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Highlights

Tenure security affects willingness to invest in household sanitation

Households with *de facto* tenure security will pay for the capital costs of sanitation

Tenants will pay for operational rather than capital costs of sanitation services

Tenure status accounts for a greater disparity in sanitation than in other services

Urban sanitation policies do not account for peoples' tenure-related investment logic

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Tenure security and household investment decisions for urban sanitation: the case of Dakar, Senegal

Abstract

This paper explores the relevance of householders' security of tenure to their willingness to pay the capital and operational costs for sanitation in low-income urban areas. When the sanitation norm is self-managed on-site systems, as is the case in many low-income areas of towns and cities, household investment decisions in sanitation are inherently linked to tenure security. Based on evidence gathered in Dakar, Senegal, it is *de facto* rather than *de jure* tenure rights that provide sufficient security for household investment in sanitation. We make a critical distinction between *willingness to invest* and *willingness to pay* for the capital investment costs and on-going operational servicing costs of sanitation. Whilst tenants and those with lower tenure security do not invest in capital infrastructure, they are willing to pay for the operational aspects of sanitation services. Current formal policy settings and strategies for urban sanitation tend not to cater for this group; this is a fundamental oversight as these constitute significant and growing segments of the population. Land tenure and sanitation issues need to be considered in an integrated way and the capital and operational costs need to be disaggregated in planning to respond more effectively to the spending decisions of the urban poor.

Keywords

Urban sanitation
On-site sanitation
Tenure
Household investment
Operating costs
Dakar

Introduction

46 This paper addresses how tenure security affects household investment
47 decisions for urban sanitation. This is achieved through a review of the relevant
48 literature on sanitation for the urban poor and urban land tenure; the gaps in
49 knowledge are explored through field studies in Dakar, Senegal. The research
50 explores different components of tenure: legal tenure, tenure security and tenure
51 status (i.e. landlord or tenant) and their associated implications for sanitation
52 development. It seeks to answer what the relationships are between tenure
53 issues and sanitation and to what extent they affect investment in on-site
54 sanitation systems (that is, systems in which the disposal of excreta takes place
55 on or near the housing plot in the absence of networked sewerage; pit latrines
56 and septic tanks fall into this category). Throughout the paper an important
57 distinction is drawn between: capital investment costs that are incurred through
58 constructing a new latrine or otherwise improving the quality of a sanitation
59 asset by upgrading; and operating costs which are paid to service the facility, for
60 emptying the pit or tank and subsequent transport and disposal of the contents.

61

62 To achieve citywide sanitation, understanding the dynamics of tenure i.e. how
63 residents obtain and keep land and housing, and invest in infrastructure is
64 critical. Furthermore, the paper argues that failing to take these dynamics into
65 account results in inappropriate sanitation strategies for a significant, and
66 growing segment of the population of cities in low and middle-income countries.

67

68 Sub-Saharan Africa presents some of the most critical challenges for improving
69 sanitation, where population growth exceeds the increase in sanitation coverage.
70 Between 2004 and 2010 the number of people practising open defecation in
71 urban areas rose by 3 million and the number serviced by unimproved sanitation
72 systems rose from 145 to 183 million (WHO/UNICEF, 2012). The projected
73 demographic trends compound these challenges.

74

75 Tenure is often described as legal – illegal, or formal – informal. However, the
76 reality is that the majority of housing and land development falls between these
77 extremes (Payne, 2001). Tenure is contextually embedded and layered through
78 the primary rights on the land, legal tenure status and the occupancy status of
79 the land and the dwellings (Durand-Lasserve & Selod, 2007). Formal land tenure
80 relates to legal tenure rights recognized by the state land authority. Tenure
81 security is a more elusive term generally understood to mean a lack of fear of
82 eviction (UN-HABITAT, 2002). Importantly, and especially in the context of
83 complex land arrangements, tenure security and formal tenure are one and the
84 same (Durand-Lasserve & Royston, 2002).

85

86

87 **Key review findings**

88

89 ***The prevalence of self-built and self-managed sanitation***
90 Urban government is largely absent from the provision of sanitation services.
91 Households are increasingly expected to carry the cost burden for their own
92 sanitation needs. A study of 10 African cities highlighted how the vast majority of
93 residents are served by small-scale independent providers for their sanitation
94 services (Collingnon & Vezina, 2000). Furthermore there is little recognition of
95 the millions of households across the world who invest in sanitation without
96 subsidy or intervention programs (Jenkins & Sugden, 2006; Evans, Hutton &
97 Haller, 2004). Factoring self-built household sanitation facilities into planning is
98 important. Firstly, to identify appropriate triggers and incentives, there is a need
99 to understand when and how households invest in their own sanitation.
100 Secondly, facilities that are self-built may not adhere to conventional design
101 standards (AECOM & Sandec, 2010) and may risk contaminating the immediate
102 environment. Since self-built facilities and small-scale service providers do not
103 offer a complete solution to urban sanitation provision and alone cannot secure
104 and maintain public health benefits, there is a need for municipal facilitation and
105 regulation. However, the discussion in the literature does not distinguish
106 between spending on capital *versus* operational cost, nor is the role of land
107 tenure security addressed as a determinant of decision-making behaviour with
108 regard to sanitation.

109
110 ***The paradox of demand-led approaches for sanitation***
111 Marketing based approaches intending to ‘unlock demand’ and stimulate
112 household investment in sanitation have been promoted in the urban
113 environment (Budds *et al.*, 2002). For the household, the primary drivers for
114 improving sanitation are comfort, privacy, safety, convenience, social status and
115 cleanliness, rather than health. (Jenkins & Scott, 2007). A fundamental
116 assumption underpinning sanitation marketing is that an awareness of the
117 benefits of improved sanitation will translate to investment and changed
118 behaviour in the target population. There is a significant variation in the ability,
119 willingness and freedom of residents to modify their infrastructure (Jenkins &
120 Scott, 2007). Due to this heterogeneity, critics contest the validity of marketing
121 approaches for achieving sanitation at scale (Ling *et al.*, 1992; Mulenga &
122 Fawcett, 2003).

123
124 ***A lack of affordable urban housing and prevalence of rental housing***
125 By 2025 it is anticipated that 80% of the population of developing countries will
126 live in urban areas (Mooya & Cloete, 2010). Current political and legal systems
127 are failing to provide affordable housing and services to meet the land, housing
128 and basic services needs of these growing populations. This results in one of two
129 shelter options – informal occupation of land or rental housing. Where land is
130 limited and land delivery has become commercialized, albeit informally, ‘*the*
131 *squatter is now a tenant*’ (Amis, 1984).

132

133 Rental housing (both formal and informal) represents 61% of housing in Africa
134 (UN-HABITAT, 2003). Kumar (2001) argues that rental housing is a viable and
135 necessary livelihood strategy for both tenants and landlords. Rental real estate is
136 often understood in its simplest form, whereas the reality of settlements includes
137 a broad spectrum of living arrangements where the range is defined by the needs
138 and means of the residents (Satterthwaite, 2005). At one end of the spectrum
139 there are self-help landlords who share similar socio-economic characteristics as
140 the tenants; at the other end, there exists a form of exploitative and absentee
141 landlordism that has earned rental a poor reputation (Gulyani & Talukdar,
142 2008). Despite the prevalence of either form of rental housing, the rental
143 arrangements and their tenant entities are often neglected in national housing
144 policies (Kumar, 2001) and wider development discourse (UN-HABITAT, 2003),
145 particularly in relation to basic services such as sanitation.

146

147 ***Tenure security is a necessary precursor for investment.***

148 Security of tenure as a precursor for household investment is the cornerstone of
149 the property rights debate (Payne *et al.*, 2007). There is lively deliberation among
150 scholars whether it is *de jure* or *de facto* tenure arrangements that are the
151 necessary preconditions for housing investments. Proponents of land titling
152 argue that legal tenure is the precursor and prerequisite for investment in
153 housing stock (De Soto, 2000). The contrary argument, that tenure legality is not
154 a necessary precursor for housing investment, is supported by a growing body of
155 empirical evidence (Van Gelder, 2009; Broegaard, 2005; Durand-Lasserve &
156 Royston, 2002; Razzaz, 1993). Different forms of tenure security may provide
157 thresholds for investment, where perceived tenure security in the absence of
158 legal status is enough by itself to stimulate investment. Improvements to legal
159 status can significantly enhance this effect and people can be expected to
160 consolidate significantly faster when their legal status improves (Van Gelder,
161 2009).

162

163 Whether it is legal status or more complex socio-economic arrangements in any
164 given context that constitute tenure security, proponents of the property rights
165 logic state that the need for security of tenure is '*a common sense conclusion*'
166 (Choguill, 1999); '*that lack of security of tenure is one of the greatest known*
167 *impediments to voluntary resource mobilisation for housing*' (Mayo, 1993) and
168 '*occupation rights are insecure in most slums and so people do not want to invest*
169 *when they may be evicted or moved on at any time*' (Kar & Pasteur, 2005).
170 Mulenga and Fawcett (2003) and Rakodi (1999) argue the relevance of this
171 debate to sanitation, in that sanitation-marketing approaches fail to meet those
172 with limited choice or who do not have the incentive to invest

173

174 ***Gaps in knowledge***

- 175 From a review of the sanitation and urban property rights literature the
176 following knowledge gaps were identified:
- 177 • **There is no consensus of the impacts of land titling on urban**
178 **infrastructure.** The situation for sanitation is obscured further as sanitation
179 is often twinned with water, or in a generic ‘basic services’ bundle, where the
180 characteristics and inherent implications of improved low cost technologies
181 such as on-site sanitation are overlooked (Alamasi *et al.*, 2003).

 - 182 • **The distinction between household spending on capital and operational**
183 **costs has not been made.** Whilst issues of operation and maintenance have
184 been explored (Sohail *et al.*, 2005), factors that determine the disaggregation
185 of spending between capital and operational costs have not been explored.

 - 186 • **Tenants and rental housing are neglected in the sanitation discourse**
187 **(Gilbert, 2003).** In a review of sanitation policy in South Africa, tenant
188 backyard dwellers were overlooked because the municipality recognized a
189 plot as one ‘household unit’ despite multiple households being present (Mjoli,
190 2010). A similar case is reported in the *thika tenancies*¹ of the slums of
191 Kolkata where sanitation improvement programs have provided two toilets
192 per plot. It was common for the principal tenant to keep one of the toilets for
193 their own use, leaving the other to be shared by 200 plot residents. These
194 examples demonstrate how access to sanitation is being drawn along lines of
195 tenure and raises questions on the intra-household and intra-plot variation of
196 tenure and sanitation access.

 - 197 • **Household investment decisions and behaviour.** There is a generally a
198 good understanding of why people want private sanitation. Tenure status is
199 known to be one of several factors affecting willingness to pay for sanitation.
200 Others include: income level; existence of piped water supply; existence of
201 level of payment for sanitation services; and dissatisfaction with existing
202 sanitary arrangements (Jenkins & Scott, 2007). However, willingness to pay
203 studies for urban sanitation have focused on offering consumers a choice
204 between different types of technology as investment decisions in
205 infrastructure (Whittington *et al.*, 1993; University of Colorado at Boulder,
206 2012) rather than distinguishing between the different aspects of sanitation
207 services that could be offered. There is a need for a more nuanced
208 understanding concerning the decisions of how, when and why households
209 invest in sanitation. For example, it is not known whether there is a trade-off
210 between households investing in capital assets (new latrines) as opposed to
211 improved operational services such as frequency of collection and removal of

¹ Thika tenancies are where land has been taken over by the government. A thika tenant is given rights to build on the plot and sub-let. The plots are often 200-300 square metres and occupied by approximately 200 people.

212 the contents of latrine pits and tanks. This distinction is of crucial importance
213 when it comes to developing city wide strategies for sanitation improvement.

- 214 • **How to improve citywide service provision at scale?** How to provide
215 services to informal areas has been an on-going dilemma for many
216 governments. Areas where work is more feasible are likely to be prioritized
217 by government (Leitmann & Baharoglu, 1998; Aguilar *et al.*, 2007) and there
218 are strong incentives for governments not to work in informal areas (Evans,
219 1995). Little is understood about how to approach and manage citywide
220 sanitation; a key challenge is the limited awareness of policymakers in
221 relation to the support required for the operational activities of sanitation
222 such as faecal sludge management and the corresponding need for policy
223 setting, funding allocation, and enforcement (AECOM & Sandec, 2010).

224

225 **Methodology**

226

227 ***Study location***

228 Dakar, Senegal was chosen as the location for the research due to its rapid
229 urbanization rate, the existence of high density habitats and its innovative
230 approaches to both sanitation and tenure regularization policies. The population
231 of Dakar is estimated at 2.8 million residents with an annual growth rate of 3.1%
232 (UN-HABITAT, 2008).

233

234 The National Senegal Sanitation Agency (ONAS) was created in 1996 as part of a
235 major sector reform to assign sanitation to a dedicated agency. ONAS is
236 responsible for sanitation in urban areas throughout the country. As part of its
237 overall responsibilities, ONAS managed the *program targeting the provision of*
238 *sanitation services to low-income populations of peri-urban Dakar* (PAQPUD) as
239 part of a wider strategy the *Water and Sanitation Program for the Millennium*
240 (PEPAM) to meet the Millennium Development Goals. The PAQPUD project
241 included a catalogue of technology options for on-site sanitation and greywater
242 management, small-bore sewerage networks, public toilets, school sanitation
243 and three faecal sludge treatment plants targeting 60,000 households in six
244 years. Considered a success, the PAQPUD was subsequently extended under a
245 Global Partnership Output Based Aid until 2011, targeting a further 15,100
246 households. It is unusual for urban sanitation agencies in sub-Saharan Africa to
247 have responsibility for both sewerage and on-site sanitation; a wide range of
248 options were offered in poor peri-urban areas around Dakar.

249

250 64% of households in Greater Dakar have access to improved sanitation; 39%
251 have on-site or semi-collective systems and 25% are connected to the sewer
252 network. The most common sanitation technologies are on-site systems,
253 typically a pit latrine or septic tank (Hoang-Gia *et al.*, 2004). These facilities are

254 regularly serviced for emptying by a range of technologies and services (suction
255 trucks, tractors with trailers and manual labour). The pit-emptying market in
256 Dakar comprises both a formal and informal sector, where approximately half of
257 the pits are emptied manually (Hydroconseil, 2008). Factors which are likely to
258 lead to a relatively high frequency of pit-emptying include good access to water
259 supply (76% of households have piped connections which is likely to give rise to
260 high volumes of greywater) and susceptibility to flooding in low lying areas, for
261 example in Pikine.

262

263 The department of Pikine of Greater Dakar was selected as the study location
264 due to the cross section of tenure typologies with a similar age, location in terms
265 of proximity to the economic centre and the overall regulatory setting.

266 Approximately half of the residents of the Dakar region reside in Pikine where
267 the population density is 10,166 inhabitants/km² (Hoang-Gia *et al.* 2004).

268

269 Formal market real estate mechanisms have failed to meet the housing needs of
270 Dakar's growing population, which has led to the proliferation of informal
271 settlements. As such, the majority of housing development is spontaneous and
272 self-built, where houses are modified within the occupants' means and needs
273 (World Bank, 2002; Precht, 2003). 38% of the Dakar region is classified as
274 'informal' (Precht, 2003) although it is noteworthy that the informal land
275 delivery mechanisms are well established and mimic formal systems; and many
276 of the residents of Dakar's informal settlements enjoy a relatively high level of
277 tenure security (Durand-Lasserve & Selod, 2007). Provision of basic services to
278 these informal areas can be problematic and encounters both real and perceived
279 barriers. Irregular layouts and narrow streets prevent vehicular access; however,
280 this is often only to pockets of a settlement.

281

282 ***Sampling and Key Variables***

283 Primary data were collected in relation to tenure status, available sanitation
284 services and the expenditure by users on different aspects of sanitation services.
285 The bulk of the data was collected at household level, where the socio-economic
286 data are particular to each household. This was collected using administered
287 questionnaires, consisting of both closed and open-ended questions to identify
288 how tenure and sanitation issues interact and, if so, how tenure influences
289 households' sanitation decisions.

290

291 To have a fair representation, four settlement types were identified as *planned*,
292 *unplanned*, *regularized* (formally spontaneous) and *traditional village* based on
293 Dakar's master plan, the *Plan du Directeur Horizon 2025* (MUAT-DUA, 2001) and
294 previous studies (Durand-Lasserve & Selod, 2007). A representative district
295 within Pikine for each settlement type was selected by cluster sampling. Within
296 each district 10 survey zones were randomly selected using aerial survey maps

297 (5 for the traditional village due to large concessional housing). A transect walk
298 randomly selected ten plots from each survey zone. In total 363 households and
299 340 plots participated in the survey.

300

301 Tenure status was defined by three variables: the settlement typology, the level
302 of tenure security and the occupancy status (i.e. landlord or tenant headed
303 households). For tenure security, proxy indicators were used where the
304 perception of risk of eviction is a primary indicator (Van Gelder, 2009). For
305 occupancy status, householders who own the dwelling on either formal or
306 informal settlements are defined as 'owners.' Tenants are defined as those who
307 pay rent for their dwelling, either with or without a formal contract (Precht,
308 2003). The survey questionnaire consisted of two parts, using the plot and the
309 household as the unit of analysis respectively. Plots were categorized (Table 1)
310 as: i) owner occupier dwelling; ii) owner sharing dwelling with one tenant; iii)
311 owner sharing dwelling with multiple tenants; and iv) tenant(s) with absent
312 landlord (Jenkins & Scott, 2007). This approach allowed the intra-plot
313 characteristics with shared infrastructure to be captured.

314

315 Available sanitation services were also defined by three variables: access to
316 sanitation, household investment in sanitation infrastructure and household pit-
317 emptying behaviours. Access to sanitation was defined according to categories of
318 the Joint Monitoring Program: improved (including flush toilets, pit latrine with
319 cover, VIP); shared; unimproved (basic latrines that do not ensure hygienic
320 separation of excreta from human contact); and open-defecation (WHO/UNICEF,
321 2012). Expenditure on sanitation was disaggregated by payment for the
322 following costs: the initial investment in sanitation infrastructure; maintenance
323 of the facility including repair and structural changes; and operational costs for
324 pit-emptying.

325

326

327 **Results**

328

329 ***Access to sanitation - de facto tenure security matters.***

330 Access to sanitation was measured across all four settlements. The settlement
331 with the highest coverage of improved private sanitation was in the regularized
332 area (72.0%), followed by the planned settlement (64.7%), informal settlement
333 (62.8%) and traditional village (48.9%). In the regularized area, less than half of
334 the residents who are eligible for a title have actually obtained one; the option of
335 completing the titling process has been found to be sufficient for obtaining an
336 adequate level of tenure security (Payne *et al.*, 2007).

337

338 Whilst drawing causality about sanitation developments and tenure is difficult,
339 the data show the following.

340 1. A higher perceived risk of eviction correlates with a lower likelihood of
 341 improved sanitation (Figure 1). The existence of improved sanitation was
 342 unlikely without a (very) low perceived risk of tenure eviction.
 343 2. The length of time a household had been resident also played a role. Shared
 344 sanitation facilities were more common for households who had been resident
 345 for five years or less. Improved sanitation was more likely for households with
 346 over five years of residency in one place (Figure 2).

347

348 ***Tenants are lower on the sanitation ladder***

349 Table 2 indicates that significantly more tenant households shared their
 350 sanitation facility with two or more households: 81.1% of owners had an
 351 improved (private) sanitation facility compared with only 20.6% for tenants. On
 352 average and adjusting for differences in landlord-tenant household sizes, tenants
 353 shared their sanitation facility with 3.2 households (20.4 people) compared to
 354 1.2 households (14.4 people) for owners. These *household per sanitation facility*
 355 figures are useful to underline the intra-plot dynamics. Whilst tenants enjoy
 356 similar levels of water and electricity coverage, they are markedly lower on the
 357 sanitation ladder than owner households (Table 2).

358

359 Table 1. Summary of tenure status in study areas

Occupational status Dakar-Pikine	Survey sample data
Owner	58.6%
Owner with tenant	5.5%
Owner with multiple tenants	15.2%
Tenant with absent owner	20.7%

360

361 Table 2 Access to sanitation and other services

Access To Basic Services & Living Standards	Owner Household	Tenant Household
Household size (5% trimmed mean)	12.01	6.39
Household total monthly income (median)	\$281 - \$373	\$187- \$280
HH Improved (private) sanitation	81.1%	20.6%
HH Shared sanitation	17.4%	77.3%
Households per sanitation facility (5% trimmed mean)	1.2	3.2
Average users per toilet	14.4	20.4
Households per pit/tank (5% trimmed mean)	1.2	3.4
Average daily loading on pit/tank (kg)	25.9	39.1
Mechanical pit emptying	47.6%	32.8%
Water connection in plot	89.7%	83.5%
Electricity connection	90.1%	84.5%
No. of mobile phones (5% trimmed mean)	3.35	1.76
No. of TV's (5% trimmed mean)	1.24	0.62
'Poor' level of habitat	16.2%	27.1%

362

363 The data for plot composition show that tenant plots with absent landlords had
 364 the lowest levels of improved sanitation (22.7%), compared to 27.3% for mixed
 365 occupancy plots and 91.5% for owner-occupiers. These echo the wider problem
 366 of plots with absent landlords where very little of the capital generated by the

367 rental sector is reinvested into the housing stock. Tenants cited absent, unwilling
 368 or financially constrained landlords as barriers to improve their sanitation.

369

370 ***Who pays for the initial investments?***

371 Both the tenant and landlord groups place the onus of responsibility on the
 372 landlord for capital investment in, and repairs to, infrastructure. Owners who
 373 had constructed the first toilet of their current dwelling (N=183) were asked if
 374 they recalled a trigger for the construction. Of those who could, the primary
 375 factors were 'modesty' and concurrence with other household construction
 376 activities (Table 3). Construction events were commonly the extension of the
 377 dwelling and rebuilding with permanent building materials.

378

379 Table 3: Initial capital investment trigger for household sanitation

	Female headed household		Male headed household		Total	
	N	Valid %	N	Valid %	n	Valid %
Modesty	7	31.8%	22	31.4%	29	31.5%
Toilet built at the same time as other household construction	8	36.4%	17	24.3%	25	27.2%
To be independent and not disturb neighbours	3	13.6%	13	18.6%	16	17.4%
Importance of a toilet for a Muslim household	0	0.0%	9	12.9%	9	9.8%
TOTAL	18	22.8%	61	77.2%	79	100.0%

380

381 ***Who pays for maintenance?***

382 Structural changes or improvements were made by 183 households to their
 383 sanitation infrastructure. The primary reason for modification was found to be
 384 essential repair when the facility showed signs of severe defects that prevented
 385 continued use, most often relating to pit collapse (Table 4). The distribution of
 386 the repairs was found to be more heavily concentrated in the informal and
 387 spontaneously occupied zones that are flood-prone.

388

389 Table 4: Why people invest in existing household sanitation

Why people invest in their existing household sanitation	Frequency	Valid Percent
Essential repair (pit collapsed or imminent risk of collapse / severe malfunction)	76	41.5%
Improve comfort or usability	29	15.8%
Poor operation (frequent emptying, blockages)	23	12.6%
project (PAQPUD/subsidy) stimulus	19	10.4%
Household enlargement (family / tenants)	18	9.8%
Home reorganization / new construction /newly move in	17	9.3%
Total responses	183	100.0%

390

391 **Who pays for operational Costs?**

392 Tenants and landlords agreed that, regardless of ownership, it is ‘users’ who pay
 393 latrine pit-emptying charges. From the households surveyed, the mechanical pit
 394 emptying service costs an average of 23,500 CFA (\$44) and manual emptying
 395 costs 12,500 CFA (\$23). Owners tended to prefer mechanical emptying whereas
 396 tenant households preferred manual emptying, either by employing a service
 397 provider to dig out the contents or by doing it themselves (Table 5). It is
 398 noteworthy that the vacuum tankers of Dakar cannot remove the solids whereas
 399 manual emptying offers a full emptying service and therefore a longer lifespan.
 400 67.5% of all pits surveyed are being emptied at least once a year with an
 401 annualized average cost per household of 29,490 CFA (\$55) for mechanical
 402 emptying and 13,681 CFA (\$26) for manual emptying. It is understood that the
 403 high emptying frequency is due to high pit loading including household
 404 greywater. Although it is hard to confirm on a case by case basis, local experts
 405 believe many of the septic tanks in Dakar are unsealed and therefore potentially
 406 subject to water infiltration.

407

408 Table 5: Emptying service by tenure status

		Owner	Tenant	Total
Mechanical Emptying	Count	94	21	115
	% within emptying	81.7%	18.2%	100.0%
	% within tenure status	50.0%	34.4%	46.2%
Manual emptying – (contractor)	Count	53	31	84
	% within emptying	63.1%	36.9%	100.0%
	% within tenure status	28.2%	50.8%	33.7%
Manual emptying – by householder	Count	41	9	50
	% within emptying	82.00%	18.0%	100.0%
	% within tenure status	21.8%	14.8%	20.1%
Total Count		188	61	249

409

410 Interestingly, whilst tenants were opting for a cheaper manual service they were
 411 less likely to empty the pit themselves. In doing so, tenant households have
 412 demonstrated their on-going *willingness to pay* for operational costs of sanitation
 413 services.

414

415 Both landlord and tenant respondents were asked to state the reasons for
 416 choosing a particular type of pit-emptying service. Financial reasons and a
 417 preferred/satisfactory service ranked the highest (Table 6).

418

419 Table 6: Decision factors for preferred emptying

Priority Rank	Decision factors for preferred emptying	Owner /occupiers	Tenants
1.	Financial	35.3%	48.2%
2.	Preferred/satisfactory service	31.5%	35.7%
3.	Cleanliness	31.0%	17.9%
4.	Not to annoy neighbours	30.4%	16.1%

420

421 Whilst there was a difference between how landlords and tenants chose to empty
422 their pits, interestingly no significant difference was found regarding tenure
423 security. This implies that operational sanitation services such as emptying may
424 be neutral regarding differences in tenure security.

425

426 **Implications for urban sanitation strategies**

427

428 ***Tenure security matters for household investment in sanitation***

429 This research has shown that low-income residents can, and do, progressively
430 invest in the capital cost of their own sanitation infrastructure; however this was
431 only found with owners who enjoyed relatively good tenure security. Tenant
432 households or those with lower levels of tenure security were less likely to
433 invest. This confirms that residents have the agency to progressively improve
434 their own infrastructure and do so upon a basis of tenure security, thus implying
435 a parallel development between housing and infrastructure (Choguill, 1999). The
436 study also suggests that where sanitation is an on-plot independently managed
437 infrastructure, it is *de facto* rather than *de jure* tenure security that is a necessary
438 but sufficient precursor to household investment in sanitation. This argument is
439 underpinned by two essential facts: firstly, in the developing world context
440 *tenure security* and *legal tenure* are not necessarily the same (Durand-Lasserve &
441 Royston, 2002) and secondly, non-networked sanitation e.g. a pit latrine or
442 septic tank, constitutes improved sanitation (WHO/UNICEF, 2012).

443

444 These findings imply that sanitation development in low-income areas can be
445 linked to housing and fundamentally, *de facto* tenure security matters for
446 household investment in sanitation.

447

448 ***Willingness to invest vs. willingness to pay***

449 In the absence of government service provision it is the households themselves
450 that assume the role of service provider. When sanitation is an on-plot system
451 requiring emptying, as is the norm in Dakar and most African cities, the
452 difference between a household's willingness to *invest in a sanitation fixed-asset*
453 and *pay for a sanitation service* becomes pertinent.

454

455 These nuances become clearly illustrated in the case of absent landlords. Tenants
456 and landlords surveyed agreed that structural changes to the dwelling (including
457 sanitation) are the landlord's responsibility. The onus of responsibility of
458 sanitation service provision often falls to the landlord although there is little
459 incentive or enforceable legal framework to incite them to adopt this role
460 (Schaub-Jones, 2009). For landlords, a private toilet facility has little effect on the
461 potential rental turnover (Gulyani & Talukdar, 2008). Tenants are averse to
462 investment as they are not able to reap the benefits of any long-term investment
463 (Gilbert, 2003). Tenants also often lack the agency to improve their sanitation
464 facility. Under informal rental agreements, timely and complete payments of rent

465 guarantee the tenants' tenure security (Schaub-Jones, 2009).

466

467 Whilst tenants do not have the willingness or ability to invest, tenants are willing
468 to pay for sanitation services. This is demonstrated in this research by the
469 regular pit emptying, at considerable cost, to ensure their sanitation facility
470 remains operational.

471

472 These landlord-tenant dynamics provide valuable insights into the payment and
473 investment logic of those without tenure security. What is clearly emerging is
474 that there are significant differences in what households are both *able* and
475 *willing* to pay. *Willingness to pay* can, and indeed for sanitation should, be
476 disaggregated into *willingness to invest in an asset*, and *willingness to pay for a*
477 *service*, in addition to the differences between *ability to change infrastructure* and
478 *affordability of sanitation*. These nuances are often overlooked in the
479 development of city sanitation strategies.

480

481 **Implications for urban professionals and government**

482 Urban sanitation strategies focus primarily on capital investment in new latrines.

483 This is a disconnection between strategy and the reality of urbanization where
484 significant and growing segments of the population lack tenure security.

485 The vast majority of the sanitation services for residents of low-income areas are
486 provided by small-scale independent providers. This presents a complex
487 challenge to utilities and municipal governments who are organized
488 conventionally to manage utility-based service provision such as sewerage. On
489 the other hand, on-site systems served by independent service providers
490 interface with households in a very different way via a demand-responsive pay-
491 as-you-go service. Whilst utilities cite barriers preventing their operation and
492 service in informal areas, independent providers not only overcome these
493 barriers but thrive due to their flexibility and their responsiveness to demand
494 (Collignon & Vézina, 2000). Moreover, as the findings of this study have shown,
495 households can engage with the latter regardless of where they live, whether
496 they are a landlord or a tenant, and their level of tenure security. Operational
497 sanitation services are tenure neutral.

498

499 This suggests that for populations where tenure insecurity is acting as a
500 disincentive to household investment, the focus of sanitation developments
501 needs to change. There is a need for more broadly based sanitation service
502 provision, including non-networked systems and a greater emphasis on
503 operational activities rather than solely investment in physical infrastructure.

504

505 Government has a pivotal role in creating and enforcing an enabling and
506 regulatory environment for operational sanitation activities. This research has
507 found that whilst there may be vast segments of urban populations who are

508 unwilling to invest the capital costs, they are willing to pay for the operational
509 costs of sanitation services. A concrete recommendation is to use this finding to
510 segment the population. For those who are willing to pay for operational services
511 rather than capital investment, feasible mechanisms towards citywide sanitation
512 are to support the operational activities of collection, transport and safe disposal
513 of the faecal sludge. These activities provide a tenure-neutral mechanism for
514 municipal service provision to find interfaces with residents of informal areas –
515 without encountering compromising situations of consolidating state
516 infrastructure in informal settlements. In short, citywide sanitation strategies
517 need to respond in a way that accounts for the investment logic of residents.

518

519 **Conclusions**

520 The study has found that *de facto* tenure security is a sufficient but necessary
521 precondition for household capital investment in sanitation. Equally important is
522 the finding that tenants and those lacking tenure security, whilst they are
523 unlikely to be willing to invest in the capital cost of latrines, do pay substantial
524 fees to service providers for operational sanitation services such as the emptying
525 of full pits and tanks and the removal and disposal of their contents. These
526 operational investments are not accounted for in formal policy settings. Tenure
527 status is associated with a much greater disparity in the level of service for
528 sanitation than it is for either water supply or electricity.

529

530 Few urban sanitation strategies make this important distinction between
531 willingness to pay for operational as opposed to capital costs to cater for those
532 who are unwilling or unable to invest. This is a fundamental oversight in current
533 sanitation strategies for the population segments who cannot invest, thus failing
534 to provide a sanitation strategy for all. This is of growing concern given the type
535 of urbanization being witnessed in developing countries which is characterized
536 by increasing concentrations of low income populations and tenants. Urban
537 sanitation strategies therefore need to distinguish between *willingness to invest*,
538 *willingness to pay* and *ability to pay*. Those who are unwilling to invest in capital
539 costs may be willing to pay for operational costs of sanitation services.

540

541 The effect of tenure issues on household sanitation decisions in turn implies that
542 there is a need for a broader sanitation service provision, including non-
543 networked systems and a greater emphasis on supporting downstream activities
544 associated with faecal sludge management. Currently few interfaces actually
545 connect the city with the majority of the population, especially the poor.
546 Sanitation provision happens largely under the radar of formal city planning and
547 urban management via multiple formal or informal service providers. Policy and
548 strategic planning for sanitation needs to embrace the issues of operational costs
549 and tenure security and be integrated into wider city development strategies in
550 cities such as Dakar.

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554 **References**

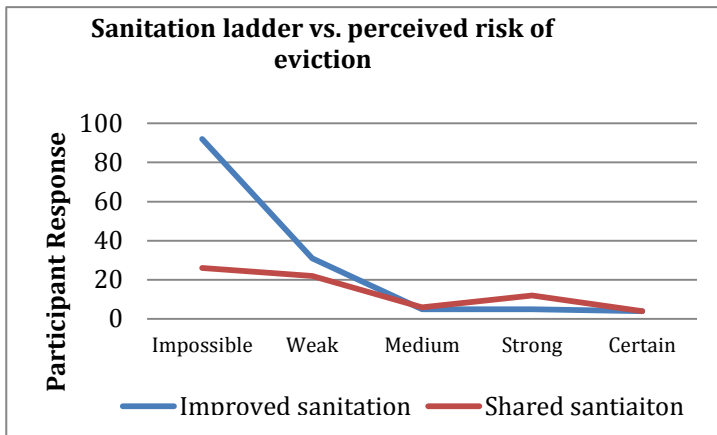
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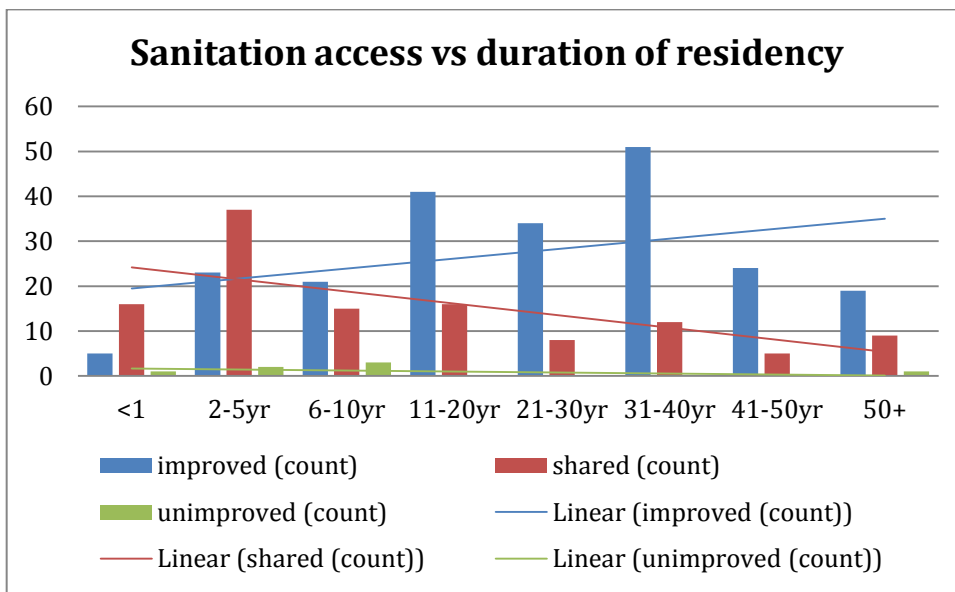
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Figure 1. Sanitation status and the perceived risk of eviction



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Figure 2. Access to sanitation by type and duration of residency

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Reviewer 1	Action taken
2. Inclusion of 'on-site sanitation' as a keyword would be useful	Done
3. it would be useful to: - Define what the phrase 'on-site services' covers early in the article	Done: lines 54-56
- Provide some background on the relatively good access to sanitation in Dakar because of massive investments in infrastructure (EU, AFD and USAIND funded) and subsidies under the World Bank funded PAQPUD	Done: section "Methodology: study location" expanded with new para on institutional background Lines 234-248
- Under the projects listed above, a wide range of sanitation options, especially on-site sanitation were offered in poor peri-urban areas around Dakar. This is important because open defecation and use of public toilets appears to be rare (likely because of the incentives and subsidies available under the projects) and MAY BE LESS ACCEPTABLE because a high percentage of households have on-site sanitation.	Done: The wide range of options is described (Lines 241-244) Access figures for sanitation in Dakar are quoted (Lines 250-253)
- The National Senegal Sanitation Agency (ONAS), unlike the norm (urban government is largely absent from the provision of sanitation services), is responsible for both - piped sewerage and on-site sanitation.	Done Lines 246-248
-. There is need for including factors that influence the frequency of emptying septic tanks/ operational costs in parts of Dakar e.g.: - About 95 percent of the population has good access to water (76 percent to piped water, 19 percent to community stand-pipes, and only 5 percent through vendors or wells). - The frequent and severe flooding in many of the poorest districts of Pikene and Rafisque.	Done Lines 257-261
4. The Study location: The statement "Dakar, Senegal was chosen as the location for the research due to its rapid urbanisation rate, the existence of high density habitats and its innovative approaches to both urban sanitation and tenure regularisation policies" is not substantiated by some description of the innovative approaches to urban sanitation and tenure regularisation.	Done The new para referred to above (Lines 234-248) highlight the innovative approaches adopted by the government agencies
5. Language - Frequent use of the term 'urban' in a sentence is not required/ distracting e.g. page 2	Done The use of the term 'urban' has been edited out other than where it is essential in order to retain the sense of

	the narrative
- When the sanitation norm is self-managed on-site systems, as is the case in many low-income areas of (???) towns and cities, household investment decisions in sanitation are inherently linked to tenure security	Done: Line 22 (thank you for spotting this)
- To achieve citywide sanitation, understanding the dynamics of tenure i.e. how residents obtain and keep land and housing, and invest in infrastructure is critical. Furthermore, the paper argues that failing to take these dynamics into account results in inappropriate urban sanitation strategies for a significant, and growing segment of the urban population of cities in low and middle-income countries.	Done Lines 65-66 redrafted
- At one end of the spectrum there are self-help landlords who share similar socio-economic characteristics as the tenants. On the other hand, there is also a form of exploitative and absentee landlordism that has earned rental a poor reputation (Gulyani & Talukdar, 2008).	Done Lines 138-140 redrafted
- There is a significant variance in ability, will and freedom of the urban residents to modify their infrastructure ..	Done Lines 118-120 redrafted
- It was common for the principal tenant to keep one of the toilets for their own use, leaving the other for shared usage between 200 plot residents.	Done Lines 192-193 redrafted
- For occupancy status, householders who own the dwelling on either formal or informal settlements are considered 'owners.'	Done Line 306 redrafted
6. Primary data were collected in relation to tenure status, available sanitation services and the expenditure by users on different aspects of sanitation services. Is this clearly elaborated????	Done Clarified by redrafting Lines 301-303, Lines 315; addition of lines 321-324
Reviewer 2	Action Taken
Results: Table 1 should be part of the Result and not the Method. Again the statistics in Table 1 are not clear enough as the total percentage figures exceed 100%. And yet the impression given is that the sample size (100%) was segregated into the TENURE echelons (status or levels) in the study area. Also figures 1 and 2 are repeated. Nevertheless, the results are logically well explained.	Done Table 1 moved to results section (Line 359) Done Table 1 amended to show only the tenure echlons, values add up to 100% (a sub category had erroneously been transposed to a main category thereby causing this error)

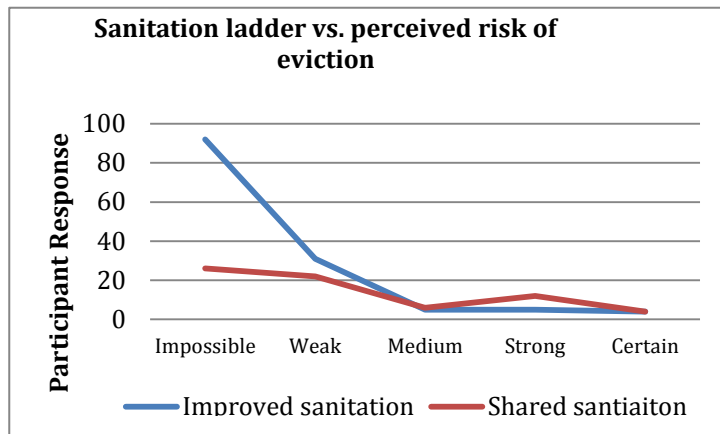


Figure 1. Sanitation status and the perceived risk of eviction

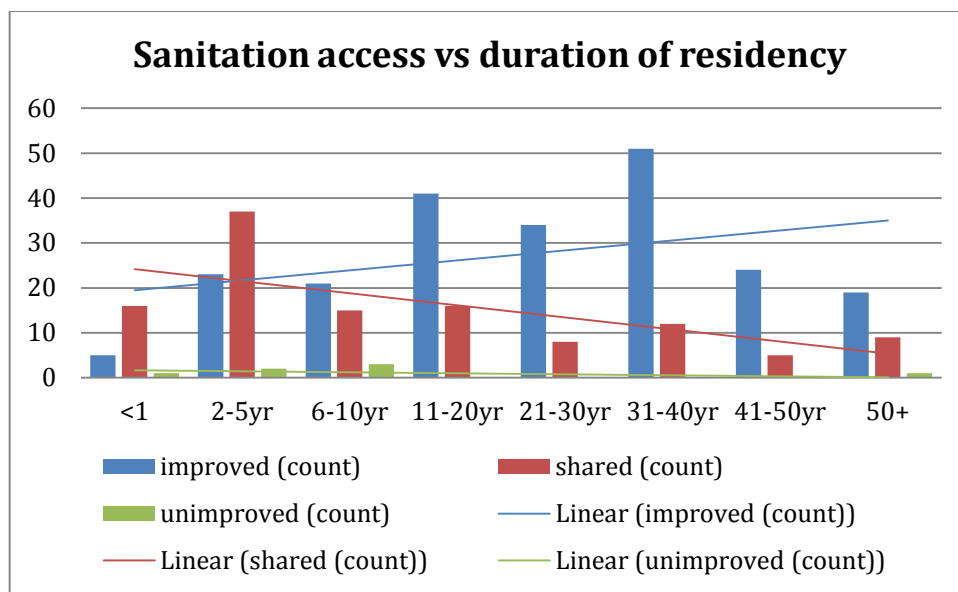


Figure 2. Access to type of sanitation and duration of residency

Figure 1. Sanitation status and the perceived risk of eviction

Figure 2. Access to type of sanitation and duration of residency

Tenure security and household investment decisions for urban sanitation: the case of Dakar, Senegal

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