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

This item was submitted to Loughborough University’s Institutional Repository by the/an author.


Additional Information:

- This article was published in the journal, Habitat International [© Elsevier Ltd.] and the definitive version is available at: http://dx.doi.org/10.1016/j.habitatint.2013.02.004

Metadata Record: https://dspace.lboro.ac.uk/2134/12321

Version: Accepted for publication

Publisher: © Elsevier Ltd.

Please cite the published version.
This item was submitted to Loughborough’s Institutional Repository (https://dspace.lboro.ac.uk/) by the author and is made available under the following Creative Commons Licence conditions.

For the full text of this licence, please go to: http://creativecommons.org/licenses/by-nc-nd/2.5/
Manuscript Number: HABITATINT-D-12-00294R1

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

Article Type: Full-length article

Keywords: Urban sanitation; Tenure; Household investment; Operating costs; Dakar.

Corresponding Author: Dr. Andrew Cotton,
Corresponding Author's Institution: Loughborough University
First Author: Philippa Scott
Order of Authors: Philippa Scott; Andrew Cotton; M Sohail
Suggested Reviewers:
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
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
This paper addresses how tenure security affects household investment decisions for urban sanitation. This is achieved through a review of the relevant literature on sanitation for the urban poor and urban land tenure; the gaps in knowledge are explored through field studies in Dakar, Senegal. The research explores different components of tenure: legal tenure, tenure security and tenure status (i.e. landlord or tenant) and their associated implications for sanitation development. It seeks to answer what the relationships are between tenure issues and sanitation and to what extent they affect investment in on-site sanitation systems (that is, systems in which the disposal of excreta takes place on or near the housing plot in the absence of networked sewerage; pit latrines and septic tanks fall into this category). Throughout the paper an important distinction is drawn between: capital investment costs that are incurred through constructing a new latrine or otherwise improving the quality of a sanitation asset by upgrading; and operating costs which are paid to service the facility, for emptying the pit or tank and subsequent transport and disposal of the contents.

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 sanitation strategies for a significant, and growing segment of the population of cities in low and middle-income countries.

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

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

**Key review findings**
The prevalence of self-built and self-managed sanitation

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

The paradox of demand-led approaches for sanitation

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

A lack of affordable urban housing and prevalence of rental housing

By 2025 it is anticipated that 80% of the population of developing countries will live in urban areas (Mooya & Cloete, 2010). Current political and legal systems are failing to provide affordable housing and services to meet the land, housing and basic services needs of these growing populations. This results in one of two shelter options – informal occupation of land or rental housing. Where land is limited and land delivery has become commercialized, albeit informally, 'the squatter is now a tenant' (Amis, 1984).
Rental housing (both formal and informal) represents 61% of housing in Africa (UN-HABITAT, 2003). Kumar (2001) argues that rental housing is a viable and necessary livelihood strategy for both tenants and landlords. Rental real estate is often understood in its simplest form, whereas the reality of settlements includes a broad spectrum of living arrangements where the range is defined by the needs and means of the residents (Satterthwaite, 2005). At one end of the spectrum there are self-help landlords who share similar socio-economic characteristics as the tenants; at the other end, there exists a form of exploitative and absentee landlordism that has earned rental a poor reputation (Gulyani & Talukdar, 2008). Despite the prevalence of either form of rental housing, the rental arrangements and their tenant entities are often neglected in national housing policies (Kumar, 2001) and wider development discourse (UN-HABITAT, 2003), particularly in relation to basic services such as sanitation.

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

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

Whether it is legal status or more complex socio-economic arrangements in any given context that constitute tenure security, proponents of the property rights logic state that the need for security of tenure is *'a common sense conclusion’* (Choguill, 1999); *'that lack of security of tenure is one of the greatest known impediments to voluntary resource mobilisation for housing’* (Mayo, 1993) and *'occupation rights are insecure in most slums and so people do not want to invest when they may be evicted or moved on at any time’* (Kar & Pasteur, 2005).

Mulenga and Fawcett (2003) and Rakodi (1999) argue the relevance of this debate to sanitation, in that sanitation-marketing approaches fail to meet those with limited choice or who do not have the incentive to invest.

**Gaps in knowledge**
From a review of the sanitation and urban property rights literature the following knowledge gaps were identified:

- **There is no consensus of the impacts of land titling on urban infrastructure.** The situation for sanitation is obscured further as sanitation is often twinned with water, or in a generic 'basic services' bundle, where the characteristics and inherent implications of improved low cost technologies such as on-site sanitation are overlooked (Alamasi et al., 2003).

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

- **Tenants and rental housing are neglected in the sanitation discourse** (Gilbert, 2003). In a review of sanitation policy in South Africa, tenant backyard dwellers were overlooked because the municipality recognized a plot as one ‘household unit’ despite multiple households being present (Mjoli, 2010). A similar case is reported in the thika tenancies1 of the slums of Kolkata where sanitation improvement programs have provided two toilets per plot. It was common for the principal tenant to keep one of the toilets for their own use, leaving the other to be shared by 200 plot residents. These examples demonstrate how access to sanitation is being drawn along lines of tenure and raises questions on the intra-household and intra-plot variation of tenure and sanitation access.

- **Household investment decisions and behaviour.** There is a generally a good understanding of why people want private sanitation. Tenure status is known to be one of several factors affecting willingness to pay for sanitation. Others include: income level; existence of piped water supply; existence of level of payment for sanitation services; and dissatisfaction with existing sanitary arrangements (Jenkins & Scott, 2007). However, willingness to pay studies for urban sanitation have focused on offering consumers a choice between different types of technology as investment decisions in infrastructure (Whittington et al., 1993; University of Colorado at Boulder, 2012) rather than distinguishing between the different aspects of sanitation services that could be offered. There is a need for a more nuanced understanding concerning the decisions of how, when and why households invest in sanitation. For example, it is not known whether there is a trade-off between households investing in capital assets (new latrines) as opposed to 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.
the contents of latrine pits and tanks. This distinction is of crucial importance when it comes to developing city wide strategies for sanitation improvement.

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

**Methodology**

**Study location**

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

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

64% of households in Greater Dakar have access to improved sanitation; 39% have on-site or semi-collective systems and 25% are connected to the sewer network. The most common sanitation technologies are on-site systems, typically a pit latrine or septic tank (Hoang-Gia et al., 2004). These facilities are
regularly serviced for emptying by a range of technologies and services (suction trucks, tractors with trailers and manual labour). The pit-emptying market in Dakar comprises both a formal and informal sector, where approximately half of the pits are emptied manually (Hydroconseil, 2008). Factors which are likely to lead to a relatively high frequency of pit-emptying include good access to water supply (76% of households have piped connections which is likely to give rise to high volumes of greywater) and susceptibility to flooding in low lying areas, for example in Pikine.

The department of Pikine of Greater Dakar was selected as the study location due to the cross section of tenure typologies with a similar age, location in terms of proximity to the economic centre and the overall regulatory setting. Approximately half of the residents of the Dakar region reside in Pikine where the population density is 10,166 inhabitants/km² (Hoang-Gia et al. 2004).

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

**Sampling and Key Variables**

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

To have a fair representation, four settlement types were identified as **planned**, **unplanned**, **regularized** (formally spontaneous) and **traditional village** based on Dakar’s master plan, the **Plan du Director Horizon 2025** (MUAT-DUA, 2001) and previous studies (Durand-Lasserve & Selod, 2007). A representative district within Pikine for each settlement type was selected by cluster sampling. Within each district 10 survey zones were randomly selected using aerial survey maps.
(5 for the traditional village due to large concessional housing). A transect walk randomly selected ten plots from each survey zone. In total 363 households and 340 plots participated in the survey.

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

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

**Results**

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

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

Whilst drawing causality about sanitation developments and tenure is difficult, the data show the following.
1. A higher perceived risk of eviction correlates with a lower likelihood of improved sanitation (Figure 1). The existence of improved sanitation was unlikely without a (very) low perceived risk of tenure eviction.

2. The length of time a household had been resident also played a role. Shared sanitation facilities were more common for households who had been resident for five years or less. Improved sanitation was more likely for households with over five years of residency in one place (Figure 2).

**Tenants are lower on the sanitation ladder**

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

**Table 1. Summary of tenure status in study areas**

<table>
<thead>
<tr>
<th>Occupational status Dakar-Pikine</th>
<th>Survey sample data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner</td>
<td>58.6%</td>
</tr>
<tr>
<td>Owner with tenant</td>
<td>5.5%</td>
</tr>
<tr>
<td>Owner with multiple tenants</td>
<td>15.2%</td>
</tr>
<tr>
<td>Tenant with absent owner</td>
<td>20.7%</td>
</tr>
</tbody>
</table>

**Table 2 Access to sanitation and other services**

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

The data for plot composition show that tenant plots with absent landlords had the lowest levels of improved sanitation (22.7%), compared to 27.3% for mixed occupancy plots and 91.5% for owner-occupiers. These echo the wider problem of plots with absent landlords where very little of the capital generated by the
rental sector is reinvested into the housing stock. Tenants cited absent, unwilling or financially constrained landlords as barriers to improve their sanitation.

**Who pays for the initial investments?**

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

**Table 3: Initial capital investment trigger for household sanitation**

<table>
<thead>
<tr>
<th></th>
<th>Female headed household</th>
<th>Male headed household</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Valid %</td>
<td>N</td>
</tr>
<tr>
<td>Modesty</td>
<td>7</td>
<td>31.8%</td>
<td>22</td>
</tr>
<tr>
<td>Toilet built at the same time as other household construction</td>
<td>8</td>
<td>36.4%</td>
<td>17</td>
</tr>
<tr>
<td>To be independent and not disturb neighbours</td>
<td>3</td>
<td>13.6%</td>
<td>13</td>
</tr>
<tr>
<td>Importance of a toilet for a Muslim household</td>
<td>0</td>
<td>0.0%</td>
<td>9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>18</strong></td>
<td><strong>22.8%</strong></td>
<td><strong>61</strong></td>
</tr>
</tbody>
</table>

**Who pays for maintenance?**

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

**Table 4: Why people invest in existing household sanitation**

<table>
<thead>
<tr>
<th>Why people invest in their existing household sanitation</th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential repair (pit collapsed or imminent risk of collapse / severe malfunction)</td>
<td>76</td>
<td>41.5%</td>
</tr>
<tr>
<td>Improve comfort or usability</td>
<td>29</td>
<td>15.8%</td>
</tr>
<tr>
<td>Poor operation (frequent emptying, blockages) project (PAQPUD/subsidy) stimulus</td>
<td>23</td>
<td>12.6%</td>
</tr>
<tr>
<td>Household enlargement (family / tenants)</td>
<td>18</td>
<td>9.8%</td>
</tr>
<tr>
<td>Home reorganization / new construction / newly move in</td>
<td>17</td>
<td>9.3%</td>
</tr>
<tr>
<td><strong>Total responses</strong></td>
<td><strong>183</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Who pays for operational Costs?

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

Table 5: Emptying service by tenure status

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

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

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

Table 6: Decision factors for preferred emptying

<table>
<thead>
<tr>
<th>Priority Rank</th>
<th>Decision factors for preferred emptying</th>
<th>Owner /occupiers</th>
<th>Tenants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Financial</td>
<td>35.3%</td>
<td>48.2%</td>
</tr>
<tr>
<td>2.</td>
<td>Preferred/satisfactory service</td>
<td>31.5%</td>
<td>35.7%</td>
</tr>
<tr>
<td>3.</td>
<td>Cleanliness</td>
<td>31.0%</td>
<td>17.9%</td>
</tr>
<tr>
<td>4.</td>
<td>Not to annoy neighbours</td>
<td>30.4%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>
Whilst there was a difference between how landlords and tenants chose to empty their pits, interestingly no significant difference was found regarding tenure security. This implies that operational sanitation services such as emptying may be neutral regarding differences in tenure security.

**Implications for urban sanitation strategies**

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

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

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

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

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

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

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

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

Implications for urban professionals and government

Urban sanitation strategies focus primarily on capital investment in new latrines. This is a disconnection between strategy and the reality of urbanization where significant and growing segments of the population lack tenure security. The vast majority of the sanitation services for residents of low-income areas are provided by small-scale independent providers. This presents a complex challenge to utilities and municipal governments who are organized conventionally to manage utility-based service provision such as sewerage. On the other hand, on-site systems served by independent service providers interface with households in a very different way via a demand-responsive pay-as-you-go service. Whilst utilities cite barriers preventing their operation and service in informal areas, independent providers not only overcome these barriers but thrive due to their flexibility and their responsiveness to demand (Collignon & Vézina, 2000). Moreover, as the findings of this study have shown, households can engage with the latter regardless of where they live, whether they are a landlord or a tenant, and their level of tenure security. Operational sanitation services are tenure neutral.

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

Government has a pivotal role in creating and enforcing an enabling and regulatory environment for operational sanitation activities. This research has found that whilst there may be vast segments of urban populations who are
unwilling to invest the capital costs, they are willing to pay for the operational costs of sanitation services. A concrete recommendation is to use this finding to segment the population. For those who are willing to pay for operational services rather than capital investment, feasible mechanisms towards citywide sanitation are to support the operational activities of collection, transport and safe disposal of the faecal sludge. These activities provide a tenure-neutral mechanism for municipal service provision to find interfaces with residents of informal areas – without encountering compromising situations of consolidating state infrastructure in informal settlements. In short, citywide sanitation strategies need to respond in a way that accounts for the investment logic of residents.

**Conclusions**

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

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

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

AECOM & Sandec 2010, A Rapid Assessment of Septage Management in Asia: Policies and Practices in India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Vietnam, AECOM International Development, Inc. and the Department of Water and Sanitation in Developing Countries (Sandec) at the Swiss Federal Institute of Aquatic Science and Technology (Eawag).


Gilbert, A. 2003, Rental Housing: An essential option for the urban poor in developing countries, UN-Habitat, Nairobi.


Jenkins, M. & Scott, B. 2007, "Behavioral indicators of household decision-making and demand for sanitation and potential gains from social marketing in Ghana Pages", Social Science & Medicine, vol. 64, no. 12, pp. 2427-2442.


UN-HABITAT 2003, "Rental Housing: An essential option for the urban poor in developing countries", UN-Habitat, Nairobi.


Figure 1. Sanitation status and the perceived risk of eviction

Sanitation ladder vs. perceived risk of eviction

![Sanitation ladder vs. perceived risk of eviction](image)

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

Sanitation access vs duration of residency

![Sanitation access vs duration of residency](image)

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

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

Philippa Scott\textsuperscript{a}, Andrew Cotton\textsuperscript{b,*}, M. Sohail Khan\textsuperscript{c}

\textsuperscript{a} Independent Water & Sanitation Consultant
\textsuperscript{b} WEDC, School of Civil and Building Engineering, Loughborough University UK
\textsuperscript{c} WEDC, School of Civil and Building Engineering, Loughborough University UK

* Corresponding author.
Postal address: WEDC, John Pickford Building, Loughborough University, Loughborough LE11 3TU, UK
Telephone: 441509223772
Email address: a.p.cotton@lboro.ac.uk
Word count 6510