STeP Sanitation Technology Platform

User Insights from a Multi Unit Reinvented Toilet (MURT) Field Trial

Senior living facility in Coimbatore, India

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The Sanitation Technology Platform (STeP) helps innovative products and services reach the 4.5 billion people worldwide who do not have access to safely managed sanitation. STeP provides a full range of services including field testing, market intelligence, and user insights to help inventors and companies address sanitation market and user needs.

STeP is a collaboration of global experts and organizations that reduces risk and streamlines the path to market, fostering greater success for its clients. As a department within RTI International, Innovation Advisors is the implementing partner of STeP.

Executive Summary

Context

A multi unit reinvented toilet (MURT) was installed to process the blackwater from 15-20 users in an apartment building from 2015 to 2016.

The system was operated in closed loop, whereby treated water was reused in the flushing process.

Interviews with users before and after the field test illuminate key insights that can inform go-to-market strategy for MURT developers.

Key insights from MURT system users

- Users see the MURT system as a wholly positive addition to their household and community.
- Interaction with the system increases awareness of water scarcity and need for conservation among users.
- Toilet behaviors that introduce water into the toilet, such as flushing, remain largely unchanged.
- Odor and appearance are key factors determining user acceptance of the treated water.
- Trust in the system was built through consistent quality of treated water over time and external guarantees.
- Perception of chlorine, when present in moderation, is largely positive.

Background and Methods

The installation treated blackwater from 15-20 users of flush toilets in an apartment-type living environment.

Installed in a senior living center in Coimbatore, the MURT treated flush toilet blackwater from both squat plate and pedestal toilets in a closed loop.

The biological treatment stage digested solids and reduced chemical oxygen demand (COD) and ammonia in the effluent. Then, electrochemical processes used custom bi-layered semiconductor anodes for effluent disinfection.

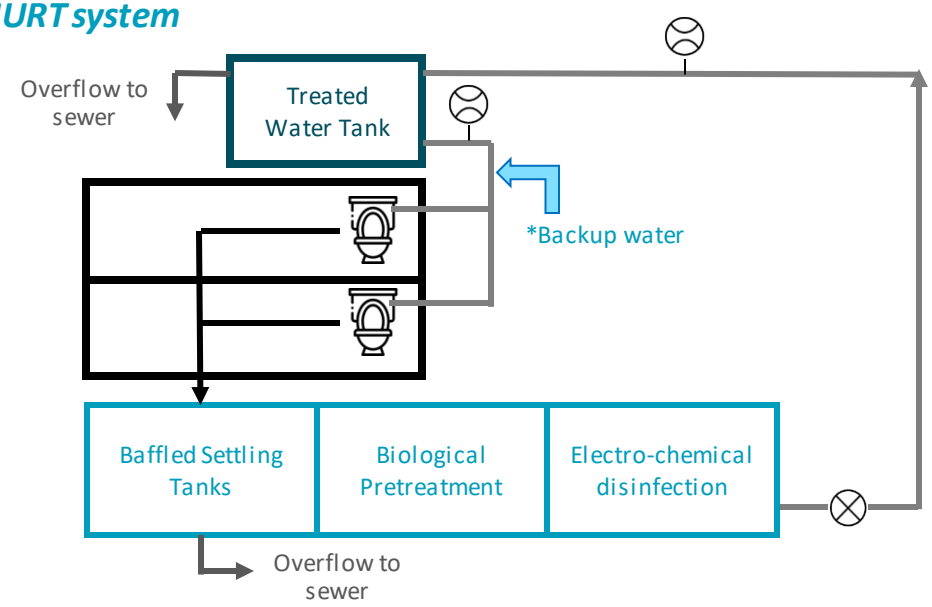
After processing, the treated water was re-used for toilet flushing.

Characteristics and flow diagram of the installed MURT system

1000
L/day of wastewater

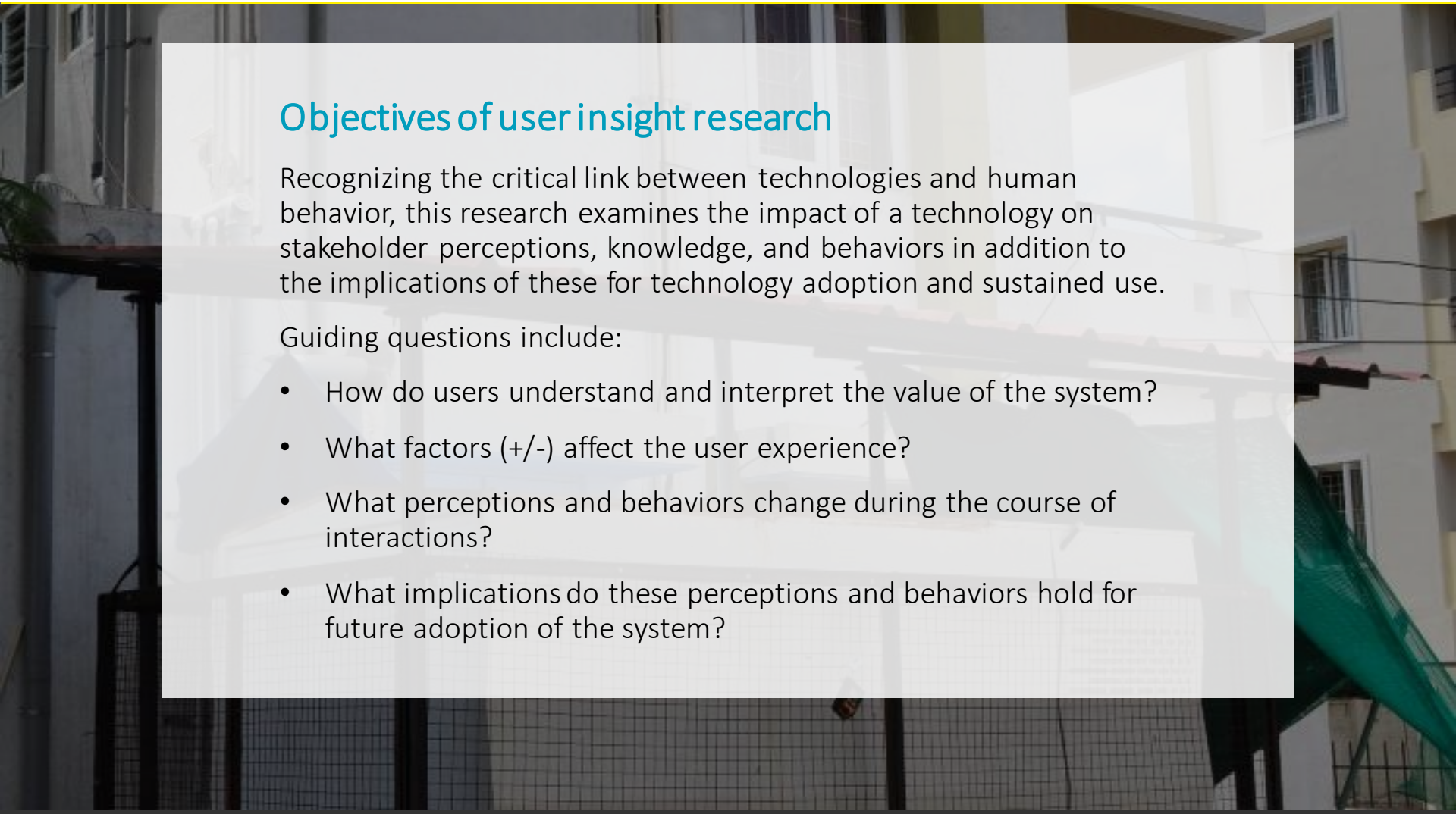
8
Apartment, floors G, 1, and 2

15-20
Users living at the site



**Backup connections to the water and sewerage network were in place to prevent disruption of services to the user during engineering field testing and times of MURT system maintenance in the event of a temporary shutdown.*

User insight research focuses on the interaction between technology and human behavior.



Objectives of user insight research

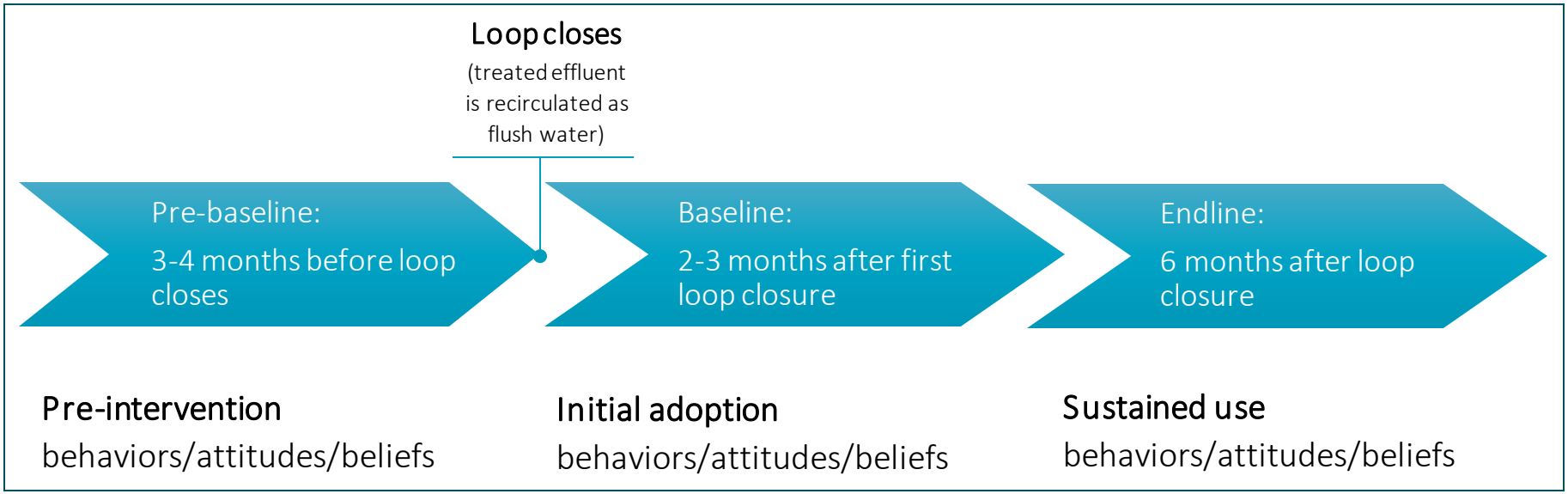
Recognizing the critical link between technologies and human behavior, this research examines the impact of a technology on stakeholder perceptions, knowledge, and behaviors in addition to the implications of these for technology adoption and sustained use.

Guiding questions include:

- How do users understand and interpret the value of the system?
- What factors (+/-) affect the user experience?
- What perceptions and behaviors change during the course of interactions?
- What implications do these perceptions and behaviors hold for future adoption of the system?

Insights captured during technology development show how stakeholder perceptions and behaviors change over time.

User Insights Timeline



Residents were not alerted to the change in water source if/when the loop reopened.

Upon loop re-openings, on-site treated water was temporarily replaced with tap water until the treated water was confirmed to pose no risk to users.

Initial insights draw on structured qualitative interview data with resident users of the MURT system.

Pre-baseline:
3-4 months before loop closes

Baseline:
2-3 months after first loop closure

Endline:
6 months after loop closes

Pre-intervention
behaviors/attitudes/beliefs

Initial adoption
behaviors/attitudes/beliefs

Sustained use
behaviors/attitudes/beliefs

Pre-baseline:

- **Focus**: standard household behaviors (e.g. water use, sanitation, cleaning)
- **Data collection:** Sept to Nov 2015
- **Methods:** Observation, facility mapping, and informational interviews with users and facility managers conducted in Tamil and Hindi

Baseline:

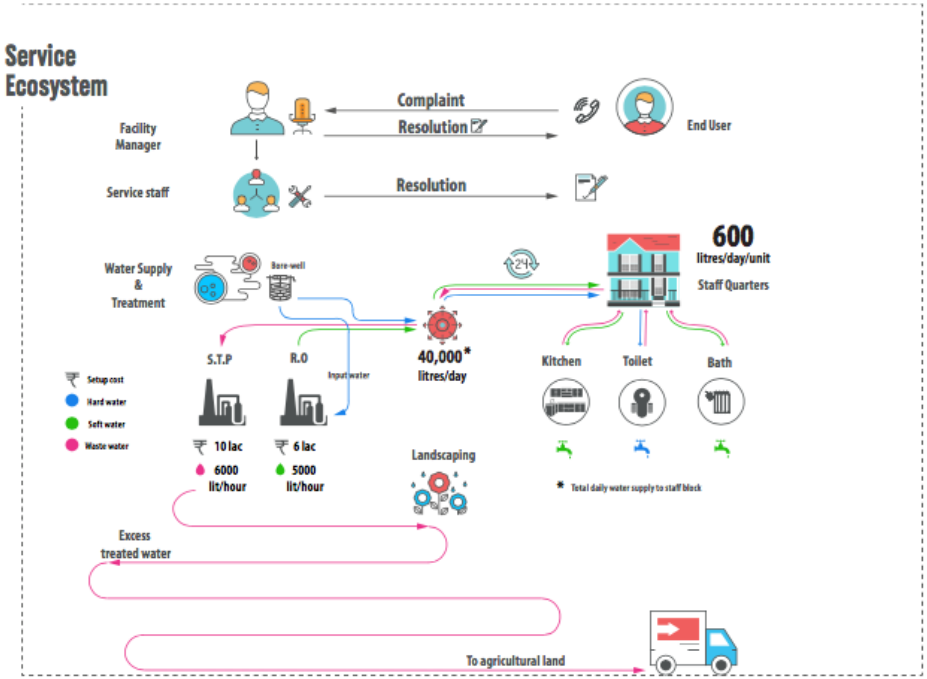
- **Focus:** system perceptions and understanding, related changes to user behavior and attitudes after initial exposure to system
- **Data collection**: Two weeks in July 2016
- **Methods:** 12 structured interviews conducted in Tamil with residents (family and bachelor residences)

Endline:

- **Focus:** changes in system perceptions and related changes to behavior/attitudes after sustained use of system, long-term impacts within and beyond household
- **Data collection:** Oct to Nov 2016
- **Methods:** In-depth structured interviews conducted with 6 residents; role-play session conducted with 4 residents; conducted in Tamil
  - Role-play sessions involved participants acting out scenarios associated with new system

Local qualitative research firms were engaged to conduct the user insight assessments, with STeP involvement and oversight during data analysis. No attrition or refusals to participate in the user insight studies occurred during the six-month period.

User insights research uses a mixed methods approach to collect data throughout the field test.



Facility maps, built through walk-throughs with the facility manager, illustrates key points of interaction between the exiting waste management system and its stakeholders.

Structured interview guides were developed by RTI with input from Quicksand and adapted to specific questions of CLASS system.

Residents were given **calendars** to note system-specific events or issues to help with memory recall during in-depth interviews.

Role-plays, where users act out their perceptions and reactions, were used with residents to aide with respondent fatigue.

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User Insights

Users see MURT system as a wholly positive addition to their households and community.

Users see the MURT system as aspirational, innovative, and safe:

- The automatic flush was new and seen as a modern amenity to several users.
- Sharing information about the system with external guests, friends was common and often detailed as a source of pride.

Before commissioning, concerns that the system would affect the health of the users were common.

No users voiced these concerns during the endline assessment, or upon completion of the two-year engineering field testing of the system.

"I haven't seen [a system] like this anywhere outside, this is new, this is nice."

"As far as we are concerned, we are much satisfied with this, even if guests come to our home, we take them to it and show how it is getting cleaned…"

Interaction with system increases awareness of water scarcity and need for water conservation among users.

At the senior living center, no users pay for the water that they use. Water supply for drinking and household use is always available, but many have experienced water scarcity elsewhere.

Users note that the MURT system's **water conservation was a primary benefit.** Residents demonstrated high awareness to small-scale water conservation, a feeling which draws on experiences of water shortage and a macro climate of regional or global water scarcity.

> *"One of the main positives of this system is its ability to reuse the water. Because of it, my water consumption while using the toilet has reduced…"*
>
> *"In Chennai you don't get water. That situation might come here."*

Despite some reduced water use, toilet behaviors that introduce water into the toilet remain largely unchanged.

Water is introduced into the toilet cistern through flushing, cleaning, anal and genital cleansing, and bathing. Tap water, not the system-treated water, continues to be predominantly used.

Flushing behaviors changed somewhat over the course of the study, partially due to the addition of an auto flush.

- Several users were asked at endline to report any change in flushing habits: those who previously **used three buckets** for flushing, **now use one flush and one bucket** (after use) for cleaning.

Before the MURT system was installed, users expressed resistance to changing the cleaning practices in the toilet space.

- The practice of pouring extra water before or after a flush to "clean the bowl" – either from a bucket or with an additional flush – has not changed.
- This practice is more common among shared, non-family households (e.g. a "bachelors flat") and households with children who seek to keep the space clean.

> *"Earlier we pour 3-4 [small] buckets [after use], whereas now we can pour 1 or 2 buckets and use the flush water for cleaning the toilet"*

Odor and appearance are key factors determining user acceptance of the treated water.

The importance of smell and appearance (e.g. turbidity, color) were consistent factors that residents use to judge the water quality.

Many users felt the treated water appeared and smelled better than the sewage treatment plant (STP) water that they use regularly.

Familiarity and some bad experiences with STP water in the past gave some users initial concern, however, smell and clarity of water distinguished the treated water from the STP water over time.

"The STP water is not very clear. But what disturbs me is the smell… I wouldn't use it for my toilets or garden because to me it isn't clean water."

"I am very surprised to see the treated water pure and clear as RO water. It's hard to believe."

Trust in the system was built through consistent quality of the treated water over time and external guarantees.

Even initially skeptical users felt that treated water, judged by smell and appearance, were consistent and always available during the MURT field test. Given the importance that households put on water supply, linked closely with health and hygiene, this reliability was highly valued.

External guarantees boosted user acceptance and willingness to use treated water:

- STeP field team's consistent presence at the site gave users confidence that the system's function and its water output were being closely monitored and cared for. Residents felt comfortable sharing concerns or issues with technicians.
- Town hall information sessions conducted with residents before commissioning were frequently cited as key points for users to receive information and ask questions, which helped to build trust.
- Presence of "foreign" engineers gave some users the sense that the system was important and carefully monitored for quality.

"

"There is always some technician on site. If I notice anything unusual about the water, I inform him."

"Foreigners came [to explain]. They used to hold small meetings and tea parties."

Perception of chlorine, when present in moderation, is largely positive.

When the loop was initially closed, some residents recalled extreme chorine smells coming from the treated water and toilet area. While all users are familiar with the smell of chlorine from common cleaning products, users had mixed attitudes towards the intense chlorine smell in their toilet. Several users felt it signaled cleanliness, others felt it might be damaging to health.

Users reported that chlorine smells have decreased significantly since the system was first commissioned. **Nearly all say that when the small is moderate, it is seen as clean and helps to mask odors in the toilet.** Users suggest that a *mild* chlorine smell is not harmful and may have additional benefits, such as keeping insects away.

"

"In our village in drinking water they will add chlorine… So we are used to it."

"About two months ago, I noticed a very heavy chlorine smell in the treated water and raised a complaint. I think since that time, I have noticed the smell to be not so strong."

"There are so many mosquitoes in our house, but there aren't many in the toilet. I think they don't like the chlorine smell."

Treated water is incorporated into a pre-existing hierarchy of water types and assigned distinct uses.

Household decisions about water management depend on water quality and its perceived cleanliness.

After installation, users most often retained existing distinct water uses by available water type and integrated treated water into a hierarchy of water sources. In the case of limited availability, **users will revert to one step "up" the hierarchy, but not "down"**.

For example, tap water is commonly used for anal cleansing, however users will use RO water if tap water is unavailable, not MURT-treated water.

Hierarchy	Water Type	Source	Uses
1	RO water	Tap water treated in RO filter (local)	Used for drinking and cooking
2	Tap water	Bore well	Used for bathing, anal cleansing, cleaning
3	Treated water	MURT system	Flushing