Restructuring the Fecal Sludge Market in Dakar

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Background

- 84% of sub-Saharan inhabitants use on-site sanitation facilities (latrines, septic tanks, etc.).
- In Senegal, nearly 92% of the population are on non-collective sanitation.
- In the areas of Pikine and Guediawaye (suburbs of Dakar), 75% of the population uses on-site sanitation.
- The average cost of on site-sanitation (mainly pit desludging) is around 130 USD/year/household.
- Three fecal sludge treatment centers are currently functional in Dakar.
- Victims of their success, these stations quickly proved undersized with major malfunctions.

Manual Desludging

- Manual emptying is predominant in Dakar, it represents 52%.
- Problems of Manual desludging:
  - Strong negative externalities to surrounding neighborhood
  - Health consequences to desludgers, households, etc.
    - Initial results show 50% fewer incidences of diarrhea among children in households using mechanical desludging (but may be correlated with other improved sanitation practices).
- Attraction of Manual desludging:
  - Price:
    - Less than ½ the cost of mechanized desludging
    - Requires no capital equipment
    - There are no barriers to entry

Low Adoption of Mechanized Desludging Services

- High prices reduce demand for mechanized desludging:
  - Room to increase competition
  - And improve efficiency.
- Knowledge about the dangers of manual desludging/household flooding is lacking.
- Desludging services represent a large expense.
  - Poor tradition of saving among target population.
- Strong externalities mean that current low level of desludging reduces the benefit to a HH to investing in a desludging service.

Project Objective

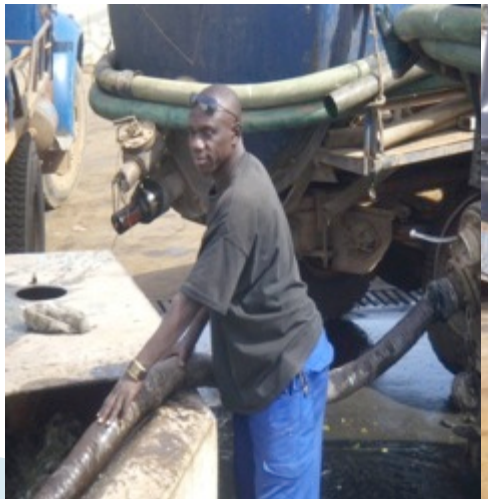
The objective of the program is to improve health and living conditions of the inhabitants of Dakar's suburbs with access to hygienic and affordable sanitation service. It will:

1. encourage the development of sanitation's private sector;
2. improve the quality of service offered by private emptiers;
3. enhance the demand for mechanical service by improving access to information and awareness at the household level;
4. facilitate the access to fecal sludge treatment facilities and their performance;
5. delegate the management of FSTP to the private sector.

Research objectives

In this project we will test new products and business models in order to understand how to:

- best increase the take-up of mechanized fecal sludge management (FSM) services in Senegal.
- furnish policy makers with the information needed to improve policy by developing tools leading to increased coverage, lower prices, and higher quality FSM services in Senegal.



Research themes (WSA and IPA)

Key Demand Questions of Interest

1. What is the impact of social pressure or coordination on the take up of mechanized desludging?
2. How large are the spillovers from the demand side treatment – to what extent can demand side treatments push households to a new equilibrium?
3. How do payment mechanisms affect the willingness to pay for mechanized desludging services?
4. How much does quantity of mechanized desludging demanded change when price of mechanized desludging changes?

Key Industrial Organization Research Questions of Interest

1. How can we most efficiently match household demand for desludging services with suppliers?
2. What is the elasticity of demand for mechanical desludging services? What is the willingness to pay to substitute from manual to mechanical desludging?
3. What is the effect of privatization on access to treatment centers?
4. To what extent do firms coordinate to increase prices and reduce supply?

Improve neighborhood coordination to increase adoption of mechanized desludging

- Harnessing social pressure
  - Finding sustainable ways to maintain improved levels of take-up of sanitation practices.
- Using local social network connections
  - Identifying key social network links allows for improved targeting of messages to those most likely to diffuse ideas to the community.
- Measuring spillover effects
  - Allows for a more complete cost/benefit analysis of government sanitation projects.

Increase access to mechanized desludging through improved payments systems

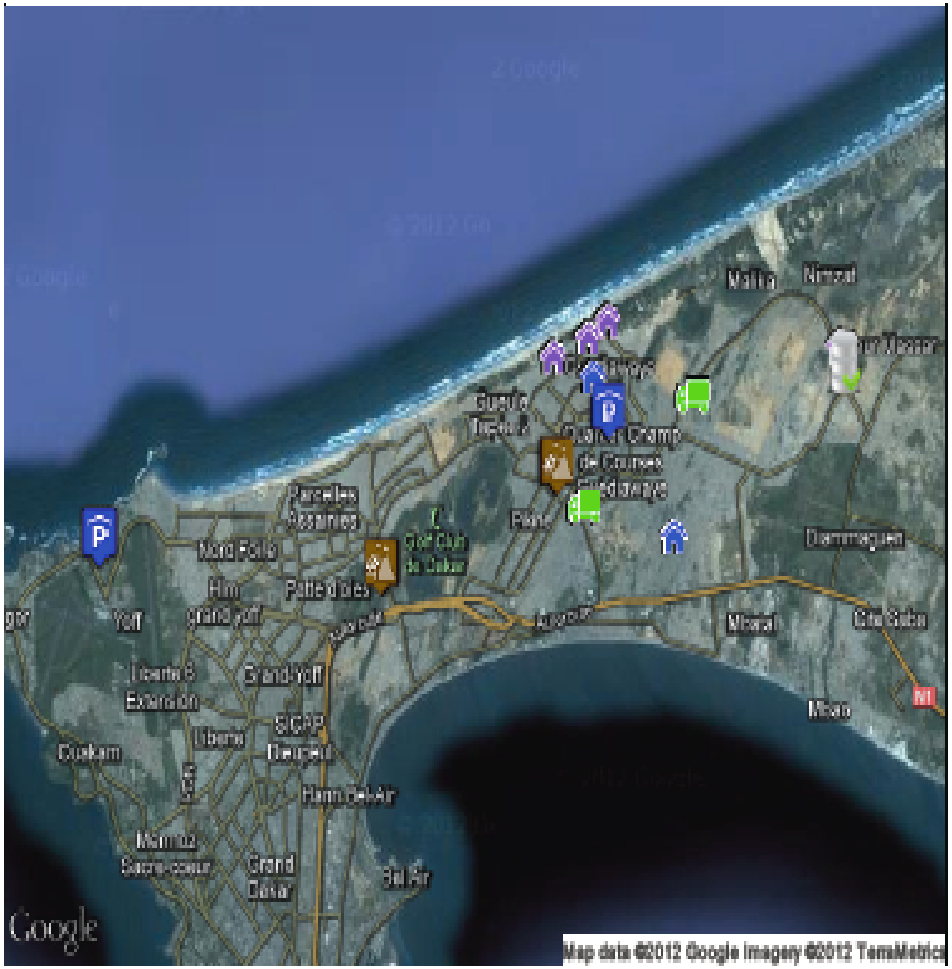
- Solutions to the problem of saving for infrequent large expenses:
  - Subscription service
    - Monthly payments of at least 8.3% of expected household annual cost
  - Micropayments service (randomized at the household level)
    - Earmarking
    - Billing frequency
      - Monthly (Averaged) Billing
      - At will savings
      - Payment in full at time of service.

Improving linkages between suppliers and customers

- Development of a call in center
  - Customers call the center when they need a desludging service.
  - Affiliated and independent desludging operators are invited to submit an offer.
  - Calls for bids goes out over cell phone text messages, and require low-level technology.
  - Lowest bidder among the operators is awarded the job.

The ONAS Call in Center System

Client | Vidangeur | Etat ... | Dev'is reçu | Date



Date	Client	Vidangeur		Prix	Etat
		Nom	Véhicule		
13/11/2012	Immeuble Warodia			12000	
14/11/2012	Immeuble Warodia			15000	
14/11/2012	Immeuble Warodia			16000	
15/11/2012	Immeuble Warodia			13300	
23/11/2012	Immeuble Warodia			12000	
23/11/2012	Immeuble Warodia			12000	
23/11/2012	Immeuble Warodia			25000	
26/11/2012	Immeuble Warodia			12000	
26/11/2012	Immeuble Warodia			11000	
26/11/2012	Immeuble Warodia			13000	
26/11/2012	Immeuble Warodia			16500	
26/11/2012	Immeuble Warodia			14500	
26/11/2012	Immeuble Warodia			13000	
26/11/2012	Immeuble Warodia			12200	
26/11/2012	Immeuble Warodia			14400	

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Client Management

Liste des clients

Création d'un client

Type de client : | Prénom, Nom | Quartier | Adresse | Client N° | N° Compteur (Eau, Elec...) | Tél

Prénom	Nom	Localité	Adresse	Commande Date	Statut
Immeuble	Waradia	Pikine	595Gueule Tapee2	06/12/2012	
Abdouramane	Ndiaye	Pikine	Wakhinane	26/11/2012	
Mareme	Kandji	Pikine	Guediaway gueule tape 688		
Binta	Cise	Pikine	Bagdade	26/11/2012	
Fatou	Thiam	Pikine	Baye laye n 503		
Oumou	SOW	Pikine	Fith mith Guediawaye 427		
Awa	Mbegue	Pikine			
Djibril	Dia	Pikine	Notaire	26/11/2012	
Galaye	Dieng	Pikine	Baye laye	26/11/2012	
Diouma	Ba	Pikine	729 route des ndiayes	26/11/2012	
Moustapha	Thiam	Pikine			
Hady	Diallo	Pikine	Darou han		
Arame	Ndiaye	Pikine	Daroukhan baye laye		
Jean	Sylva	Pikine	Darourahmane		
Aissatou	Awa	Pikine	1804		

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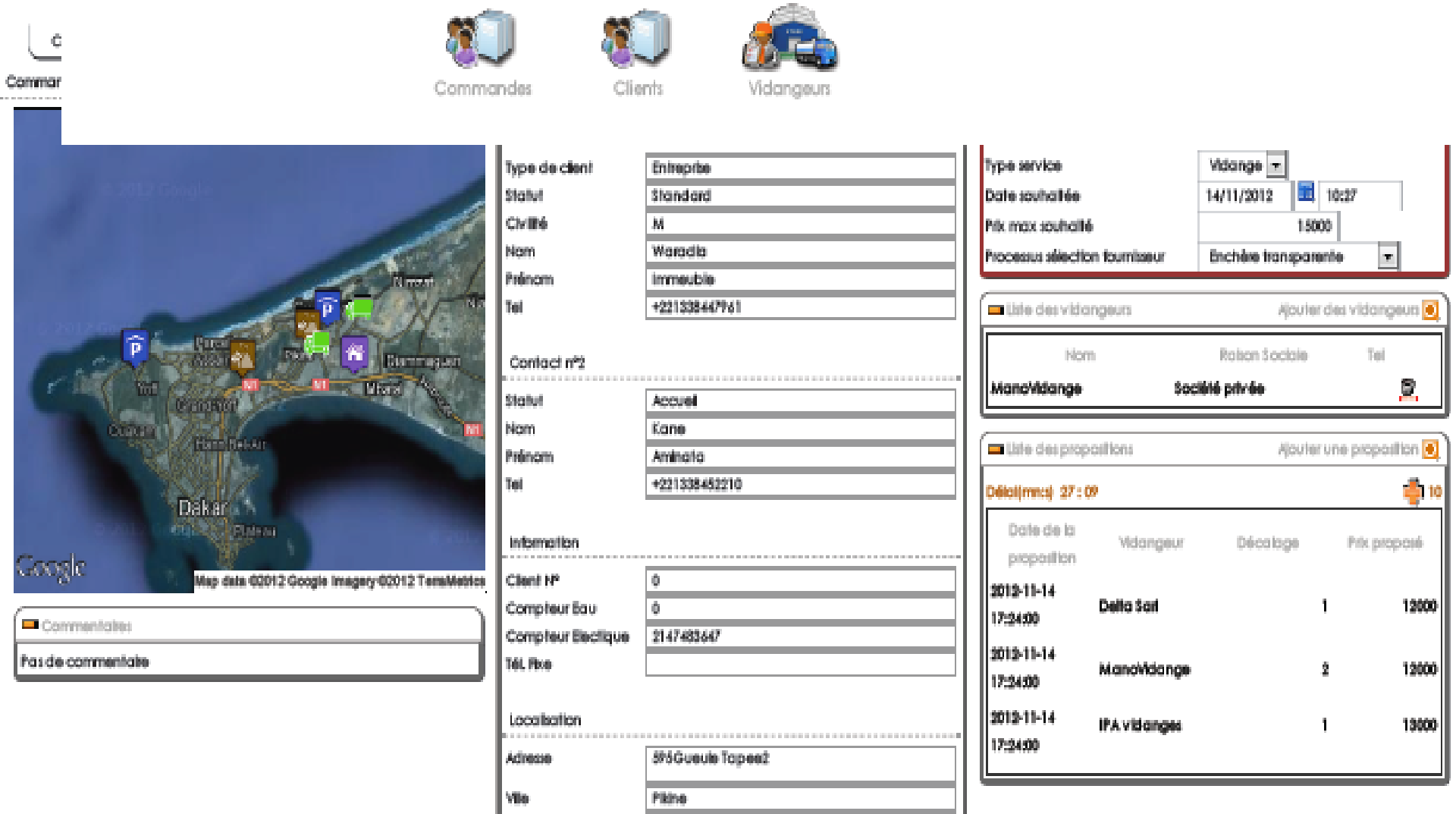
Procurement Auctions



Restructuring the Fecal Sludge Market in Dakar

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Market Power? High Prices and relatively low accessibility of services.

- 138 desludging truck operators work across Dakar
  - 20% of households report having used manual desludging in the past year
- Operators do on average 7.7 desludging trips per week across Dakar.
  - Excess supply?
    - Desludging jobs each take at most 2-3 hours.
    - Low quantity could be difficulty of linking households with suppliers
    - Possibly low demand for services
    - Could be a market power/competition issue.

Supply adjustment to changes in input prices

VARIABLES	(1) Trips (log)	(2) Trips (log)	(3) Trip > 0
Dumping price = 300 F/m^3	0.0609	-0.188***	-0.157***
	(0.0892)	(0.0682)	(0.0268)
Transportation price index (log)	-2.196**	-2.202***	
	(0.847)	(0.371)	
CPI, excluding transportation (log)	-0.0125	0.218*	
	(0.167)	(0.116)	
Constant	16.73***	10.39***	0.243***
	(3.260)	(1.762)	(0.0269)
Observations	65	12,722	11,269
R-squared	0.374	0.064	0.046
Sample	Monthly volume	Weekly panel	Daily panel
Period	2006-2012	2006-2012	7 jan. +/- 30 days
Number of plates		259	121

Standard errors in parentheses are clustered at the plate level (col. 2-3)
*** p<0.01, ** p<0.05, * p<0.1

RQ1: Is collusion in the desludging market generating high prices and low quantities?

Policy relevance: *if high prices are being maintained through collusion, policies encouraging increased competition could decrease prices and increase quantity.*

- **Treatment Design** (integration with ONAS call in center):
  1. Invite randomly selected desludging operators to each procurement auction.
  2. Compare bids in two types of auctions: blind and open auctions (randomized across each call).
  3. Under null hypothesis of no collusion, low bid price should be the same across the two auctions.
  4. Separately, observe the level of price discrimination and pass-through of input costs to consumer prices.

Some early signs of potential collusion…

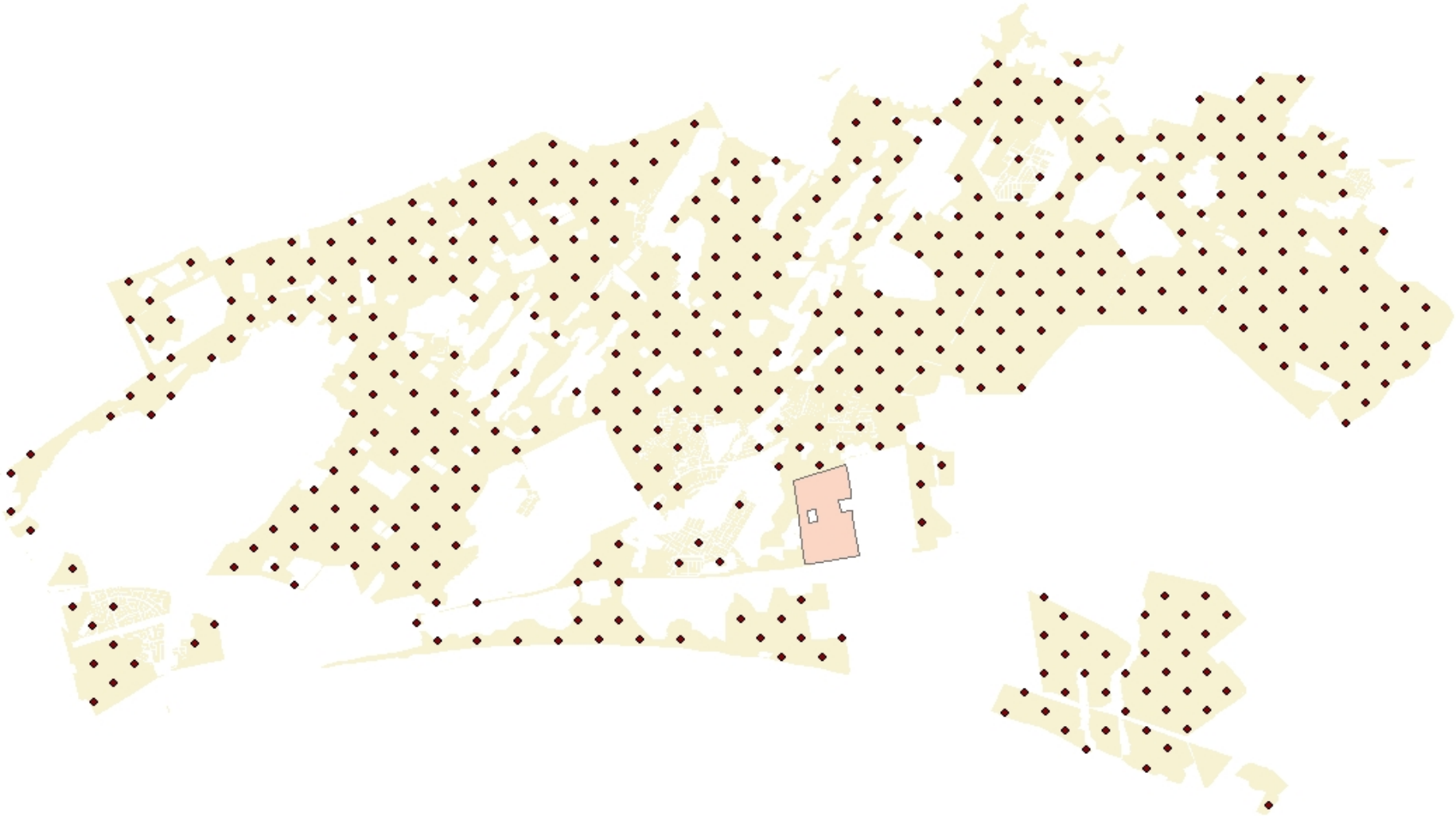
- 85% of desludging operators say that they could get more business if they wanted to.
- Desludging operators who get their business through garages do fewer desludgings per week and charge higher prices.
- Another way to look at the variation in prices:
  - 23% is explained by characteristics of the truck (age, experience, etc).
  - 35% is explained when you add controls for area served.
  - 53% is explained when you add controls for the garages themselves.
  - Take away message: Garage prices appear to be higher and more correlated than independent prices.

RQ 2: Does social pressure, leadership, or reciprocity affect likelihood of take-up of mechanical desludging?

Policy relevance: *incentivizing households to take up mechanical desludging through their social networks may yield less expensive ways to market sanitation solutions.*

- **Treatment Design** :
  1. Randomly select 10 households near each of 400 GPS points to participate.
  2. Households receive randomized discounts.
     a) Public Pressure treatment: public pressure group is told everyone's discounts, control group is not told discount levels.
     b) Leadership treatment: 5 households are randomly selected to be offered the desludging services first, second group of 5 is told who accepted, who did not and how many adopted in coordination group.
     c) Reciprocity and altruism: we play economic games with a subset of the households, and see whether their play is affected by the take-up or not of mechanized desludging.

Sampling Map—Willingness to Pay Treatments



Payment timing

- 27% of households waited at least two days to get their desludging done after their latrine was full.
  - 73% of these waited because of lack of funds to pay for the desludging.

- Mechanical desludging and manual desludging are substitutes:
  - Median price of mechanical desludging is 25,000 CFA (approximately $50).
    - Price differs substantially across consumer types—from 10,000 to 60,000.
  - Median price of manual desludging is 13,000 CFA (approximately $26)

***Public Policy Importance**: Difficulty in saving for sanitation expenses could lead people to substitute to less expensive manual desludging.*

RQ3: Is there a spillover effect on untreated households in take-up of mechanized desludging services?

Policy Relevance: *If there are strong spillover effects, then a few local treatment areas will generate wide take-up and be less expensive overall than a generalized campaign.*

- **Treatment Design** :
  1. 2 "spillover" households surveyed per cluster point.
  2. Randomization of prices creates cluster level variation in number offered high subsidies—random variation in take-up rate among treatment households.
  3. Measure the difference in take-up among households in clusters with more high versus low subsidies.

RQ4: Does payment timing affect the take-up of mechanized desludging services?

- **Treatment Design** :
  1. Households are randomly assigned to one of three groups (each group has 1333 households):
     a) Monthly billing (subscription model)
     b) Pay at will (lay-away plan model)
     c) Pay at time of use (current sales model).

We use mobile money payments systems in collaboration with W@ri.

Next Steps

- Piloting of call-in center system to begin in February 2013.
- Demand treatments begin in March 2013.
- 18 month research data collection/trial period.
- Following data collection period, data analysis
- Final results expected end of 2014 or in 2015.
- ONAS use of results in general scale-up of project.