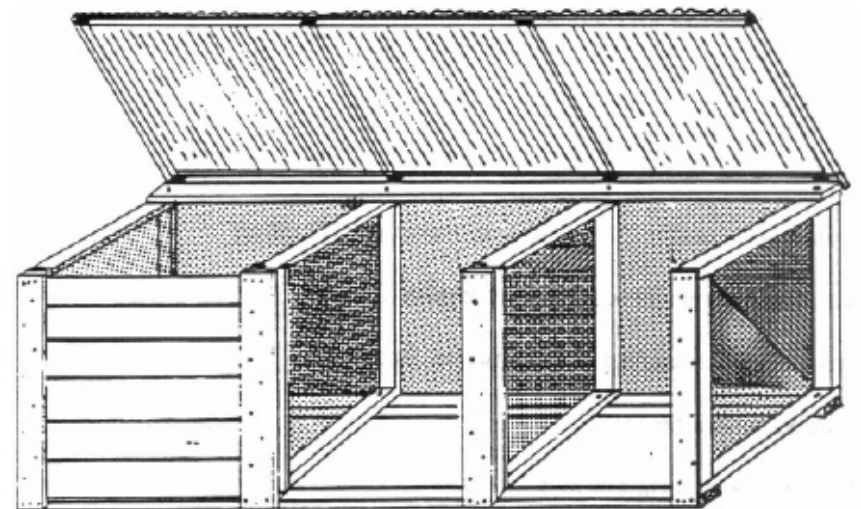


design considerations

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What makes a good dry/ecosan toilet schema?

- Comfort?
- Cleanliness?
- Smell-free?
- Affordable?
- Convenience?
- Accessible?
- Timely collection service?



Dry/Eco-san Toilet Types

- Dry Toilet (DT)
- Urine Diverting Dry Toilets (UDDTs)
 - Liquid fertilizer production source-separated urine

On-site Humanure Production Treatment

- Thermophilic (high-temperature/heat) composting
 - 122°F (50°C) maintained in the faeces pile > 1 week
 - > 140°F (60°C) maintained for a 24-hrs (complete pathogen die-off)
 - Solar drying (sanitizing)
- Vermi-composting (pathogen re-dux 'insurance')
 - Earthworms
 - Other mesophilic micro-organisms

the tech solutions (cont'd) 21

Derived from hot composting, field-tested, proof-of-concept & PHLUSH recommendation estimates for a pilot in Alameda County:

- 15-20 people/encampment
- 42 5-gal, 80% full toilet receptacles/week
 - poo | 4 receptacles/day x 7 days = 28 receptacles/week
 - pee | 2 receptacles/day x 7 days = 14 receptacles/week
- 3 4'hx4'wx4'd hot compost processor bins needed
- 71 ft³ (2.6 yd³) toilet material collected/week
- 162 ft³ (or 6 yd³)/encampment/month cover material

Out think the box.
Prepare. Respond. Adapt.

*People who compost
humanure are recycling
—there is no waste in nature.*

*Mother Nature is the expert.
(Wo)Man are the amateurs.*

*It's only called human waste if
we waste it. - H. Skermer*

