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Attitudes and practises with regard to emptying of onsite systems in Maputo, Mozambique

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Rapid urbanisation as well as the rising need for water from industries and agriculture is intensifying freshwater scarcity in delta cities such as Maputo, Mozambique. Environmental pollution caused through the disposal of untreated wastewater and faecal sludge is additionally increasing water competition, posing a serious hazard to public health. Safe water reuse could hereby significantly lower the pressure on freshwater resources, still cities in developing countries lack knowledge, tools and capacities to integrate reuse into the overall (waste)water and faecal sludge management. With a city-wide onsite coverage of 90% it is essential to understand prevailing attitudes and practises along the faecal sludge management chain in order to quantify the end-use potential. This issue has been addressed through a survey of around 1,200 households in Maputo conducted by a cooperation of the Technical University of Delft and the Water and Sanitation Programme of the World Bank.

Introduction

Fundamental knowledge about the overall situation of sanitation in Maputo was recently provided by the comprehensive study *Caracterização do Saneamento em Maputo*, conducted by the Water and Sanitation Programme of the World Bank (WSP, 2014). Faecal sludge (FS) has been defined as the "next sanitation challenge" (Strande, 2014) and according to the collected data by WSP, 54% of Maputo's FS waste-streams are neither treated, nor safely disposed or remain open in the direct surrounding of the population, posing a serious hazard to public as well as environmental health. Thus, for the case of Maputo, detailed data about coverage or accessibility of onsite facilities as well as insights into what happens to the content when the system fills up is hereby available and allows tracking the FS waste-streams.

Based on FS per capita production as well as FS waste flow-streams from comparable cities (Peal et al., 2014) it becomes very clear that only a small percentage of the originally produced FS in Maputo actually reaches the designated treatment facility. A large part of the volume is presumably lost either because the onsite system is not emptied at all or it is emptied by informal providers at which point it is equally lost for the rest of the faecal sludge management (FSM) service chain.

Furthermore, little is known about what influences if and how an onsite facility is emptied, hindering the implementation of effective measures to improve FSM. In general the expectations from the aforementioned WSP-study were that in Maputo only around 28% of the onsite facilities are filling up, whereby a lot of disparities could be expected between the different areas of the city, supposedly due to the variations of the ground water table and to disparities in socio-economic levels. Based on such factors users install different forms of onsite systems and decide differently on which services to request whenever building, emptying or replacing a system is necessary.

Depicted Figure 1 (WSP, 2014) shows that the further away from the city centre (south-eastern tip in the map) the more systems are emptied by informal emptiers – interestingly these are areas where pit latrines are predominant. A reason for this might be the increasing distance to the treatment plant, but a better explanation for what the causes might be is expected from the current households study.

Figure 1. Percentage of systems emptied by formal enterprises (*empresas*).

Source: WSP, 2014.
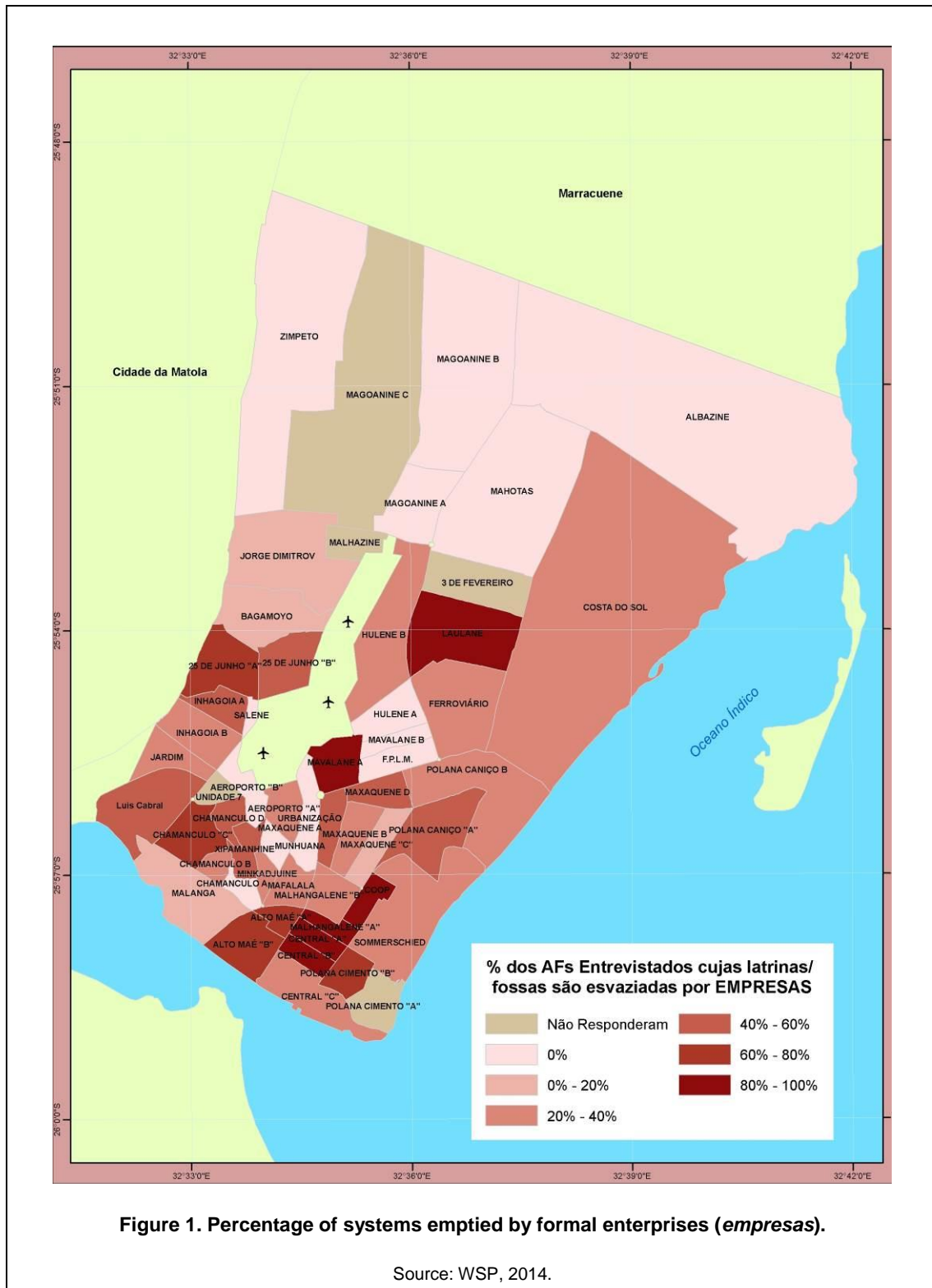
Objectives

In order to overcome this identified gap of knowledge by gaining a general understanding about the attitudes and practises with regard to the emptying of onsite systems, a household survey targeting around 1,200 households in all bairros (Portuguese for neighbourhoods) of Maputo was designed. The survey focused on

what influences the behaviour and conditions that lead to a certain form of emptying, than quantifying the actual FS-flow. The following research questions should be answered:

1. Which parameters determine if and how an onsite facility is emptied?
2. Who is responsible for organising the emptying process?
3. How is the emptying process paid for?

With detailed investigation of the factors leading to the decision if the onsite system is replaced or emptied in a formal or informal way, the compilation of a set of indicators, allowing to conclude on whether for example financial, social, spatial, habitual or other factors would influence this decision was planned.

The identified households were further aimed to serve for a long-term follow-up study on filling-rates of onsite systems and to gather empirical data on per capita production of FS for Maputo over several years.

Methodology and statistical approach

In order to collect information about attitudes and practises with regard to emptying, households were targeted where contents (excreta as well as infiltrating water) of onsite facilities actually fill up rather than infiltrate into the ground, so emptying would become necessary.

The chosen methodology was to randomly distribute GPS-coordinates for each *bairro* and to collect the required information from the first household where such a system could be identified as close as possible to the originally given point (Figure 2).

The overall representative amount was calculated based on the *Designing Household Survey Samples: Practical Guidelines* (United Nations, 2005) and resulted in an amount of 846 households with a 95% confidence-level. In perspective of the planned long-term study, this number was rounded up to 1,200 households as it can be expected that some of the households will be lost in due course of the process.

The *bairro*-specific percentage of how many systems can be expected to fill up was weighed together with the amount of population per *bairro*, distributing the points over entire Maputo, but being able to draw conclusions for each neighborhood and allowing to link the collected data to previously collected *bairro*-specific data.

Figure 2. Example of the maps showing the specific points per bairro.

Source: modified from Google Earth, December 2014.

Following a one-day pilot session the field-work was conducted by ten trained enumerators covering around 1,200 households in 44 *bairros* in 20 days, GPS as well as PDAs (Personal Digital Assistants) were used as survey tools. As the survey was also seen as a chance to control data which was collected during the aforementioned WSP-study (WSP, 2014), measuring tapes were provided to determine the size of the onsite facilities.

Preliminary conclusions and outlook

The household survey was successfully completed within the originally planned 20 working days. This time frame was chosen, based on experience from previous studies and allowed enough time to overcome arising – expected as well as unexpected – challenges.

As planned, the rainy season provided difficulties in accessing some of the flooded areas. A more than reasonable amount of this time further had to be dedicated to identify the households where information about upfilling systems could actually be collected. Also the determination of the size of the facility provided difficulties and enumerators had to be send back to the field to correct unrealistic values (Photograph 1).

**Photograph 1. Interviews, facility inspection and estimation of septic tank size
as part of the field work**

Source: Bäuerl, 2014

In due course of the data collection the assumption could already be drawn that the differences of attitudes and practises of emptying between the *bairros*, and thereby between the different socio-economic levels, are as significant as expected. Space-availability as well as the ability and interest to make long-term investments could hereby play an essential role. Overall, more systems were replaced than emptied, a practise people seem to prefer as long as space is available. More detailed data analysis of the collected information will hereby show whether or not this only has financial reasons and could further play a fundamental role as basis for decisions at which stage of the FSM service chain measures aiming to increase the overall collected FS volumes should be introduced.

The large variety in water-table levels further seems to play a significant role, already strongly influencing the decision which type of onsite facility is actually constructed.

An interesting aspect that arose during first analysis of the results is that people choose to empty or replace their system, not only depending on whether or not it is full, but that also smell seems to play a very strong role.

It is further surprising that far less people than originally expected seem to discharge greywater into their facilities while the infiltration of rainwater seems to be a huge problem, and apparently can lead to every-day emptying of some facilities during the rainy season.

Another positive surprise is that a large amount of people were already using their own toilet, while only a small percentage had to use shared facilities.

An interesting aspect that will further be looked into is how strongly neighbours and communities influence each other in the decisions of what to do once the system fills up and if sufficient knowledge about the possible formal emptying services is available.

As each investigated aspect is currently analysed, this provides the opportunity to check and link to previously collected values, and will hopefully also allow to conclude on the planned set of indicators that aim to explain why and at which filling-grade the decision for a certain form of emptying is made. This should further enable to find leverages and implement measures that support the utmost urgent need to safely separate the population from the waste streams. The analysis of these aspects will hereby be done *bairro*-specific, allowing to adapt neighbourhood specific measures.

With the overall expectation that Maputo's public and environmental health situation would significantly benefit from implementing measures related to end-use oriented FSM, further in-depth studies are planned by WSP and the data will also be used in the current *Sustainable freshwater supply in urbanizing Maputo, Mozambique* project lead by TU Delft, Unesco-IHE and the Mozambican University Eduardo Mondlane, funded by NOW, the Netherlands Organisation for Scientific Research.

A complete analysis of the results is expected in the upcoming weeks and will be shared with the WEDC community during the conference.

Acknowledgements

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