

When Rural Latrine Pits Fill:

Characterizing Household Choices and
Encouraging Safe Fecal Sludge Management

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Background

Latrine access ↑ in rural Cambodia. FSM?

- Latrine access
 - 4% to 49% from 2000 to 2015
- Rural FSM services rare
- Pits emptied unhygienically

Challenge

How can we safely manage
all of this waste?

- First step: understand household's perspective
 - When pits fill, **what do they do and why?**



Study Objective #1

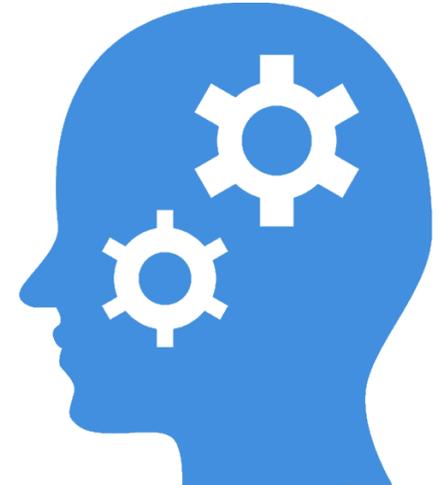
Describe rural FSM decision and practices. 832 households surveyed.

- Choice of practices
 - Self-empty, hire service
 - Bucket, pump, vacuum truck
 - Install a new pit, open defecation

- Decision-making

- Beliefs “What will be the **outcome**?”
- Attitudes “How will this make me **feel**?”
- Social norms “What will **others** think?”
- Cost & willingness to pay “How much **\$\$\$**?”
- **Context** Knowledge, demographics, ...

→ Practice selected



All Households

Regular latrine use. Flooding & bucketing common. Few services.

- Most household members used latrine (4.1, 90%)



- 1 in 4 experienced flooding



- Most had good road access (89%)



- Latrine age
 - 1 month to 31 yrs
 - 5.6 yrs avg



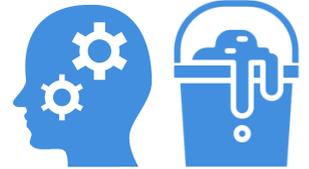
- Latrine design

- Most had one pit (88%)
- 14% pierced pit



- Most had plan to empty (87%)

- 77% bucket
- 11% unsure



- 2% believed service available

- Half knew contact info



Emptying Practices and Motivators

18% of households emptied before



- Most self-emptied (95%) by bucket (82%)
- Most had good experience (87%)
 - Only 5% reported challenges: emptying required too often



- Reasons for emptying
 - 58% latrine unusable, 23% smelled, 15% fertilize crops
- Disposal
 - 87% in field (18% fertilize crops), 10% buried, 2% in river/pond
- Most plan to empty how they emptied before ($v = 0.84$)



Emptying Rates

times emptied/year latrine owned. Many relevant factors!

Emptied more when...

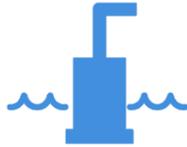
- Had road access



- Had pierced pit

- More pits

- Self-emptiers using pump



- Neutral emptying experience

- Disposed in fields

- Fertilize crops ($p = 0.07$)



- Had plan to empty

- Did not know of service provider

Emptied less when...

- IDPoor

- More people using latrine

- Property flooded

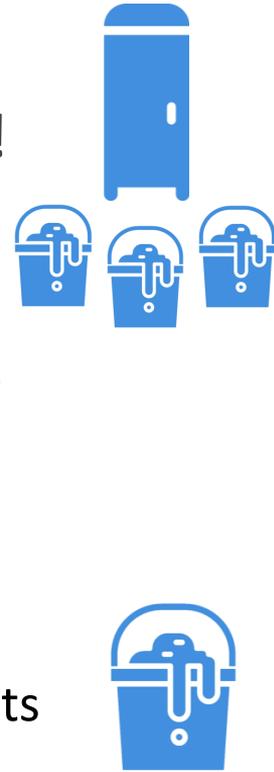


- Smaller rings

- More rings

- Self-emptiers using buckets

- Longer time to empty



Pierced Pits

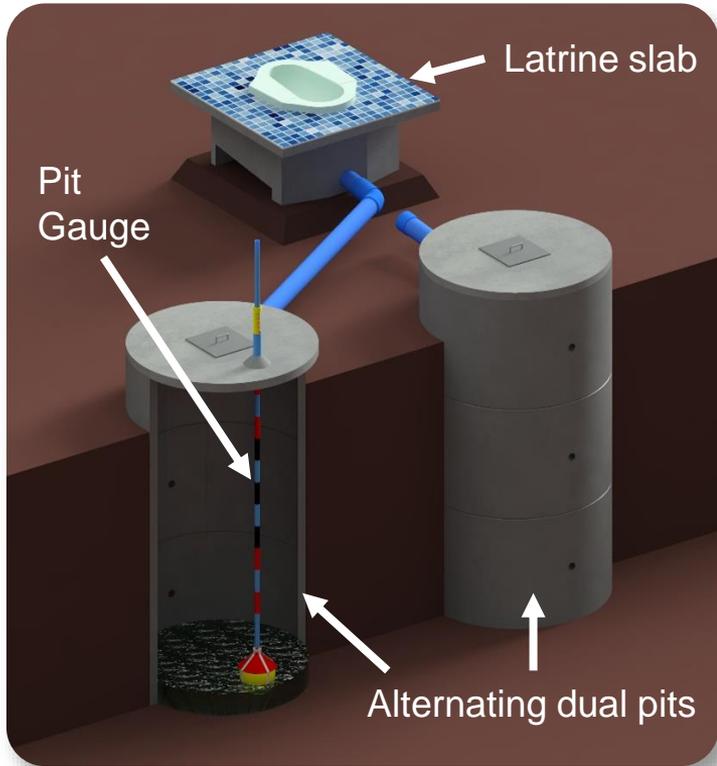
Overflow hole installed into pit's top ring to drain liquid sludge

- Dangerous! Untreated surface release of blackwater
- More common when...
 - Property flooded (22% vs. 11%, $v = 0.13$)
 - Older latrine ($R = 0.23$)
 - Household member worked technical job (e.g., mason; $p = 0.08$)
- **Challenges**
 - Improve **understanding** that blackwater is dangerous
 - Understand **motivators** for piercing pits



Study Objective #2

Measure how Pit Gauge triggers demand for safe FSM solution.



- Pit Gauge shows pit sludge level
- Alternating dual pit (ADP)
 - Safe emptying via storage treatment

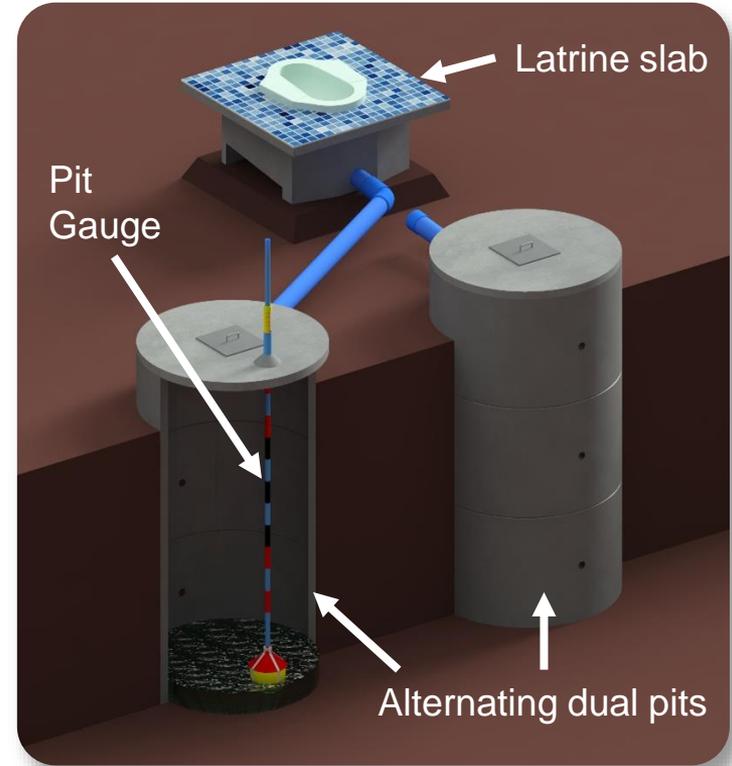
Does a Pit Gauge trigger demand for an ADP?

- Households with single pits
 - **Treatment** (226): w/ Pit Gauges
 - **Control** (429): no Pit Gauges
- ADPs sold in both areas

Pit Gauge and FSM Demand

Demand triggered, but biases exist.

- 237 ADPs sold (28% of households)
 - High product demand
- More sales w/ Pit Gauges: 27% vs. 12%
- Fewer cancellations w/ Pit Gauges: 8% vs. 34%
- **Biases**
 - Researchers measuring sludge levels
 - Village chief engagement



Key Findings

Understand decision-making to improve FSM.

- **Self-emptying using buckets** very common and socially acceptable
 - Behavior change very difficult
- Must address **reactive decisions** and **methods of convenience**
- **Households aware** of FSM options, but **FSM services** not available
- Can **trigger demand** for safe FSM solutions. Best method unknown.

Challenges

Understand decision motivators across Cambodia

Develop and promote safe rural FSM

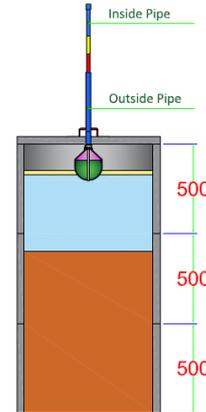
Next Steps and Future Work

Characterize FSM decision-making and practices across Cambodia

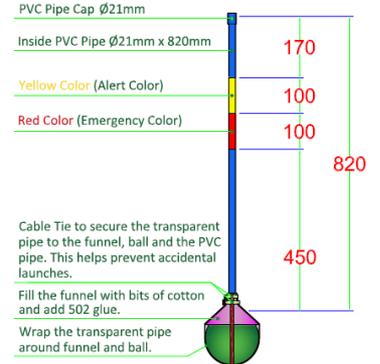
- Research: **The FSM Survey**
 - FSM decision-making and practices
 - Discrete choice experiment
 - Looking for research partners!



- **Implementation** (iDE)
 - Scale up ADP sales
 - Continue measuring sludge levels
 - Test Pit Gauge 2.0
 - Sludge-level alarm, not measurement



Inside Pipe Detail



Thank You!

Are there any questions?

Feedback always welcomed!



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Let's all learn from our failures. Sign the **Nakuru Accord** with me!

All values reported without p -values are statistically significant below $p = 0.05$.

All icons were created by various artists on Noun Project.

Backup Slides

Survey Results

3 of 98 households emptied very frequently (every 4-8 months)

- All of household used latrine
- Had road access
- Did not flood
- No challenges when emptying
- Emptied because latrine was unusable
- Disposed in field
- Plan to empty in the same way
- Will not pay for service provider
- Reported no FSM service providers available in their village

	Household 1	Household 2	Household 3
IDPoor	No	No	Yes
# latrine users	5	6	3
Pierced pit	Yes	No	No
Who emptied	Family member	Family member	Self
Empty method	Bucket	Bucket	Pump
Empty experience	Good	Neutral	Neutral
Time to empty	2 hours	4 hours	10 minutes
Number of empties	5	21	3
Latrine age (years)	3	7	2
Number of empties per year latrine owned	1.5	3.0	1.7

Survey Results

Households that had not emptied before

- 46% in control, 54% treatment (36% did not have PG, 18% did)
- Latrines newer than in houses that emptied (5.1 vs. 7.9 yrs, $p = 0.000$)
- Had less knowledge of FSM service providers in the area (20% unsure vs. 6%, $p = 0.000$).
- Older latrine \sim more likely to prefer to let it overflow
- Pierced pit \sim more likely to prefer to let it overflow

Flooding

Associated with reactive methods and unsafe emptying

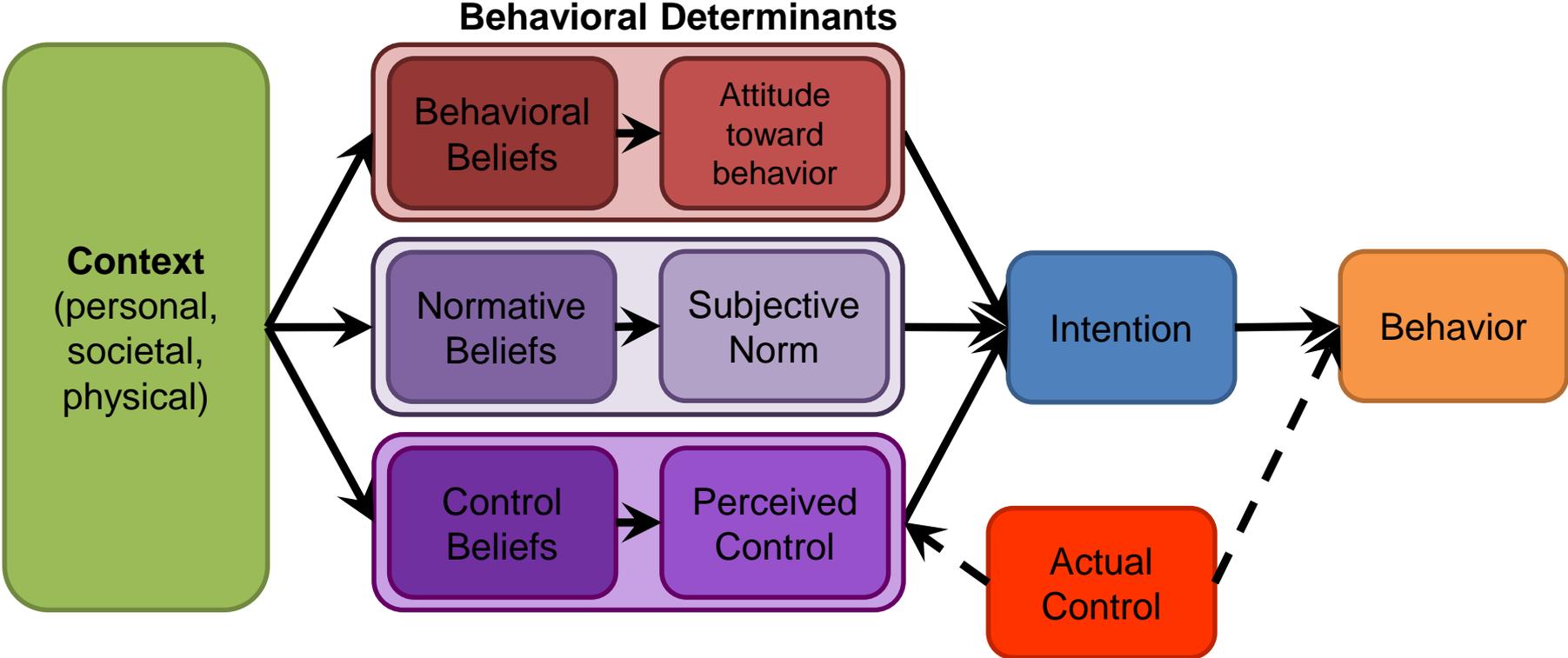
Experienced flooding

- Not having a plan ($p = 0.01$)
- Planning to bucket ($p = 0.03$)
- Pierced pit trends ($p = 0.05$)
- IDPoor trends ($p = 0.09$)
- Planning vacuum truck trends ($p = 0.07$)

Did not experience flooding

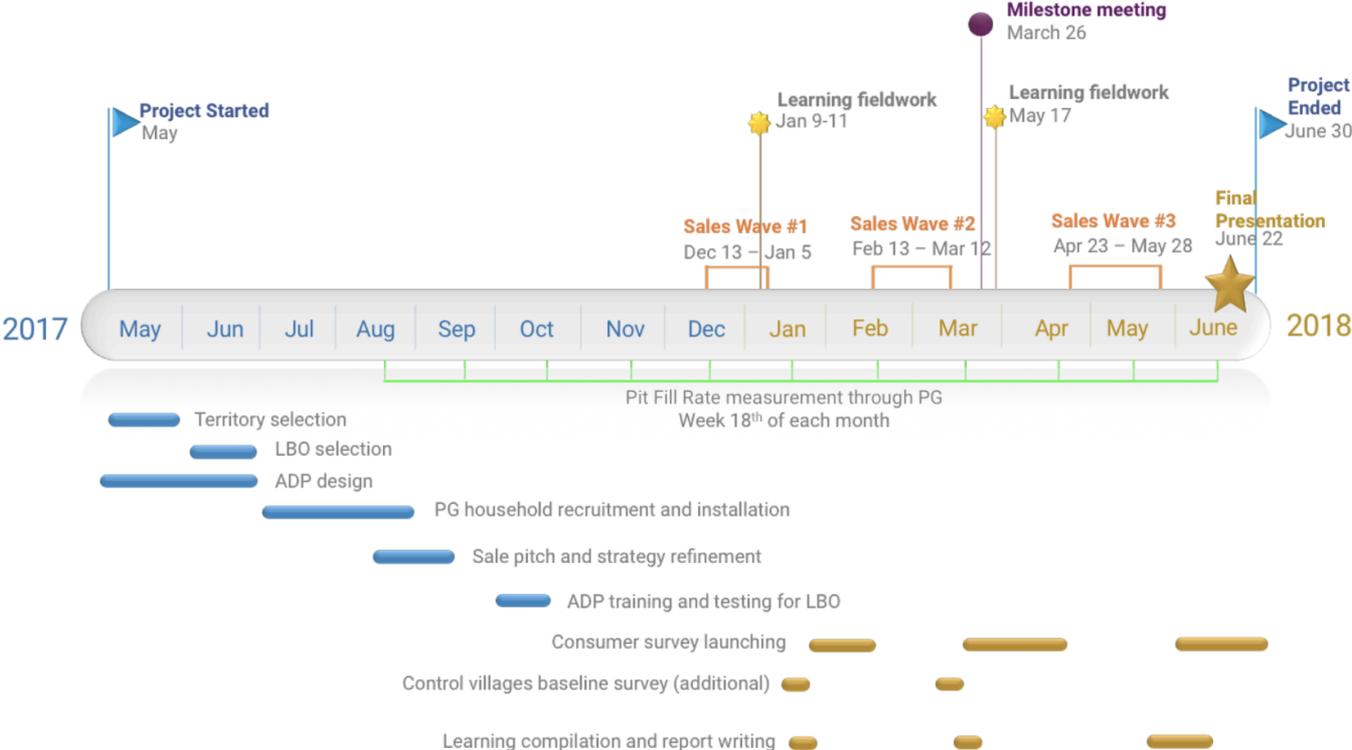
- More pits ($p = 0.04$)
- More rings ($p = 0.03$)

Theory of Planned Behavior



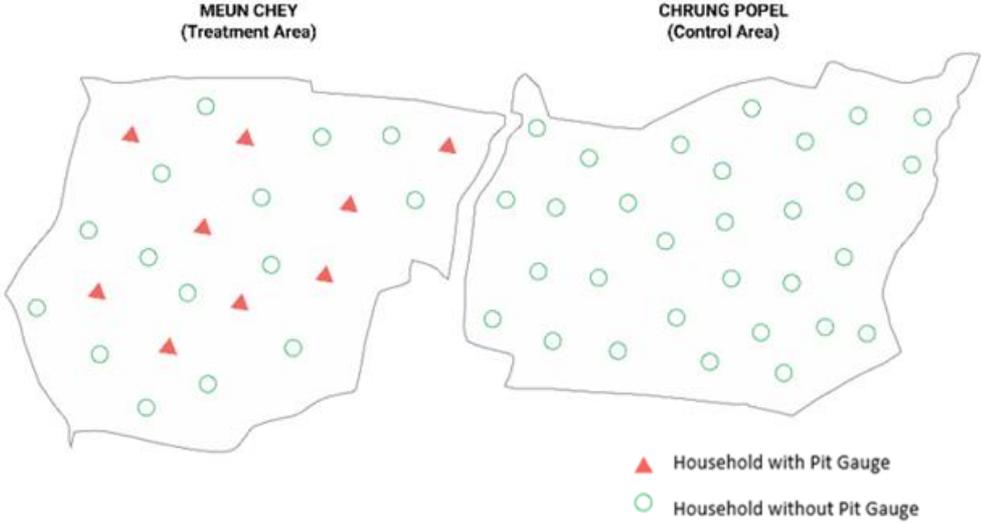
Study Timeline

PROJECT TIMELINE



Study Methodology

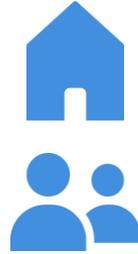
Surveys, Pit Gauges and Sales



Survey Results - All Households

All households

- 4.7 people in household
 - 90% of household members (4.1) used latrine



- 12% poor



- All located by field



- None by river/pond



- 24% experienced flooding



- 89% good road access



- Latrine age
 - 1 month to 31 yrs
 - 5.6 yrs avg



- Latrine design
 - 88% one pit
 - 93% had 3-6 rings
 - 14% had pierced pits

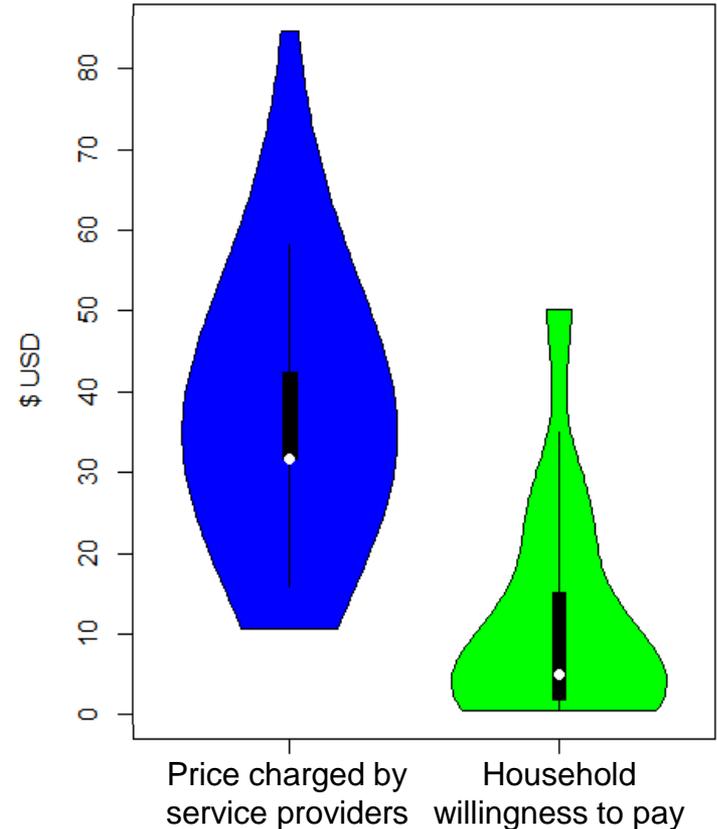
- 87% had plan to empty
 - 77% bucket
 - 11% unsure
 - 8% pump
 - 4% vacuum truck



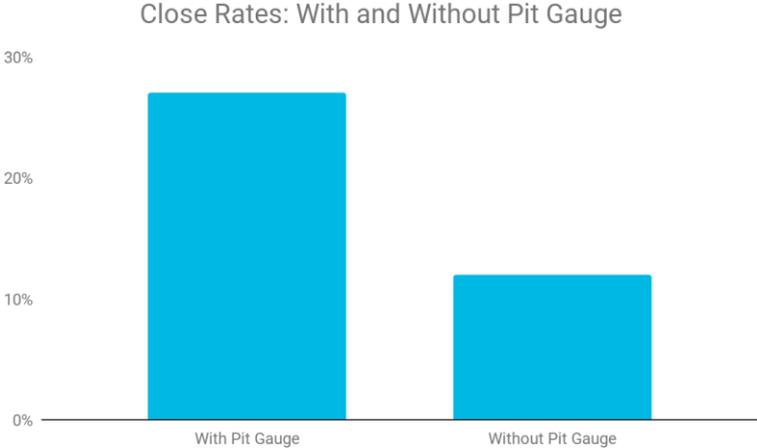
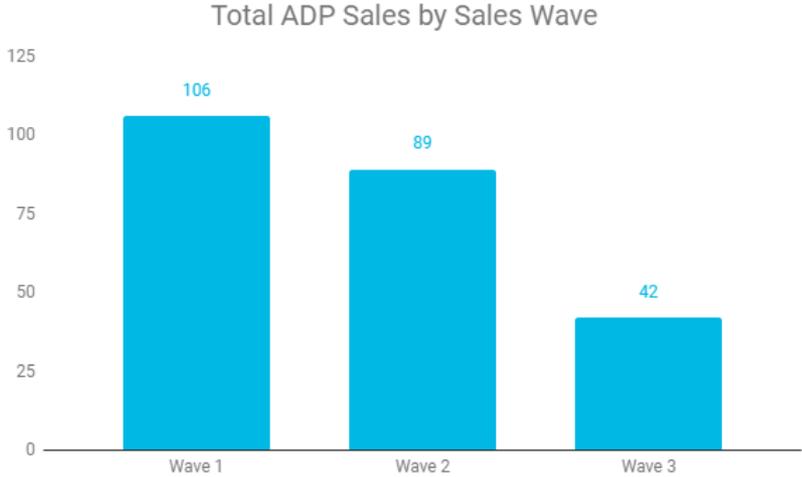
FSM Services and Willingness to Pay

Few service providers. Households unwilling to pay.

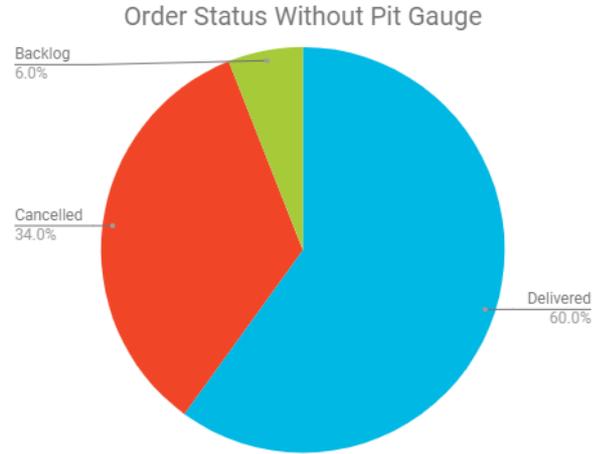
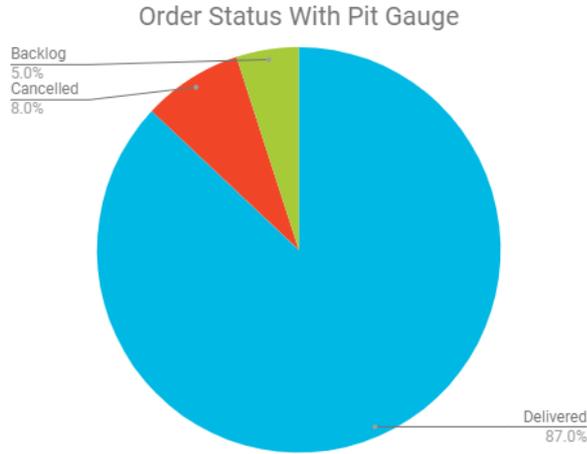
- 80% believed 0 served village
- 17% unsure
- 2% believed >1 served village
 - 7/14 knew contact info
 - 11 knew prices
 - **\$10.56/ring**
or \$71 fixed
- Willingness to pay
 - 76% unsure, 15% unwilling
 - \$0.38 - \$50, **\$11.38** avg



Pit Gauge and FSM Demand



Pit Gauge and FSM Demand



Supply Side of ADPs

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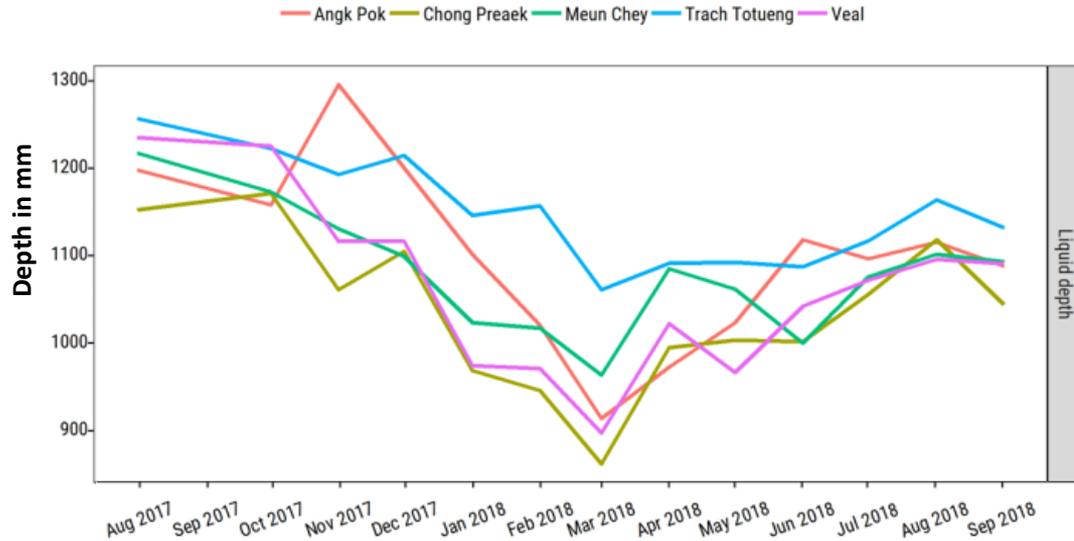
- Relatively low margins on the ADP make it less attractive for suppliers than other products.
- Demonstrating clear profit calculations of the product is key to maintaining supplier motivation.
- Late payments increased transaction costs for suppliers
- Space for installation of ADP was an issue in some cases
- Installing an ADP on an established latrine means working with sludge — unattractive for suppliers and their laborers
- Need to train suppliers on health protection protocols

Pit Fill Rates

...

- 147 pour-flush latrines sampled over 1 year
- Highly dependent on seasonal factors (e.g., flood, rain)
 - Households find it difficult to understand how full their pit is.

Monthly average depth of liquid and sludge from 122 latrines in 5 villages



Limitations

Context, control vs. treatment groups, survey questions, biases

- Only two communes in one province
- Treatment group emptied less than control group (26% vs. 11%, $v = 0.20$)
- Unclear if Pit Gauge triggered demand for FSM
 - Presence of researchers to measure sludge levels
 - Village chiefs influence over ADP purchasing decisions



End with Points to Remember

- The audience is not your prisoner!
- Focus on the main message
- Plan and practice
- End with a summary and a challenge



Presentation Guidelines and templates

Introduction

Please

- Use slides **#8** and **#9** below as templates for your presentation at FSM5/AfricaSan5.
- Edit the title slide (*slide #8*) and make copies of slide **#9** then add your text and images/graphics etc.
- Use images, photos, diagrams in your presentation, including your logos.
- Follow the guidelines in slides **#1-7** as you prepare your PowerPoint presentation.
- When complete remove slides **#1-8**

Guidelines for Preparing your Presentation

- Text on PowerPoint slides should be 24pt or larger and **must not be** smaller than 20pt.

(Although you can read small text on a computer screen, the audience may not be able to read it when it is projected)

- Tables should be simple, clear with minimum text size of **18pt**.
- Handouts are more effective than slides for detailed information.
- Presentations should be 12-15 slides maximum for a 15 minute talk - unless advised by your session leader

Use Simple Fonts, Strong colours, Less is More

- Simple easy to read fonts e.g. Arial, Century Gothic, Calibri, Trebuchet
- Dark colours and good contrast e.g., black, dark blue, dark green, maroon, brown.
- Use bold colours to highlight – but not pale ones
- Keep information short and concise. Notes not sentences.
- **Rule of 6:** Only 6 lines on each slide and 6 words per line
- Use additional slides to convey your message.

Focus on Content, Main Message not Context

Suggestions for an interesting presentation

Content	No of slides
Title slide	1
Background context	1 - 2
Method/approach/principles	1 - 2
Main content	
Findings include data	
Recommendations/lessons learned	2-3
Takeaways/Summary/main message/Challenge	1
Closing slide	1

How to submit the Presentation

- Your session leader will ask you to send a draft presentation a week or two before FSM5/AfricaSan5. They will check its length and readability, not the content.
- Please deliver the final version to the 'Speaker Prep Room' at the start of FSM5/AfricaSan5 or least 24 hours before your presentation.
- A designer/technician will be available to assist you at the 'Speaker Prep Room'. Once delivered, final presentations will be transferred to the session room.
- **Bring a backup copy** of your presentation – USBs and other devices can be corrupted in transit.
- If you use any Third party software - bring a copy of any industry specific software that you may require.