

# Digital Monitoring Systems for FSSM

@ NFSSM Alliance | Learning Labs |  
Digital Monitoring 11.10.2022



# Digital monitoring systems for FSSM

## SaniTab



- App for collecting data and provides quick analyses
- Custom survey forms
- Web dashboards reflecting real time progress

## SaniTrack



- End to end monitoring for desludging
- Role based modules – scheduler, truck operators, ULB official/administrators
- Signature based acknowledgements and reports
- Spatial dashboards

# Evolution and development history

Wai Sinner engagement – city sanitation plans

Household sanitation survey - SaniTab developed

Over time, used for other surveys like "ODF assessment" "san-credit" etc

FSSM, scheduled desludging and PLAM - need for monitoring

Moving from paper based receipts to SaniTab digital monitoring forms

Need for custom FSSM app + Inspiration from e-commerce apps = SaniTrack developed

Data on onsite systems – taking advantage of scheduled desludging – SaniTab form used

Lessons from use in other cities, evolutions, scaling up



# Monitoring needs for FSSM – CWIS perspective



**1** Ensure desludging at regular intervals

**2** Safe withdrawal of sludge by following necessary protocol

**3** Safe conveyance to designated treatment site

**4** Indicators for making decisions on "performance linked payments"

**5** Collect data on onsite systems

# Why use digital monitoring tools?

## Usually - Paper based monitoring

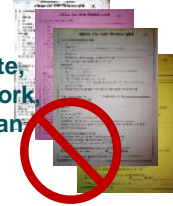


“Real time” monitoring  
No need to process  
data for results



- **Proof of safe and successful desludging** = signature of the customer on a paper form at collection as well as signature of FSTP operator at unloading.
- In case of PLAM with pvt contractor - Submission of required number of such forms is mandatory for municipality to approve monthly payment – **need to process paper based information for this**
- For issues like manual scavenging, illegal dumping, spillage, damage to septic tanks – **only option is to complain by phone**
- Forms only record basic data such as amount of sludge, date and time – **No way to visualize geographical coverage and other performance metrics**
- **Not capturing post-commencement issues** like customer readiness (septic tank covers not open), refusals and rescheduling, high trip ratio

Easy to Operate,  
Reduce paperwork,  
Minimize human  
error



Integrated monitoring system –  
Across FSM service chain



Inclusive – support vernacular  
language

Can view progress  
easily and process  
payments





# SaniTab - Mobile App for Sanitation Survey



- ✓ Custom survey forms
- ✓ Answer based looping and flows through excel based code
- ✓ Capture location and photos
- ✓ Supports local languages
- ✓ Stores offline data and uploads when internet is available

## Four Types of questionnaire available in V1.0

Open Defecation Free

Integrated ODF-FSM

Fecal Sludge Management

Basic Information

Toilet availability , OD and CT dependency

Toilet connectivity

Willingness to build own/shared toilets

Financial capability

Septic tank details

Information about emptying and cleaning

Number of septic tanks



# In 2015: > 10,000 properties surveyed in Wai for sanitation baseline assessment with SaniTab

## ✓ Citywide survey on :

- Toilet availability
- Type of disposal system
- Size and shape of septic tank
- Location of septic tanks
- Accessibility of septic tanks
- Last time septic tank was emptied

## ✓ Online dashboard for analysis of data

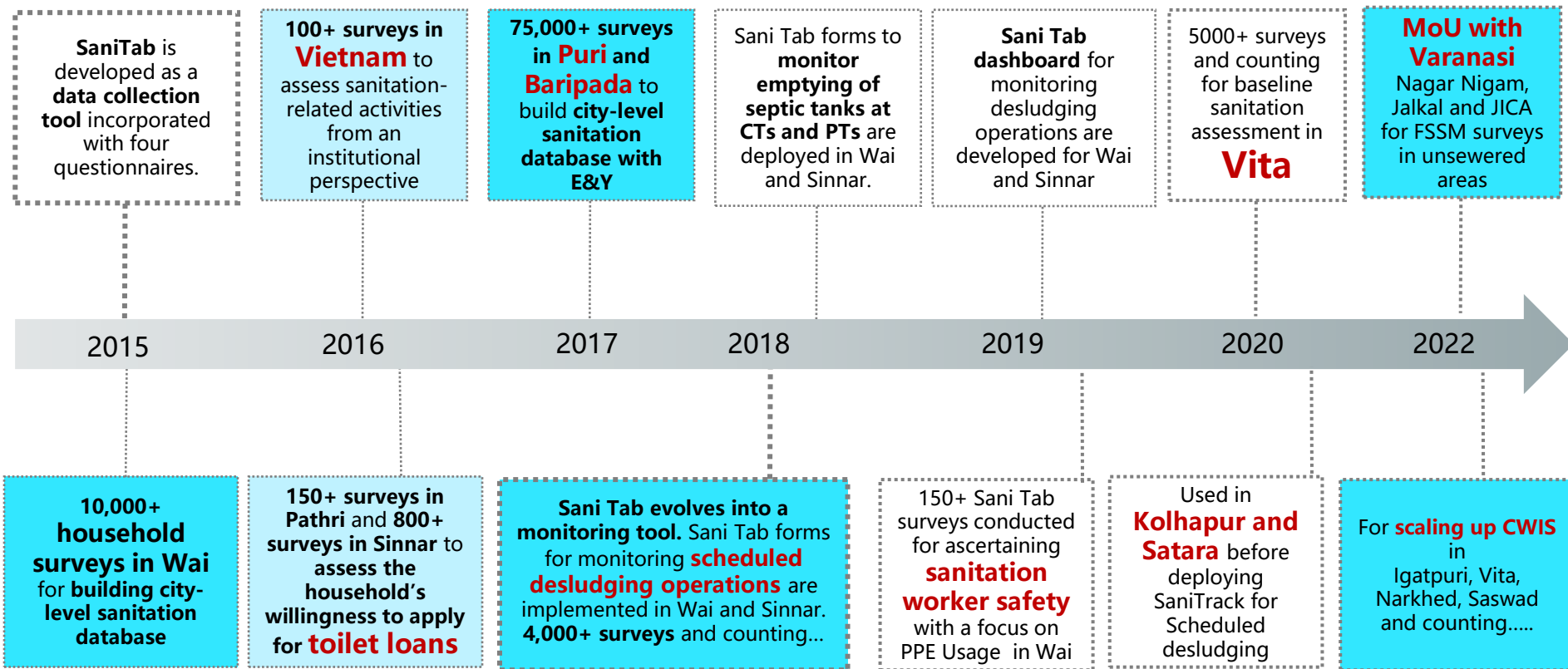


Spatial distribution of properties with and without access to individual toilets in Wai (2015).



On-field surveyors conducting surveys using SaniTab

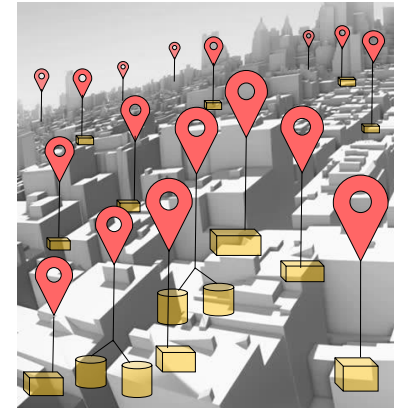
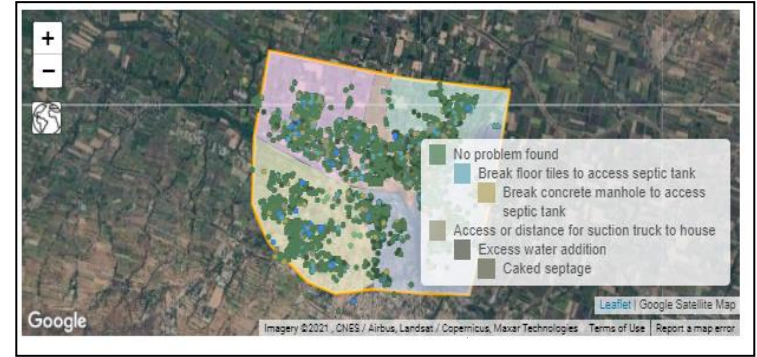
# Use of SaniTab for 1 Lakh+ surveys

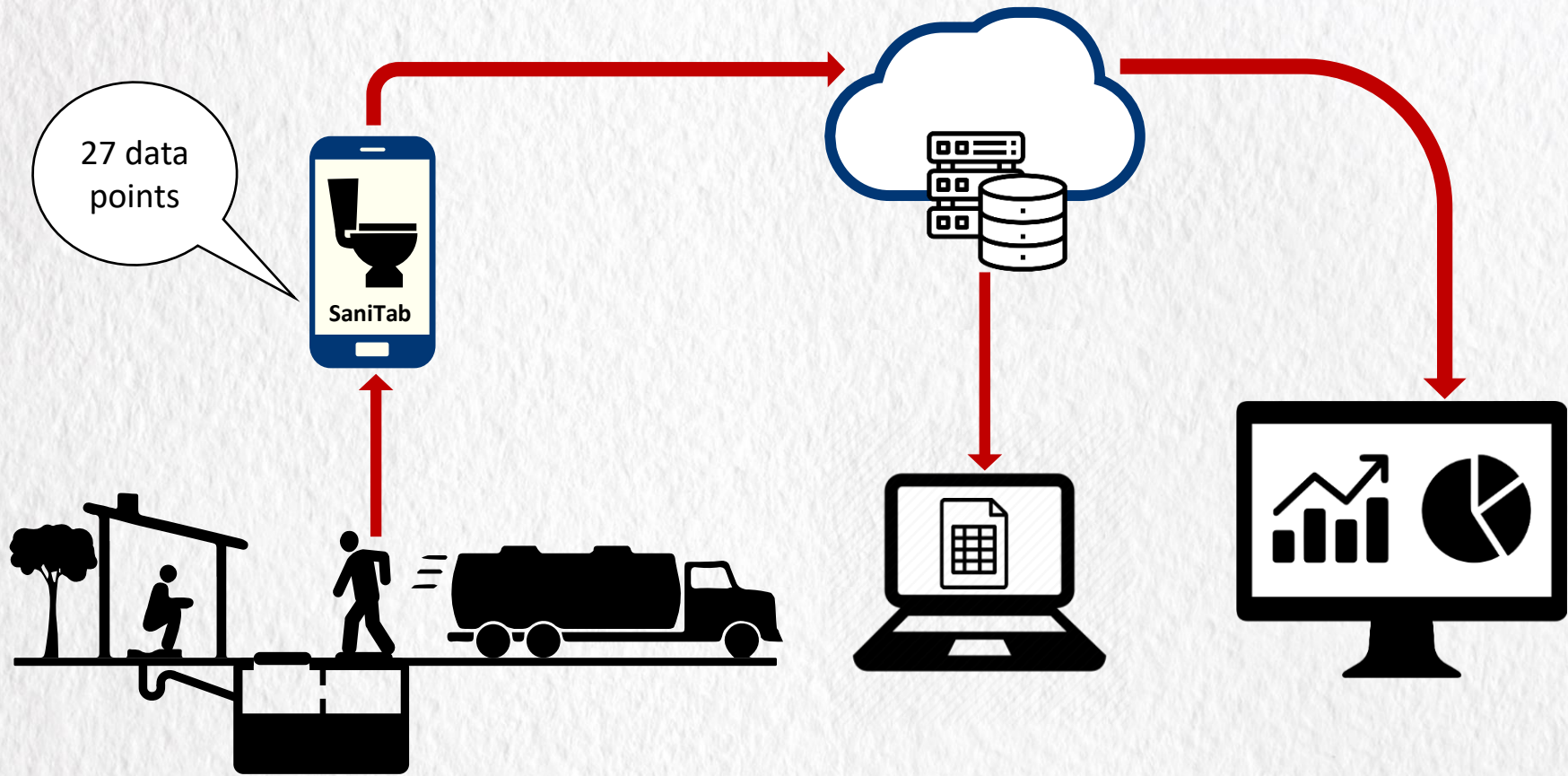




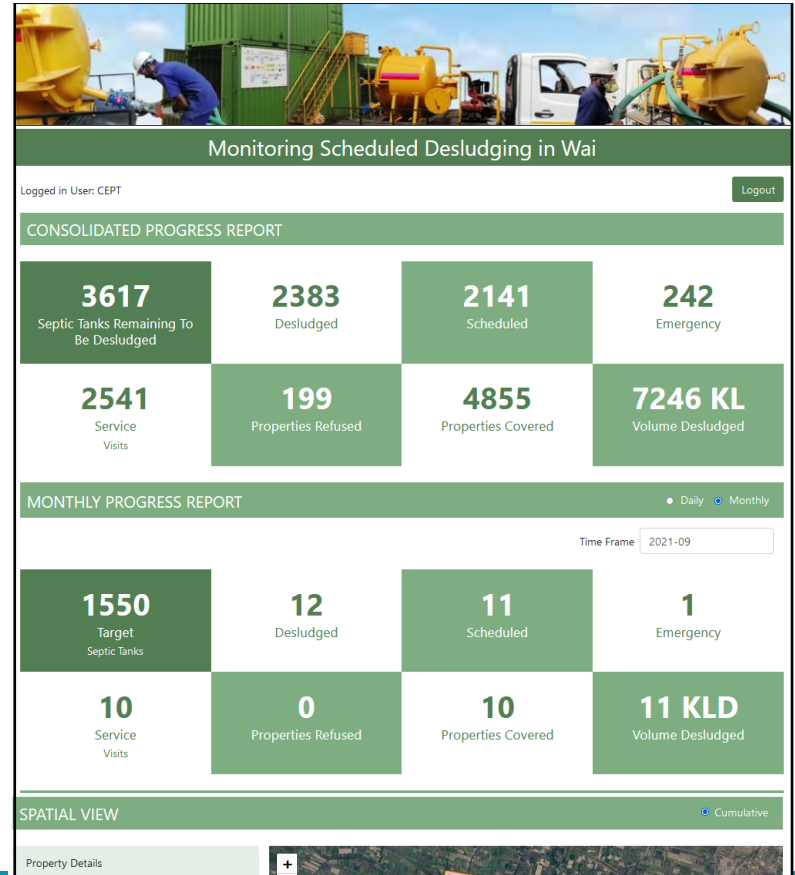
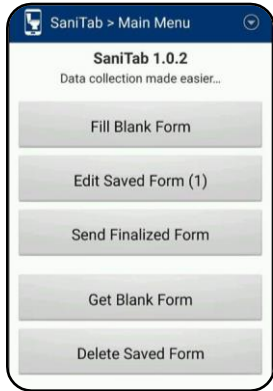
# Recently concluded – Form for monitoring desludging services + developing a database of onsite systems in Wai

- Customizable app - not only as a data collection tool but also as a **monitoring system**
- **Desludging monitoring form** created for monitoring the performance of the desludging services being provided by the private sector service provider and the ULB truck
- **Dashboard** developed for easy monitoring of the desludging operations.
- Creating a **unique database of onsite systems** – Added questions about septic tanks and CWIS perspective
- If all tanks are to be visited in 3 years – use this opportunity to create a database!








# Surveyor app + Monitoring Dashboard





# Downloadable MIS results

Submissions Form Management Site Admin Log Out   




Filter Submissions Exported Submissions

Form Scheduled Emptying Filter none Visualize Export Publish

Save Save As Delete

Submissions per page 100

Filters Applied Add Filter Display Metadata

	Previous	Scheduled Emptying	Next
	guest1	2019-02-08 10:33:13.003 2019-02-08 13:52:52.517	358410093162955 417 1 6 मधनी आळी 423 prop_open empty yes
	guest1	2019-02-08 13:16:39.99 2019-02-08 14:09:21.172	358410093162955 418 1 7 गंगामुदी 161 prop_open empty yes
	guest1	2019-02-08 16:38:54.905 2019-02-08 17:46:23.667	358410093162955 419 1 6 मधपरी आळी 449 prop_open empty yes

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW PDFsam Enhanced 6 Creator

Calibri 11 A A Wrap Text Date

B I U Bold Italic Underline Font Merge & Center Number

Clipboard Alignment Conditional Formatting Styles

C11 03-06-2019

	A	B	C	D	E	F	G	H	I	J	
1	surveyor_id	start_time	end_time	Actual Date of Emg	device_id	Form ID	Actual form	Zone No.	Ward No.	Locality Name	Proper
2	3	31-05-2019	31-05-2019	31-May-19	8.69184E+14	18	118	3	3	पाण्याचा टाकी जवळ शिवाजी नगर	87,88
3	sinr1	31-05-2019	31-05-2019	31-May-19	8.69184E+14	119	119	3	3	वाजे पेढील पंप शिवाजी नगर	
4	sinr1	31-05-2019	31-05-2019	31-May-19	8.69184E+14	20	120	3	3	पाण्याचा टाकी जवळ शिवाजी नगर	
5	sinr1	31-05-2019	31-05-2019	31-May-19	8.69184E+14	121	121	3	3	पाण्याचा टाकी जवळ शिवाजी नगर	
6	sinr1	01-06-2019	01-06-2019	1-Jun-19	8.69184E+14	122	122	3	3	सिड्डिनिनाक नगर पाण्याची टाकी	
7	sinr1	01-06-2019	01-06-2019	1-Jun-19	8.69184E+14	123	123	3	3	शिवाजी नगर	
8	sinr1	01-06-2019	01-06-2019	1-Jun-19	8.69184E+14	124	124	3	3	शिवाजी नगर	
9	sinr1	01-06-2019	01-06-2019	1-Jun-19	8.69184E+14	125	125	3	3	शिवाजी नगर	
10	sinr1	01-06-2019	01-06-2019	1-Jun-19	8.69184E+14	126	126	3	3	शिवाजी नगर	309
11	sinr1	03-06-2019	03-06-2019	3-Jun-19	8.69184E+14	127	127	7	7	सरस्वती नगर	314
12	sinr1	03-06-2019	03-06-2019	3-Jun-19	8.69184E+14	128	128	3	3	अक्षय सोसायटी	3
13	sinr1	03-06-2019	03-06-2019	3-Jun-19	8.69184E+14	129	129	4	4	बुरुड मल्ली	6,98.6
14	sinr1	03-06-2019	03-06-2019	4-May-19	8.69184E+14	18	38	5	5	उज्वल नगर m i d c	52
15	sinr1	03-06-2019	03-06-2019	14-May-19	8.69184E+14	47	68	5	5	उज्वल नगर m i d c	52
16	sinr1	03-06-2019	03-06-2019	3-Jun-19	8.69184E+14	130	130	5	5	उज्वल नगर	52
17	sinr1	04-06-2019	04-06-2019	4-May-19	8.69184E+14	21	41	6	6	उद्योग भवन	18
18	sinr1	04-06-2019	04-06-2019	4-May-19	8.69184E+14	20	40	6	6	उद्योग भवन	18
19	sinr1	04-06-2019	04-06-2019	29-Dec-19	8.69184E+14	19	466	6	6	उद्योग भवन	18
20	sinr1	04-06-2019	04-06-2019	4-Jun-19	8.69184E+14	131	131	6	6	द्वारका नगर	27
21	sinr1	04-06-2019	04-06-2019	4-Jun-19	8.69184E+14	132	132	6	6	द्वारका नगर	27
22	sinr1	04-06-2019	04-06-2019	3-May-19	8.69184E+14	14	32	6	6	द्वारका नगर	23
23	sinr1	04-06-2019	04-06-2019	10-May-19	8.69184E+14	38	59	5	5	S M g Nagar	42
24	sinr1	05-06-2019	05-06-2019	27-Mar-19	8.69184E+14	1	1	5	5	नासिक शिर्डी रोड	43
25	sinr1	05-06-2019	05-06-2019	4-May-19	8.69184E+14	16	36	5	5	पंचोश्वर नगर	43
26	sinr1	05-06-2019	05-06-2019	20-May-19	8.69184E+14	67	88	5	5	इंदुनाथ नगर सिरार हाऊस व्या बाजूला	46
27	sinr1	04-06-2019	04-06-2019	4-Jun-19	8.69184E+14	131	131	6	6	द्वारका नगर	2759
28	sinr1	05-06-2019	05-06-2019	20-May-19	8.69184E+14	63	84	2	2	नरनाथ बाबा मंदिर शिर्डी रोड	50
29	sinr1	06-06-2019	06-06-2019	14-May-19	8.69184E+14	48	69	4	4	राजानथ चौक विजय नगर	3368



# What data are we collecting?

## Property and owners

1. Property Tax number
2. Ward Number
3. Owner name and phone number
4. Address
5. GPS location
6. Type of property
7. Is it a shared system?
8. Prop. no of sharers
9. Readiness of owners to receive service
10. Ownership of Property – Owner or Tenant?

## Onsite Sanitation System characteristics

1. Type of Disposal System
2. Is it a shared system?
3. Size & location of disposal system
4. Shape of disposal system
5. Accessibility from road
6. Type of access cover

**27** data points for properties

**7** data points for CT/PT

## Service Delivery / Desludger Performance

1. Volume desludged in Its.
2. No. of Trips
3. Use of PPE
4. When was the last time the septic tanks was emptied
5. Problems faced during emptying?
6. Was there any septage spill?

## CWIS Principles

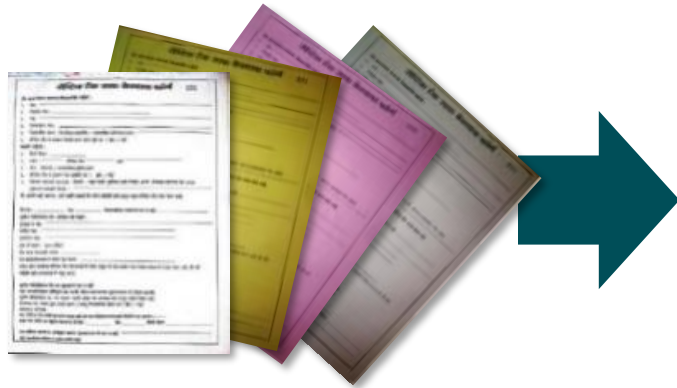
1. Vulnerable Areas Covered – BPL Card Holder, width of road on which property is located, caste
2. Gender Aspect – gender of the person responding to the form and gender of the person supervising the emptying service

## CT/PT emptying

1. Type of toilet – CT/PT/IHHL
2. Details of Property (if IHHL) or toilet (If CT or PT)
3. Problems faced during emptying
4. Volume desludged in litres.
5. Total no. of trips
6. Use of PPE
7. GPS location



# One step further -



Collection Details

Signature of property owner

*[Handwritten signature]*

My septic tank has been emptied satisfactorily and there has been no spillage.  
माझे टांकी खाली करवून दिल्या सुरूक झाली आहे न कुठेही मीन साहजान नाही.

Operator was wearing proper safety gear  
ऑपरेटर योग्य सुरक्षा गिअर घातला होता

Signature of operator

*[Handwritten signature]*

This property's septic tank has been emptied as per requirements

SAVE

**Scheduled Emptying of Septic Tanks Collection and transport record**  
Unique desludging ID: 14/02/19/01

**Property**  
Property number: 07-1432-01, 07-1432-02, 07-1433-00, 07-1434-00  
Type: Residential - Apartment, Commercial - Shop  
Address: *[Address]*  
Owner: *[Owner Name]*  
Phone no: 9873456234

**Empier**  
Truck ID: *[Truck ID]*  
Reg. no: 43413/12345  
Truck cap: 3000 L

**Desludging service**  
Type: Scheduled  
Date: 14/02/2019  
Start time: 13:20  
Total trips: 3  
Volume: 4560 L  
Access cover:  open on arrival,  replaced after emptying  
PPE use:            
Customer satisfaction:

**Safe disposal**  
Disposal site: *[Disposal Site]*  
Date: 14/02/2019  
End time: 15:30  
Disposal at correct location:

**Signatures and Times:**

Category	14/02/19/04	14/02/19/05	14/02/19/06
Truck number			
Truck Operator signature at emptying	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Property owner signature at emptying	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Truck Operator signature at disposal	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
FSTP Operator signature at disposal	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>

13:40 14:30 15:30

# SaniTrack – custom end to end monitoring for FSSM

**End to end monitoring** for desludging operations from service at property end to safe unloading at FSTP

**Web and mobile modules** catering to every stakeholder – truck operators, ULB Officials, administrators etc

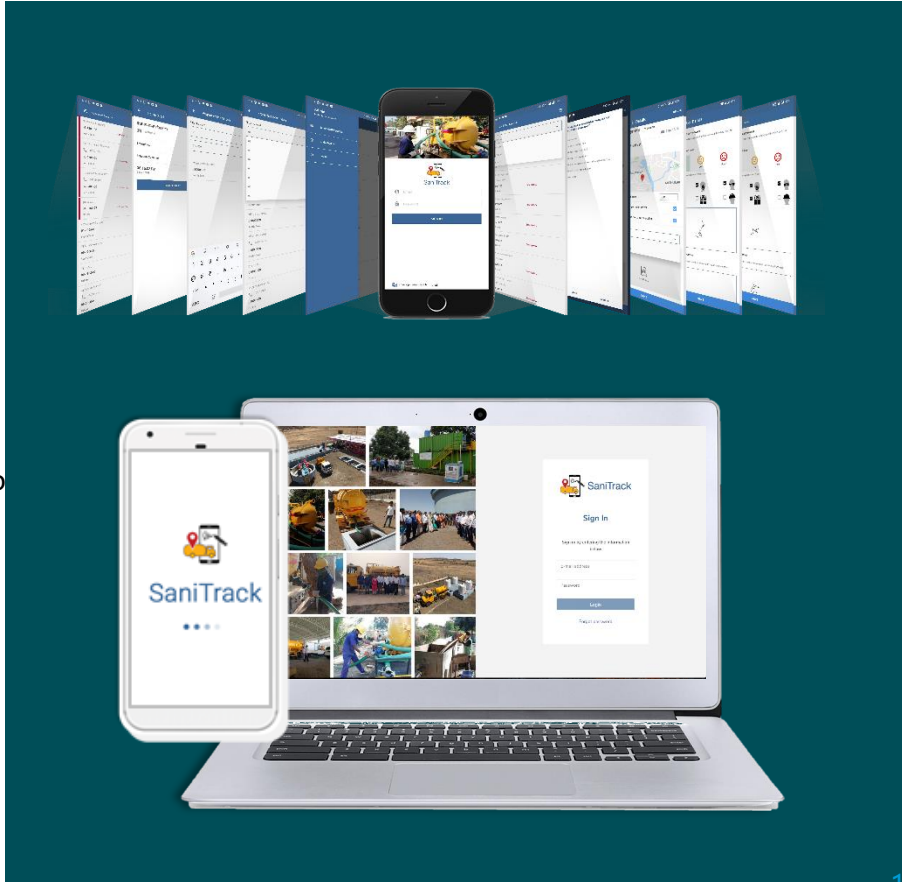
Can handle both scheduled emptying as well as demand based operations

**Integrate validation checks.** Simpler choice based questions, location checking, volume and truck capacity

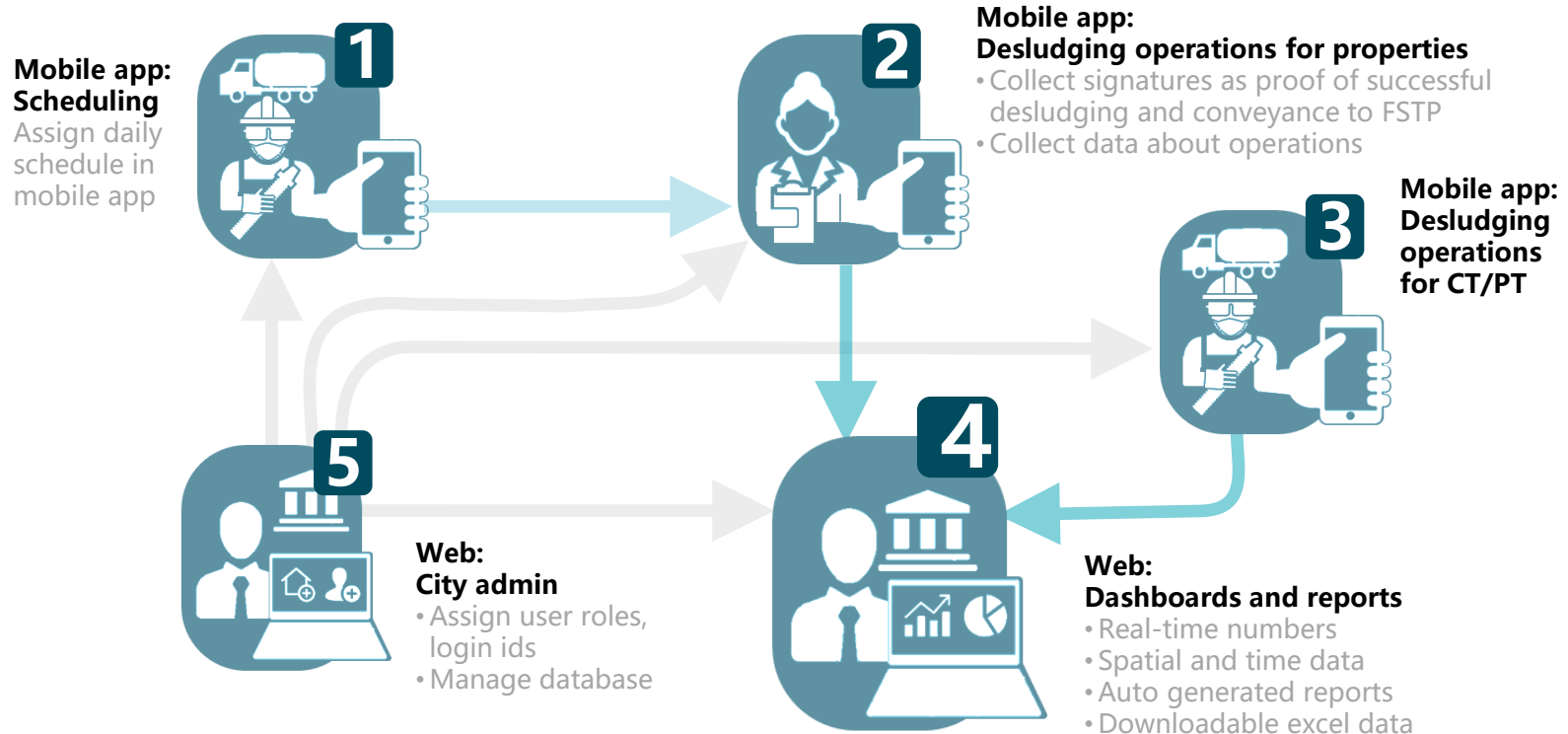
**On-screen signatures** like modern delivery apps (eg: Amazon). Can also generate individual reports automatically like paper form reporting system.

**Real time results on dashboards.** Key performance indicators displayed. Basic analysis possible.

Performance linked payments – Payment to private operator can be linked to results from this system



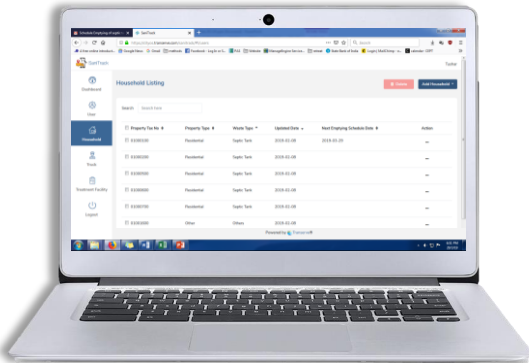
# Components and modules



# How does it work?

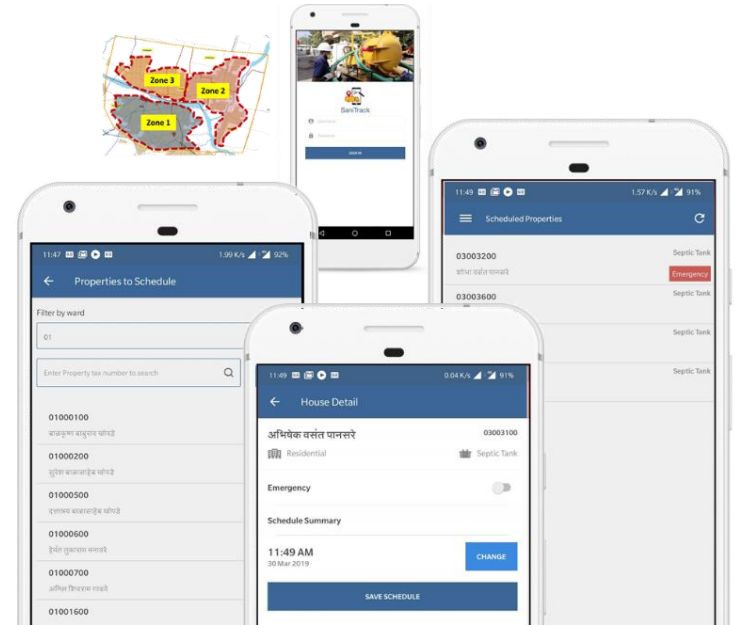
## 1 System set up – one time

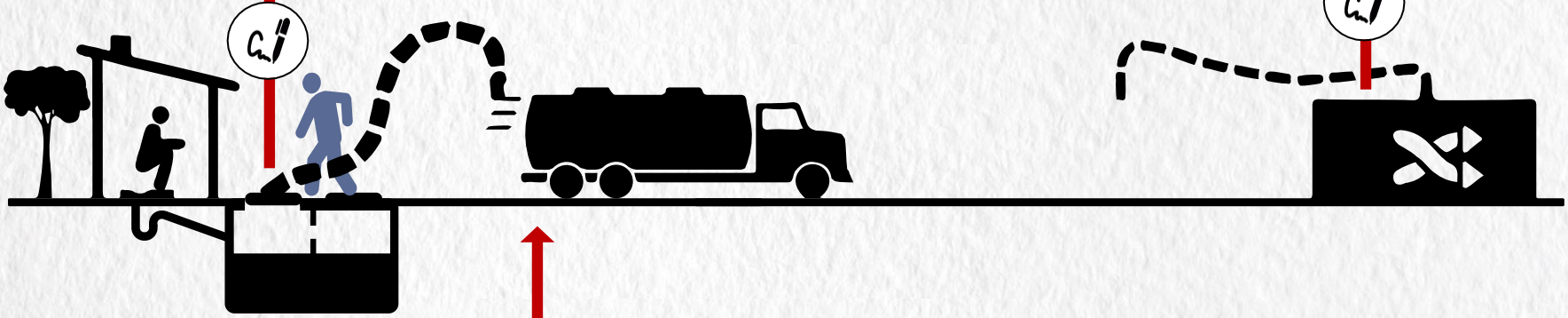
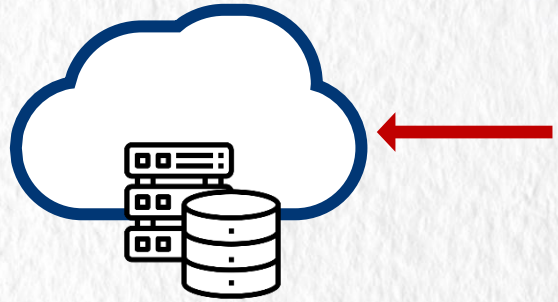
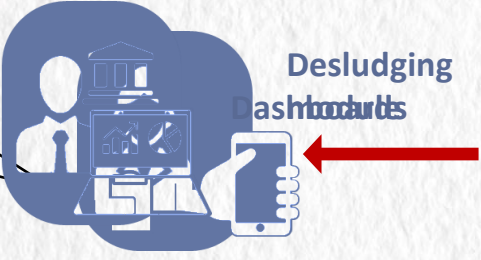
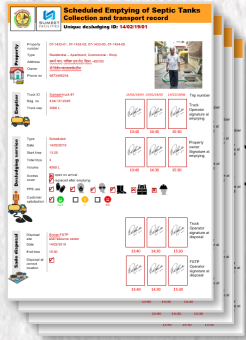
- ✓ User profiles created – admin, scheduler, delsdudger
- ✓ Uploaded a list of properties
- ✓ Registered trucks and set location of treatment facility



## 2 Supervisor creates daily schedule in app - periodically

- ↓ Supervisor login for scheduling module
- ↓ Select and schedule properties to be serviced today from available list
- ↓ "Today's Schedule" goes to truck operator





Scheduling module



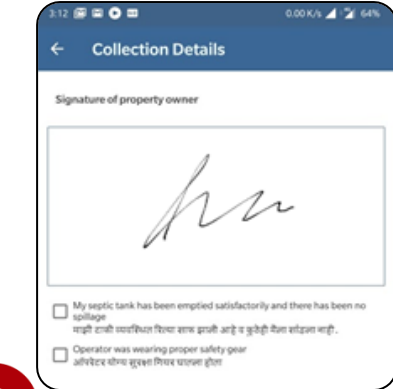
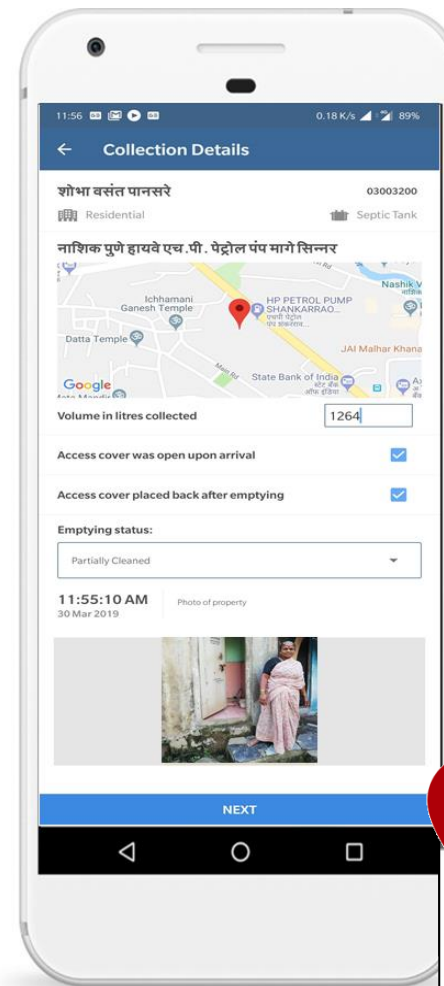
# How does it work?

## 3 Desludger records operations and signatures on app - daily

- ↓ Truck operator login for desludging module
- ↓ Select scheduled/emergency properties visible in "Today's Schedule" ←
- ↓ Location and address of property appears on screen
- ↓ Fill simple form with basic questions
- ↓ Take signature and feedback of household after emptying
- ↓ Unload at FSTP and take signature of FSTP operator

## Validation checks

- ✓ Location check - Sludge is picked up and is unloaded at FSTP only - instead of GPS tracking - geoboundary
- ✓ Sludge volume vs truck capacity
- ✓ Signatures and photo as proof of desludging + counter signature
- ✓ Time stamps at every step

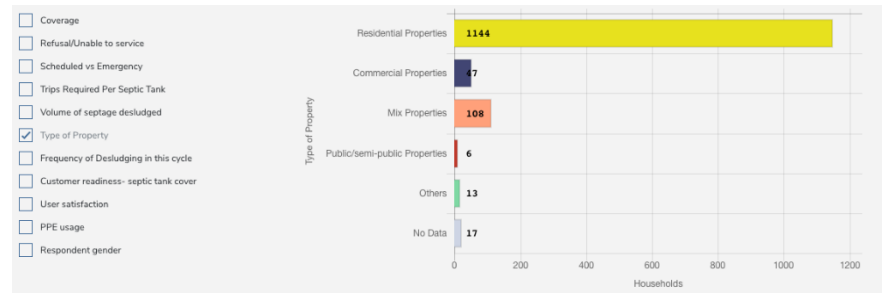
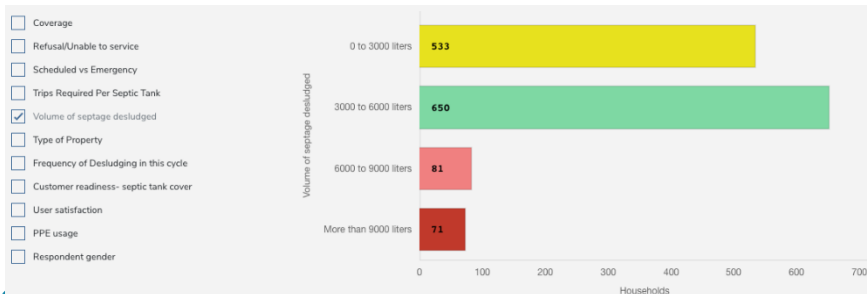
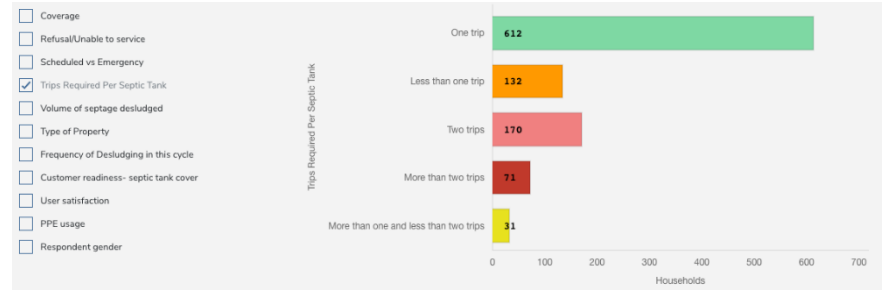
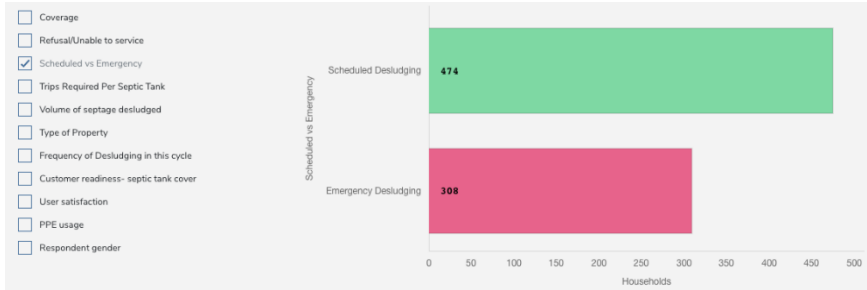
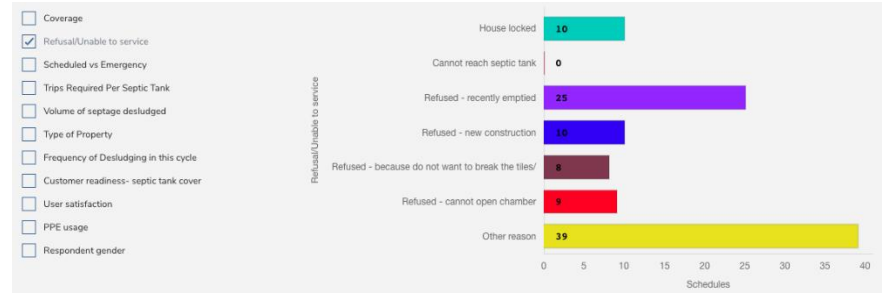
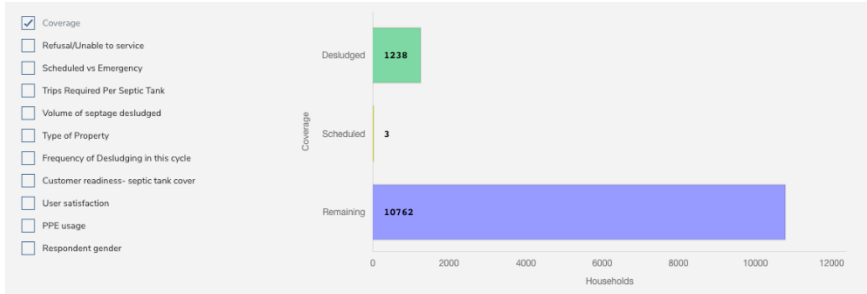


# What models for FSSM can SaniTrack accommodate?

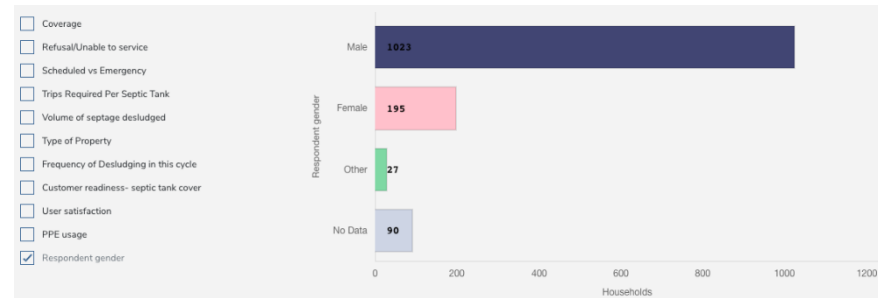
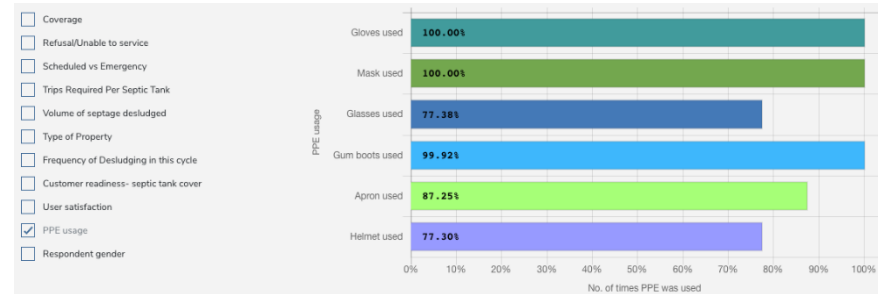
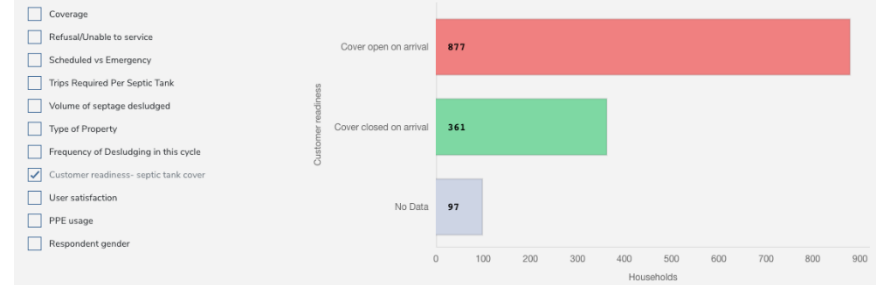
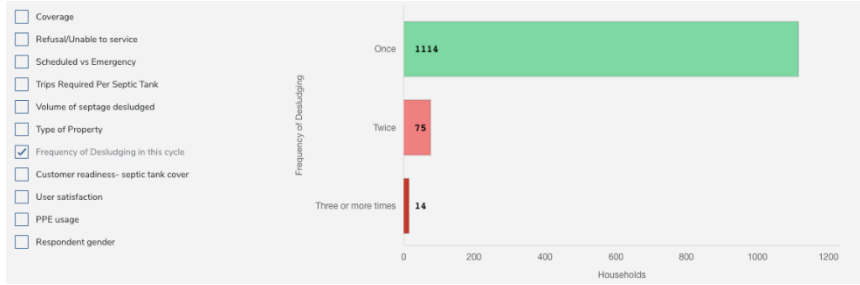
Desludging ops	Operator	Example
Scheduled	Pvt. player contracted by Municipal Govt.	Wai-Sinnar Leh
Scheduled	Municipal Govt. operating by self	Small cities in Maharashtra
Demand	Municipal government	Small cities in Maharashtra
Demand	Pvt. player contracted by govt.	Odisha
Demand	Govt call centre assigning to pvt operators	Dakar - Senegal



# Web module – Dashboard



# Web module – Dashboard





# What data are we collecting?

29 data points  
for properties

15 data points  
for CT/PT



## Pre-uploaded database

1. Property Tax number – WARD:NUMBER:PART
2. Owner name and phone number
3. Address
4. GPS location
5. Type of property
6. Type of sanitation system
7. Is it a shared system?
8. Prop. no of sharers



## Property desludging data

9. Emergency or Scheduled
10. Unique Desludging ID
11. Service refusal
12. Time stamps and dates
  - Scheduled
  - Desludging started
  - Desludging ended
  - Delivery at FSTP
16. Respondent gender
17. Status of access cover
18. Volume collected
19. PPE usage
20. Trips taken
21. Signatures
  - Property owner at collection
  - Operator at collection
  - Operator at delivery to FSTP
  - FSTP operator at delivery
25. Photo at collection
26. User Satisfaction level
27. Desludged by which truck
28. If near FSTP at delivery
29. Delivered to which Treatment Facility



## CT/PT desludging data

1. Name of CT/PT
2. Unique Desludging ID
3. Time stamps and dates
  - Desludging started
  - Desludging ended
  - Delivery at FSTP
6. Volume collected
7. PPE usage
8. Trips taken
9. Signatures
  - Operator at collection
  - Operator at delivery to FSTP
  - FSTP operator at delivery
12. Photo at collection
13. Desludged by which truck
14. If near FSTP at delivery
15. Delivered to which Treatment Facility

# SaniTab and SaniTrack

## Key Benefits - Program efficiency for FSSM services

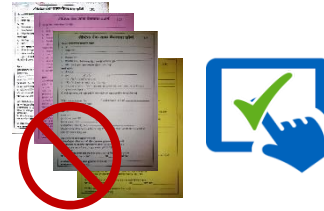
**Integrated monitoring system – Across FSM service chain**



**“Real time” monitoring  
No need to process data**



**Easy to Operate,  
Reduce paper work,  
Minimize human error**



**Can view progress easily and process payments**



**Citizen awareness about emptying procedures**



**Photo stamping,  
Geo stamping,  
Signatures**



**Unique database**



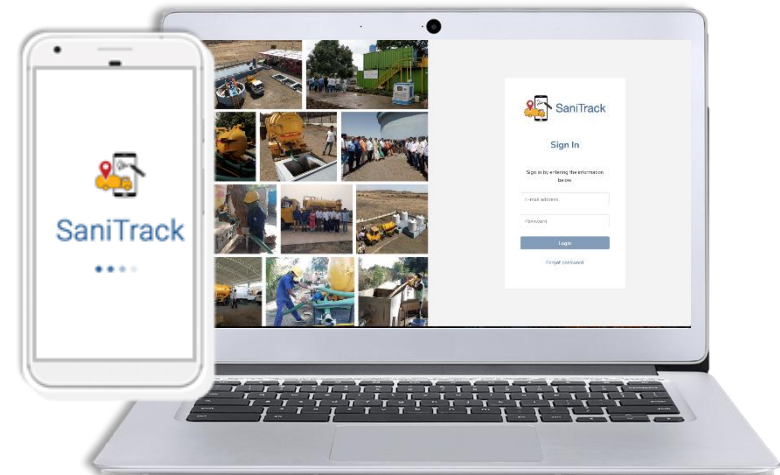
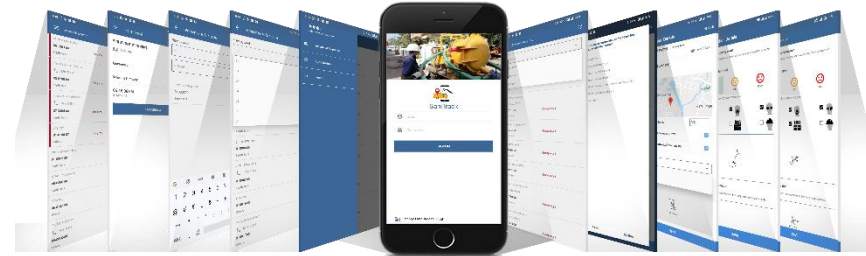
**Supports vernacular language**



# Challenges, lessons, improvements and evolution

# 1. Implementation Challenges and lessons

- Mobile format is easy and is quickly adapted however not all stakeholders have access to smartphones
- Sanitation workers are sometimes hesitant to carry their phones near septic tanks for fear of dropping them. To address this issue, a training session was held.
- Staff changes and working memory
- Using local language and terms help with quicker adaptability. Scaling up of apps would require adaptation to more vernacular languages.
- Pictures / symbology are needed to explain – what is type of onsite sanitation system and PPE
- Mobile networks are not strong at FSTPs which are usually located on the fringe of cities. This hampers completion of the form with signature of the FSTP operator.

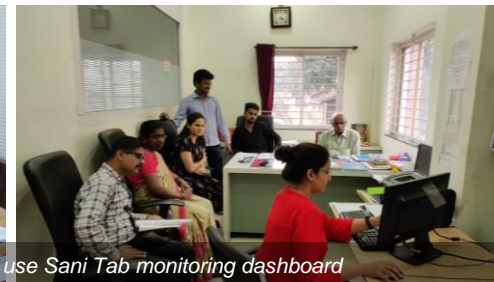


## 2. CWIS integration

Not just monitoring desludging completion, but monitoring from perspective of CWIS



Wai Municipal Council staff being trained to use Sani Tab monitoring dashboard



Safe handling of waste

Equity in service delivery

Enhancing agency of women

Sanitation worker safety and

Ownership by city governments

- ✓ Delivery to FSTPs
- ✓ No human contact

- ✓ Coverage of vulnerable HHs
- ✓ Customer satisfaction

- ✓ Questions to record who responded to the desludging vehicle at the HH vs who supervised and signed

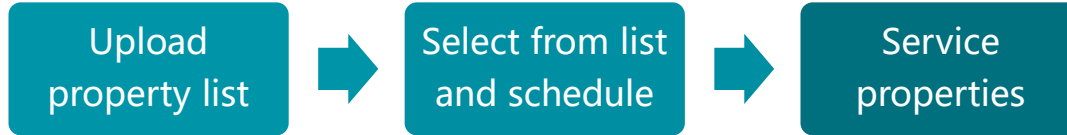
- ✓ Monitoring use of PPE – self reporting and signatures by operators
- ✓ Training in use of apps

- ✓ Use of apps by Municipalities supervisors and sanitation workers
- ✓ Use of dashboards by decision makers
- ✓ Reported by Wai and Sinnar in their Swachh Sarvekshan submissions



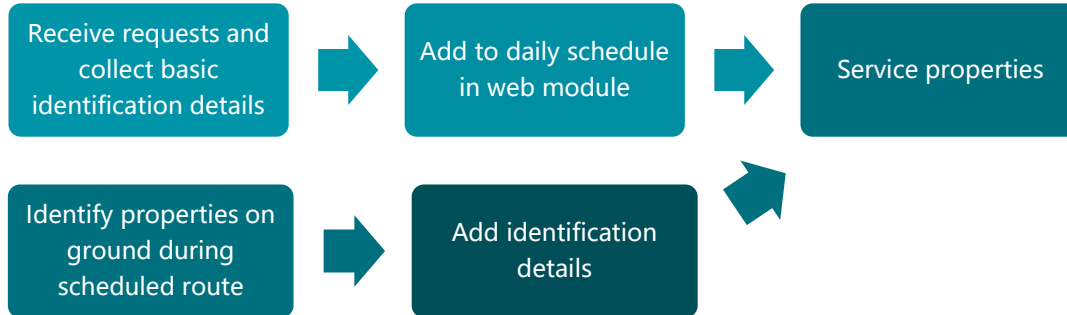
# 3. Lessons and improvement– Next iteration – delinking from property list

## Wai and Sinnar



- ✓ Property list readily available
- ✓ Unique property numbers
- ✓ Properties with locations
- ✓ Measure coverage in real time

## Kolhapur, Satara



- ✓ No need for pre-uploaded property list
- ✓ Schedule and service while on pre-defined route

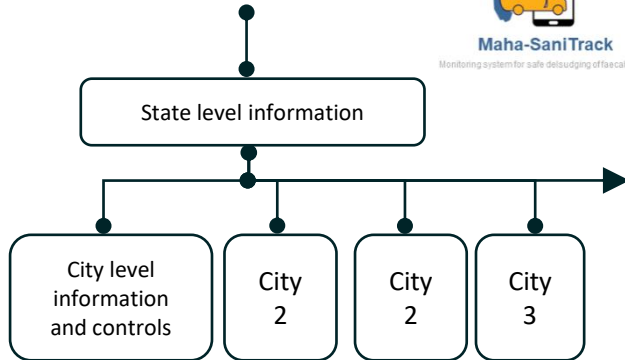


# 3. Evolution: ensuring sustained use and scaling up

## Multi – city model

- ✓ Sinnar, Wai city-wide
- ✓ Kolhapur, Satara pilots
- ⚠ 210+ FSTPs in Maharashtra

### ... MahaSaniTrack



## Working with ULBs

- ✓ Scaling up CWIS across cities in Maharashtra – scheduled desludging implementation
- ✓ Demand based implementation for ULBs
- ✓ Building SaniTrack usage into desludging contracts
- ✓ Training by CWAS divisional team
- ✓ Advocacy for “SMART systems” and “IT enabled systems” as included in Govt. Programs

## App store compliance

- ✓ Need to adhere to Google compliances to make available on public app store

## Generalize for use case

- ✓ Delink from property numbers
- ✓ Simplify user roles
- ✓ Allow flexibility in user roles
- ✓ Integrate with familiar systems – welcome emails, OTPs, pop up explanations



# Thank you

## About us

The Center for Water and Sanitation (C-WAS) at CEPT University carries out various activities – action research, training, advocacy to enable state and local governments to improve delivery of services.

**CWAS** CENTER  
FOR WATER  
AND SANITATION

**CRDF** CEPT RESEARCH  
AND DEVELOPMENT  
FOUNDATION

**CEPT**  
UNIVERSITY