

Sustainable Sanitation Practice



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Public toilets in Vienna - Austria

**Sanitation as a Business -
Malawi**

**O&M in two public institutions -
Uganda**

**O&M system for UDDTs in
Nakuru - Kenya**

**O&M in rural settings affected
by conflicts - Uganda**

Operation & Maintenance

Successful Models for O&M of Sanitation Systems

partner of
sustainable
sanitation
alliance

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Sustainable Sanitation Practice (SSP) aims to make available high quality information on practical experiences with sustainable sanitation systems. For SSP a sanitation system is sustainable when it is not only economically viable, socially acceptable and technically and institutionally appropriate, but it should also protect the environment and the natural resources. SSP is therefore fully in line with SuSanA, the Sustainable Sanitation Alliance (www.susana.org). • SSP targets people that are interested in sustainable sanitation systems and the practical approach to it. • Articles are published after blind review only. • Sustainable Sanitation Practice is published quarterly. It is available for free on www.ecosan.at/ssp.

Sustainable Sanitation Practice (SSP) hat zum Ziel praxisrelevante Information in hoher Qualität im Zusammenhang mit „sustainable sanitation“ bereit zu stellen. „sustainable“ also nachhaltig ist ein Sanitärsystem für SSP wenn es wirtschaftlich machbar, soziokulturell akzeptiert, technisch als auch institutionell angemessen ist und die Umwelt und deren Ressourcen schützt. Diese Ansicht harmoniert mit SuSanA, the Sustainable Sanitation Alliance (www.susana.org). • SSP richtet sich an Personen, die sich für die praktische Umsetzung von „sustainable sanitation“ interessieren. • Artikel werden nur nach einer Begutachtung veröffentlicht. • Sustainable Sanitation Practice erscheint vierteljährlich, kostenlos unter: www.ecosan.at/ssp.

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Medieninhaber: EcoSan Club, Schopenhauerstr. 15/8, A-1180 Vienna, Austria • Obmann: Günter Langergraber • Gegenstand des Vereins: Der EcoSan Club wurde 2002 als gemeinnütziger Verein von einer Gruppe von Personen gegründet, die in Forschung, Entwicklung, Planung und Beratung in der Siedlungshygiene - Sammlung, Behandlung oder Beseitigung flüssiger und fester Abfälle aus Siedlungen - tätig waren und sind. Das Ziel des EcoSan Clubs ist die Umsetzung kreislaforientierter Siedlungshygienekonzepte (EcoSan Konzepte) zu fördern, um einen Beitrag zum Schutz der Umwelt zu leisten.

Cover Photo / Titelbild

Elke Müllegger

Editorial

The second issue of Sustainable *Sanitation Practice (SSP)* focuses on "**Successful models for operation and maintenance of sanitation systems**". This is for a very simple reason: the neglecting of operation and maintenance (O&M) for sanitation systems in practice. Especially in developing countries, O&M of decentralised sanitation systems is neglected to a great extent. One of the reasons is that most projects aim on construction of hardware, which is simpler and less time consuming. Especially donor financed programmes end after a certain period, leaving behind nicely constructed infrastructure, but rarely a developed strategy of O&M of the systems.

Examples of different approaches and experiences of O&M in practise are shown. Four articles describe O&M systems in Africa and one paper focuses on public toilets in Austria. Especially the contributions from Kenya, Uganda and Malawi have one thing in common: They are still "insular-projects", which are at the very beginning to be taken up. We hope that the importance of O&M will be widely recognised in future and the "white elephants" disappear completely in the sanitation sector.

The planning for the next issues is already in progress, the following topics are planned:

- Issue 3: "Use of urine" (April 2010)
- Issue 4: "The ROSA project" (July 2010).
- Issue 5: "Sanitation as a business" (October 2010).
- Issue 6: "Toilets" (January 2011).

We would like to invite all interested persons to contribute articles to SSP, be available as reviewers and/or suggest topics for future issues. If you are interested and want to contribute please contact the responsible person for the SSP editorial office, Ms. Isabelle Pavese (ssp@ecosan.at), for further details. We think that only with this participatory approach it will be possible to target the content of SSP towards the expectations of the readers.

SSP is available online from the journal homepage at the EcoSan Club website (www.ecosan.at/SSP) from free. We do hope that SSP will be frequently downloaded and further distributed to interested people.

With best regards,
Günter Langergraber, Markus Lechner, Elke Müllegger
EcoSan Club Austria (www.ecosan.at/ssp)

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Public toilets in Vienna: Operation between cost efficiency and service for the public

The keys to sustainable and therefore successful operation of public toilets are cleanliness and accessibility, unfortunately in most cases these qualities cannot be found easily.

Author: N. Kläsener-Metzner

Abstract

This article reviews the status quo of public toilet facilities in Vienna. Specifically it deals with the 2004 recommendations of the municipal auditor concerning the closing of low-frequented facilities, which are subject to a high degree of not-intended use and the questions regarding the consequences of their closing, that were subsequently raised. This article explores, if employing sustainable operation and maintenance methods in public toilets in Vienna could prevent the closing of the relevant public toilet facilities or if other changes are necessary.

Administration of public toilets in Vienna

Statistics

The public toilets of Vienna are under the administration of Municipal Department 48 – Waste Management, Street Cleaning and Vehicle Fleet. According to their homepage “waste prevention and separation ... are the central goals of the municipal department.” (<http://www.wien.gv.at/umwelt/ma48/>)

In the context of public toilets they are responsible for the development, construction, management, operation and maintenance of the buildings and structures, as well as the continuous monitoring of



Figure 1: The famous Wilhelm Beetz Jugendstil facilities at Graben 1st district



Figure 2: Public toilet facilities with cleaning personnel, 1st district

Key factors for successful O&M of public toilet facilities are:

- Hard keys:
- good cleaning system and materials have to be easy to clean
 - equipment has to have a high tolerance against vandalism
- Soft keys:
- promotion of the social acceptability of public toilet facilities, to encourage social acceptable behaviour amongst the users, resulting in less waste, dirt and vandalism

Public toilets of Vienna:

- flush toilets (6 litres limit , some old models with a higher consumption rate)
- water-flushed urinals
- waterless urinals (using membrane technology, some models use sealing liquid)
- handicapped accessible flush toilets
- hand washing facilities (no-touch with faucets with flow restrictor, some old models different)
- septic tanks (for facilities at the Donauinsel, recreational area of Vienna)

technical functions. In 2004 the Municipal Department had 7 relevant staff members responsible for 327 public toilet facilities. Each district council is responsible for the allocation of the annual budget to individual public toilet facilities in their respective district. (Figure 1 and Figure 2)

The official website of the city of Vienna includes a list of public toilet facilities (Table 1), indexed by districts, that also shows which of the facilities is handicapped accessible, closed, under construction, etc. and how to find them.

The facilities are divided into 5 categories:

- facilities with handicapped accessible stalls and cleaning personnel
- facilities with handicapped accessible stalls
- facilities with cleaning personnel
- public toilet facilities
- urinals

Table 1: Distribution of the facilities in the Vienna districts 2004

| District | Public toilet facilities with personnel | Public toilet without personnel | Population per 31.03.2004 | Inhabitants per facility |
|----------|---|---------------------------------|---------------------------|--------------------------|
| 1. | 5 | 12 | 17.774 | 1.046 |
| 2. | 24 | 2 | 93.586 | 3.599 |
| 3. | 11 | 1 | 85.078 | 7.090 |
| 4. | 3 | 1 | 29.673 | 7.418 |
| 5. | 8 | 0 | 51.561 | 6.445 |
| 6. | 6 | 4 | 29.104 | 2.910 |
| 7. | 7 | 1 | 29.146 | 3.643 |
| 8. | 2 | 0 | 23.123 | 11.562 |
| 9. | 9 | 1 | 39.141 | 3.914 |
| 10. | 13 | 2 | 160.956 | 10.730 |
| 11. | 5 | 3 | 81.627 | 10.203 |
| 12. | 6 | 3 | 83.158 | 9.240 |
| 13. | 11 | 0 | 51.312 | 4.665 |
| 14. | 11 | 1 | 81.131 | 6.761 |
| 15. | 5 | 1 | 69.142 | 11.524 |
| 16. | 15 | 0 | 90.465 | 6.031 |
| 17. | 7 | 0 | 51.263 | 7.323 |
| 18. | 9 | 0 | 46.622 | 5.180 |
| 19. | 17 | 0 | 67.204 | 3.953 |
| 20. | 12 | 0 | 80.710 | 6.726 |
| 21. | 34 | 2 | 134.522 | 3.737 |
| 22. | 50 | 1 | 143.688 | 2.817 |
| 23. | 22 | 0 | 87.187 | 3.963 |
| Sum | 292 | 35 | 1.627.173 | 4.976 |

In 2004 the municipal auditor of the city of Vienna published the until today most up-to-date report (Kontrollamt, 2004): "MA 48, assessment of the behaviour in the context of the operation of public toilet facilities." The goal of this report was to evaluate the necessity of each public toilet facility and the possibility of closing them down. Between this report and 2009 26 facilities have been closed, without any alternate facilities being constructed. The facilities, which were closed were more or less evenly distributed across the entire greater municipal area. The initial uneven distribution of public toilets to the districts of Vienna follows the typical pattern of preferred locations; close to touristic attractions, in parks and recreational areas and along subway lines, i.e. in public transport stations. Of the 327 facilities in 2004, 76 are located at public transport stations, 51 in the recreational area Donauinsel and 29 close to market areas. In October 2009 the "Bezirksjournal", a Viennese local newspaper, started a survey among the inhabitants of the 4th district, if they would need more public toilet facilities in their district. A clear majority of 92 % answered with "yes we would need more public toilet facilities", not a surprising result. (Heine, 2009a, 2009b)

Running and irregular costs for public toilets

The report of the municipal auditor differentiates between facilities with and without attendants. 89 % of the existing facilities do not have attendants (292 facilities), which also means, that their usage is free of any charges, while some users of facilities with attendants have to pay for the service (Kontrollamt, 2004). These are mainly highly frequented facilities close to touristic attractions and historical facilities. Charges are only imposed on the usage of stalls.

The usage of urinals is free, whether there is an attendant or not. This automatically leads to discrimination against female users, since they do not have an alternative to using a stall. The collected money is used to pay the wages of cleaning staff, which represent the largest part to the running costs. The percentages of energy related costs are relatively small. In the course of the past few years' changing from water-flushed urinals to waterless urinals could further reduce costs. (Kontrollamt, 2004) (Figure 3, Table 2)

Vandalism and not-intended use

If one compares the frequency of use to the costs for misuse it becomes evident that less frequented facilities are significantly more often subject to misuse, e.g. the use of the facilities for the purpose



Figure 3: The typical fee for the usage of public toilet facilities in Vienna is 50 Euro cents.

oft drug abuse or shelter. (Kontrollamt, 2004)
Table 3 presents the situation of public toilet facilities in relation to frequency of use and misuse.

One also has to take into account the standard of the equipment in the facilities, which are destroyed on a regular base. The most vulnerable are those equipped with porcelain toilets and urinals, due to the nature of the material. Others, which are equipped with stainless steel objects are not destroyed as often, but if they are, one could see that vandals actually are giving a lot of thought to their act of destruction, unscrewing screws,

lifting equipment out of its usual place before destroying it. Even though the MA 48 tries to implement equipment, which is designed to endure vandalism, this problem might only be solved with the introduction of social control through attending personnel.

Most stalls are equipped with mechanical counters for the number of users. On the basis of these numbers, the amount of water used, and general benchmark values the facilities were classified as high, medium or low frequented facilities, since the actual counting of users is not possible with justifiable means. The municipal auditor advised the closing of low frequented facilities, which are subject to a high degree of not-intended use. The main argument behind this recommendation was that only the designation of an attendant would improve the situation.

This recommendation of course raises a number of questions:

- Is the closing of public toilet facilities in the interest of the general public?
- If a municipal government is responsible for the provision of a functioning urban infrastructure should they be allowed to close down public toilets? Or are they such an integral part of a functioning city that they have to be accessible regardless of the expense to the annual municipal budget?
- What consequences does the closing have for various user groups?
- Should and can restaurants and cafes (e.g. McDonalds restaurants were named in the survey quite often) take on the provision of traditional public functions like the provision of

Table 2: Cost-sharing for public toilets (Kontrollamt, 2004)

| | 2001 in Mio. EUR excl. VAT | 2002 in Mio. EUR excl. VAT | 2003 in Mio. EUR excl. VAT |
|---|----------------------------|----------------------------|----------------------------|
| Running costs for cleaning | 1,88 | 1,91 | 1,84 |
| Energy related costs | 0,13 | 0,11 | 0,09 |
| Costs due to vandalism | 0,21 | 0,14 | 0,14 |
| Maintenance costs | 0,39 | 0,37 | 0,33 |
| Total expenditure | 3,23 | 3,26 | 3,26 |
| % of total expenditure for cleaning costs | 58,2 | 61,8 | 65,9 |

Table 3: Relation user frequency to not-intended use (a total of 321 facilities were included in the study)

| Frequency of utilization | Number of facilities with low/medium/high frequency of utilization | % of users frequenting public toilet facility | Costs occurring due to vandalism in % | Not-intended use in % |
|--------------------------|--|---|---------------------------------------|-----------------------|
| low | 97 | 30 | 64 | 71 |
| medium | 150 | 47 | 22 | 18 |
| high | 74 | 23 | 14 | 11 |
| Sum | 321 | 100 | 100 | 100 |

public toilets? (Klaesener-Metzner, 2010) And what happens to user groups, which are not necessarily always granted access to private properties like restaurants and cafes or those who are unable to access them for various reasons?

The official comment of the municipal department MA48 on the report of the municipal auditor was that the MA 48 is going to work towards solutions for each single facility on the basis of the recommendation of the municipal auditor as well as their statistical data. The result, until today, was the closing of 26 facilities (2004 – 2009)

Operation and maintenance

Good toilets are based on good design and availability as much as they are on good management and maintenance. (Greed, 2003, Gersherson and Penner, 2009) The third pillar are social factors like: education of users, training of cleaners and attendants and cultural change in societal attitude towards the topic of (public) toilets. (Klaesener-Metzner, 2010)

In Vienna only about 11 % of the existing public toilet facilities are operated on an everyday base by attending personnel. These are mainly those close to touristic attractions. Virtually none of them are open everyday all year-round. The municipal department MA48 outsourced the cleaning to private companies. The public toilets inside of public transport stations are cleaned through personnel of the public transport company (Wiener Linien).

The cleaning routine consists of: emptying the waste bins, cleaning the facilities (equipment, floors, walls, etc.), re-stocking hygienic articles (soap, toilet paper) and monitoring the functions of the equipment (incl. reporting malfunctions). In some of the newer facilities the cleaning personnel can use their "Clean Handy", with which they can test, block or delay the flushing, while e.g. cleaning water-flush urinals, which operate with a movement sensor (MA48, 2009).

During highly frequented times, e.g. during an event close to the toilet facility (a significant amount of facilities are close to public places, which attract visitors for various reasons, tourists, people demonstrating, waiting in lines), cleaning personnel have the task of cleaning the toilets after each use. This means that the seat must be wiped, the availability of toilet paper has to be checked and the toilet has to be flushed, regardless if the previous user has already done

this. Considering 6 liters per flush and e.g. 200 users per day this are 1.200 litres of unnecessarily flushed water per event day, just to give users the feeling of well maintained, which in this case equals clean, toilets. Since Austria is a water-rich country and the Viennese sewer system is working properly this is not of major concern to the operators.

Apart from regular operations, maintenance work due to misuse and vandalism is necessary. As mentioned before these activities account for a significant part of the budget and are the reason for a significant number of closures of public toilets worldwide. This can be seen and is the topic of various studies all over Europe. (e.g. Greed in the U.K., Hafencity University Hamburg in Germany, Klaesener-Metzner in Austria) (Greed, 2003, Pinto, 2009)

Public toilets are a particular type of public space, since they are a space in which not only a very private need can be fulfilled. But it is a room in public, which is withdrawn from social control, in that it is blocked from sight, i.e. hiding what people really do in "there". This lack of social control seems to encourage a kind of behaviour, which would not be engaged in plain sight. The seclusion, or privacy of the stalls seems to encourage drug misuse; apathy washing ones hands if there is no one else at the hand washbasin... why wash your hands?

Keeping this in mind, as well as the fact, that public toilets are an integral part of public life in metropolitan areas, they have to be treated in accordance with their specific requirements. Even though, nowadays, great value is placed on having a "personal" facility, a personal mobile toilet for everyone living in the city remains impossible. The She-Pee (<http://www.pmatestore.co.uk/>) will not substitute the public toilet, like the mobile phone substituted telephone booths. But the product aims to give something to its potential users, which public toilets often enough cannot provide: accessibility and cleanliness. Therefore it might make a good addition to what should be provided within the city. It should not be the goal though, that women have to take care of their needs on a private base, while men are provided with a free municipal service. This would drive us away from equality further, instead of bringing gender equality into the public facilities.

Gender mainstreaming is a topic, which is included into the design of new public toilet facilities in Vienna (<http://www.wien.gv.at/menschen/>). This approach includes:

- well-lit entrances, which are easy to find and on display,
- good lighting in the toilet rooms,
- maintenance personnel will be on site to ensure regular cleaning and security through the personnel's presence,
- a larger number of cubicles for women is needed, and
- changing tables should be available not only in women's toilets.

Previously, women and men stalls were built in approximately the same number. If the urinals are taken into account, this results in a much larger offering of toilets for men than for women, resulting in the well known long queues in front of women's facilities compared to those in front of men's facilities. The inclusion of changing tables into men's facilities mirrors the changing society where finally, not only women care for small children. Those standards are valid for new facilities, which only account for a small fraction of the public toilets, until now 2 facilities are building according to these standards. Therefore the unequal distribution will continue to be present in a foreseeable future.



Figure 4: Women queuing in front of public toilet facilities, while men just walk in, a typical sight in everyday life

Conclusions

There is not any one single perfect solution related to the successful operation and maintenance of public toilets, since solutions always depend on the cultural and societal background of the various users.

Since studies show that clean toilets are much less subjected to misuse and destruction, and therefore much less subject to closures, the focus should be on solutions, which encourage socially acceptable behaviour, and lead to pollution abatement. Everyone knows the feeling of using something for the first time or after it has been cleaned, an item not contaminated by dirt is handled with more care than the same, dirty one. The more valuable this item is to us, the more careful we use it. Following this observation fashionable design could be a possible solution to achieve the goal of well-maintained toilets, e.g. a colourful, designer public toilet. Unfortunately, the state of some nightclub toilets proves this hypothesis wrong. Even though interior designers gave quite some thought to their looks, they are still a dirty mess at the end of every party evening. Such a party night could be considered the equivalent of a day full of heavy use for public toilets, which have to cope with an even more diverse clientele, which seems to care even less about the state of the toilet, when leaving it. This should not discourage planners to give special attention to design aspects, which are not purely functional. A colour, which helps brighten up the room, will certainly make a small, but maybe for some users substantial, difference.

Observations also show that users treat toilets, which are cleaned after each use, with more respect. The factor of social control plays a mayor role in this. If it is clear who the culprit is who messed the toilet up, users tend to care more. Unfortunately 100 % coverage of the city with public toilets with attendants is far from realistic, if one considers the municipal budget. Some cities have started building self-cleaning cubicles, which disinfect the whole cubicle after the user. Advertising, integrated newsstands, information booths and so on, often cover high acquisition costs of those high-tech toilets. Concepts like this are opportunities; making toilets integrated parts of public transportation and commercial facilities may make them more accessible to the general public that need them. Similar concepts of combining different functions, within public toilet buildings can be found in urban areas all over the world. The combination of public toilets with other public facilities, which can not be found in large

numbers or not at all in the city at the moment, like drug centres, street worker facilities, etc., might also lead to less misuse of the toilet facilities.

Public toilets play a vital role in a municipal environment. If they are not accessible, the general public faces consequences, from very personal bodily ones, to economic damages, due to declining numbers of tourists. Everyone sometimes is in the situation to need a toilet and not have his or her private one at hand. If we are in a foreign country, on our way to work or shopping, does not matter, when this important personal need becomes urgent. Not providing public toilet facilities in a municipal area would be discrimination against potential users. Unfortunately the limit for a possible commitment of public authorities is the respective budget. The higher costs for operation and maintenance the higher the probability of closures. Since some of those costs are directly related to user behaviour, we as potential users should start to take some responsibility too.

In the end having public toilets that are clean and accessible may not only be a question of proper operation and maintenance, but also of behavioural change of their users.

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Sanitation as a Business: A new spin on the challenge of sanitation Operation and Maintenance

This paper describes Sanitation as a Business, an innovative approach to operation and maintenance challenges in household sanitation improvements.

Author: S. Bramley, E. Breslin

Abstract

Sanitation as a Business is a new program Water For People has tested in Malawi. The ideas behind this alternative to traditional sanitation programs are innovative and stem from a simple truth: We do not have the money or human capacity available to build everyone who lacks improved sanitation a latrine. More importantly, programs that build latrines consistently struggle to have impact or reach scale, and often distort the market environment in ways that undermine future sanitation development. *Sanitation as a Business* tries to shift sanitation programming by changing the incentives and bringing the private sector into sanitation in new ways. The key to *Sanitation as a Business* is to make ongoing sanitation services the goal, rather than the latrine itself. When sanitation services are profitable and businesses see everyone without a latrine as a potential customer, businesses—rather than NGOs—will expand latrine coverage to increase their profit margin.

The problem

There is not enough charitable funding in the world to provide latrines to everyone who needs them, and experience tells us that even if we could give away enough latrines, economic, social, and health outcomes likely wouldn't improve. Sanitation is not a simple "give them a latrine and they will use it" challenge. Thus, the world needs a new way of thinking about sanitation delivery.

The 2008 Joint Monitoring Program (JMP) from WHO and UNICEF reports that since 1990, the percentage of the global populations without access to improved sanitation has decreased by only eight percentage points. The JMP suggests that the world won't even achieve half of the Millennium Development Goal for sanitation at current rates of installation and consequently is projected to miss the sanitation MDG by more than 700 million people (WHO and UNICEF, 2008).

Twenty-two percent of those without access to improved sanitation—more than half a billion people—live in sub-Saharan Africa while the greatest challenge remains in Asia and India in particular.

The reasons for the global struggle to address sanitation are increasingly clear. Some argue that sanitation is the unpopular cousin of water supply, and that investments, interest and motivation to transform the sanitation sector are lacking. Others point out that subsidized sanitation (free or discounted latrines) distorts markets, has yet to demonstrate success at scale, and has not expanded coverage once subsidies are removed (in fact, most subsidized initiatives completely collapse as the subsidy is withdrawn). Projects that rely on demonstration latrines to inspire, motivate, and convince community members are particularly ineffective. Loan-financed sanitation support has shown some promise in parts of the world but has generally been uninspiring in Africa

Key factors for successful O&M through Sanitation as a Business include:

- An ongoing relationship between the sanitation entrepreneur and the household
- Sanitation businesses should provide services that are needed on a regular basis (like pit emptying) rather than once-off services (like latrine construction)
- Entrepreneurs need seed capital to get their businesses started. Success will be understood by the private sector reinvesting profits into new latrines, thus expanding coverage without donor finance

and Latin America, and even places where loan finance has shown some promise (like India) often fails to really grow beyond small-scale successes. Sanitation Markets (SaniMarts) offer a passive private sector response to sanitation delivery, and social marketing initiatives show promise but not scale as of yet. Community-Led Total Sanitation has energized the sector for all the right reasons but the failure of this initiative to monitor its work effectively has undermined its potential.

Water For People has tried all of these approaches with some successes but more failures, since we measure the potential of rolling sanitation out at scale. As such, we are exploring a new and different approach. Instead of thinking of latrines as the ultimate goal of a sanitation program, we are thinking of sanitation as a service where profits can be reinvested to expand latrine coverage. Rather than seeing a once-off delivery of latrines that might or might not be used, we are trying to uncover financial incentives for both entrepreneurs and households so that everyone in the systems has a financial stake in successful, ongoing latrine operation and maintenance.

We are seeing the possibility for greater success from this approach, known as *Sanitation as a Business*. In this alternative to traditional sanitation programs, small, loan-inspired investments in improved sanitation could lead to dramatic sanitation expansion by trying to find ways to make sanitation a service between entrepreneurs and households, rather than a once-off delivery of a latrine.

What is *Sanitation as a Business*?

Sanitation as a Business is simple—we identify ways for the private sector to generate income from developing on-going relations with households through sanitation services, and realize that they will gain more income by finding new clients with sanitation services, thus expanding coverage. We are finding creative ways to achieve this pro-business service relationship through the use of ecological sanitation and the sale of compost, as well as support to innovative pit emptying services in cities. As such, households are incentivized to use their latrines as designed, and businesses are incentivized to provide high-quality maintenance to their clients.

Water For People, an international development organization with programs in Latin America, Africa, and India, has learned from its past challenges with providing access to sanitation. Water For People is shifting from traditional, subsidy-driven sanitation approaches to a more

business-driven model. This transformation is important, as Water For People's monitoring data consistently show that our application of traditional sanitation models will not lead to scalable sanitation solutions.

The key to the *Sanitation as a Business* model is to redefine the relationship between private sector builders and households. Conventional sanitation programs (subsidized, loan-financed, and advanced forms of Community-Led Total Sanitation) all suffer from a programmatic approach where the sanitation entrepreneur (usually a mason) has a one-off relationship with a household. The household accesses a mason (whose job is to build a latrine, but is not necessarily entrepreneurial in finding business opportunity), the mason builds the latrine, and then they have no further contact. Great energy is spent on training masons whose future is limited: Once families have latrines there is no further need for the mason. He or she will build as many latrines as will keep him or her busy but eventually business dries up and the opportunity costs and incentives associated with expanding the mason's clients become prohibitive. The mason eventually gives up as the market is saturated—there are too few households requesting his or her services to make the work worthwhile.

Sanitation as a Business attacks this problem by trying to understand and develop an on-going relationship between entrepreneurs and households. This relationship allows, at a minimum, a profit-making opportunity for continued and effective services provided by entrepreneurs. In the best-case scenario, the relationship provides a situation where both the household and the entrepreneur realize financial opportunities from sanitation.

The key to this program is to identify ways in which sanitation is expanded because it is provided as an ongoing service between service providers and households rather than a once-off transaction between a mason and a family around a latrine. Water For People has tried two options:

1. Using latrines as a tool to access composted feces and urine, which has market value and can be a source of finance for entrepreneurs. At scale, compost can be sold to large-scale entities such as large-scale commercial farms and commercial fertilizer companies. The incentive is to get more customers producing compost, which means more families using latrines
2. Establishing desludging services so that families receive a latrine and have to pay

businesses to regularly clean these latrines. The key is the desludging business and the fees earned from those services. The latrines are simply a means to that end, but the end result is, again, greater and sustained coverage as all people are potential customers, rather than once-off beneficiaries of latrines

Sanitation as a Business in Malawi

The *Sanitation as a Business* program in Malawi, begins by developing demand for composting latrines.

Composting latrines transform human excreta into safe compost that can then be used as fertilizer and enhance agricultural production. The *Sanitation as a Business* program model works with two types of composting latrines.

The first, called a Fossa Alterna, is a double-pitted, shallow latrine. Household members use one pit at a time. When the first pit is full, the pit is covered and left to transform into compost while the family uses the second pit for their sanitary needs. The first pit is dug out when the family has filled the second pit, the second pit is covered, and the process begins again. Families alternate between pits: One is used for human excrement while the other is covered and transforms the contents into useable compost. Fossa Alterna latrines are not urine-diverting (i.e. all human excrement goes in the same hole) and so take longer to dry, but produce higher-quality fertilizer because it is full of nitrates from urine. Our experience is that Fossa Alterna latrines are generally more acceptable to families than urine diversion because household members use them just as they would a traditional pit latrine.

The second type of composting latrine offered to households in this program is a “sky loo,” which is a composting latrine where the pits are constructed above ground (most often implemented in areas with high water tables or in places where this latrine is chosen by households because it is more “modern”). Sky loos can either be urine-diverting or not. A formal seat is installed in the urine diversion model with a divider. Human feces fall into one hole while urine is diverted into a smaller hole at the front of the latrine seat and collected separately, often in a jerry can, or into a French Drain (or soak-away pit) when the family does not want to manage the urine. Feces dry more quickly in urine-diverting latrines than in non-urine-diverting latrines, but the compost produced, while still high-quality, is less nutrient-rich. In a urine diversion model, the urine can be

removed from the latrine, diluted, and used to add nutrients to soil or as a pesticide. Feces are stored in the latrine chamber and dried/composted over time. The composted feces are removed from the sky loo through a door in the back of the latrine. Sky loos are often more expensive to construct than Fossa Alterna latrines because of the additional cost of construction materials necessary to create the sub-structure.

This particular *Sanitation as a Business* model is premised on the assumption that composted human feces and urine are valuable and sellable commodities, and that sanitation services can be developed that ensure an on-going relationship between families and entrepreneurs that is mutually beneficial, mutually profitable and where the entrepreneur has a clear incentive to extend services to new families as this is a vehicle for further profit. The entrepreneur has a significant incentive to seek out new clients as he or she maintains existing relationships, thus meeting sector goals of expanding sanitation coverage.

This program is new and different than other sanitation programs because the entrepreneur no longer looks at the NGO or donor as the client—a cornerstone of conventional sanitation initiatives—but rather, correctly sees every household without improved sanitation as a customer. Likewise, households don’t look to the NGO or donor to keep their latrines functional—but rather, correctly see the sanitation entrepreneur as the one providing a valuable service.

This new program is promising because it is in many respects not about sanitation. Rather, it is about profit and services, using sanitation as a vehicle for business development. As such, operation and maintenance, is the heart of the program: Businesses that offer high-quality service are the ones that make higher profits and are able to grow. Businesses where service is lacking go out of business, and households look to competitors to get their service needs met.

The rural Malawian application of *Sanitation as a Business* starts with families purchasing composting latrines on loan from the sanitation entrepreneur. Household members do not receive cash. Rather the sanitation entrepreneur installs the composting latrine. The sanitation entrepreneur organizes transportation as part of the business and collects the compost from the latrines after it is safe to handle as repayment on the loan. In the rural Malawian example, tests have shown there not to be need for secondary treatment; however, an entrepreneur could add

that if it were needed. The sanitation entrepreneur sells the compost to a local fertilizer buyer or farmer and thereby makes a profit, which pays for the investment in households as well as supports operating costs. With each collection of compost, the household works down its debt to the sanitation entrepreneur.

Once the latrine is fully paid for, the household continues its relationship with the sanitation entrepreneur and, most importantly, receives a small payment for their compost, thereby encouraging the household to continue to use the latrine appropriately. Families, therefore, make money by using their latrine. The sanitation entrepreneur continues to sell the compost, builds a customer base and, in the case of Malawi, creates the potential for large-scale bulk sales to private fertilizer companies. The fertilizer companies respond to the eventual volume that is created. Alternately, the sanitation entrepreneur helps develop a competitive internal market for compost. The sanitation entrepreneur wants to attract large-scale buyers and thus needs to find new customers. As there is profit to be made, the sanitation entrepreneur has incentive to continue his or her compost collection service to the household, and the household has incentive to continue to produce high-quality compost by operating and maintaining their Composting latrine well so that they will receive regular small payments.

A depiction of the model is provided in Figure 1. Other models using this basic concept are also being considered. There are opportunities to apply

this work in schools and at public places like taxi ranks. Water For People is supporting such work in Rwanda and has found that entrepreneurs may see possibilities for income generation using composting latrines at schools and taxi ranks because of the potential volume of income and compost. (Water For People’s work in Rwanda is just beginning but has promise.)

Water For People has developed a similar framework in Blantyre, Malawi around desludging services that does not include composting latrines. In this model, families receive a latrine from an entrepreneur and sign a contract with that entrepreneur for desludging services, which the household will pay for. The entrepreneur has a relationship with that client that ensures regular interaction. The incentive is such that the entrepreneur can make more money by not only providing affordable and high-quality service to the existing families in the entrepreneur’s network, but by expanding the network of clients to households without sanitation facilities.

Since the beginning of the program in 2008, sanitation entrepreneurs in Malawi have developed ongoing maintenance relationships with households to service over 1,000 latrines. Since that time, sanitation entrepreneurs have emptied more than 500 composting latrines, collecting 500 50-kg bags of fertilizer. So far, sanitation entrepreneurs have sold nearly 370 bags of fertilizer. Further cost-benefit analysis is needed to better understand the price of fertilizer needed in order to profit from the sales.

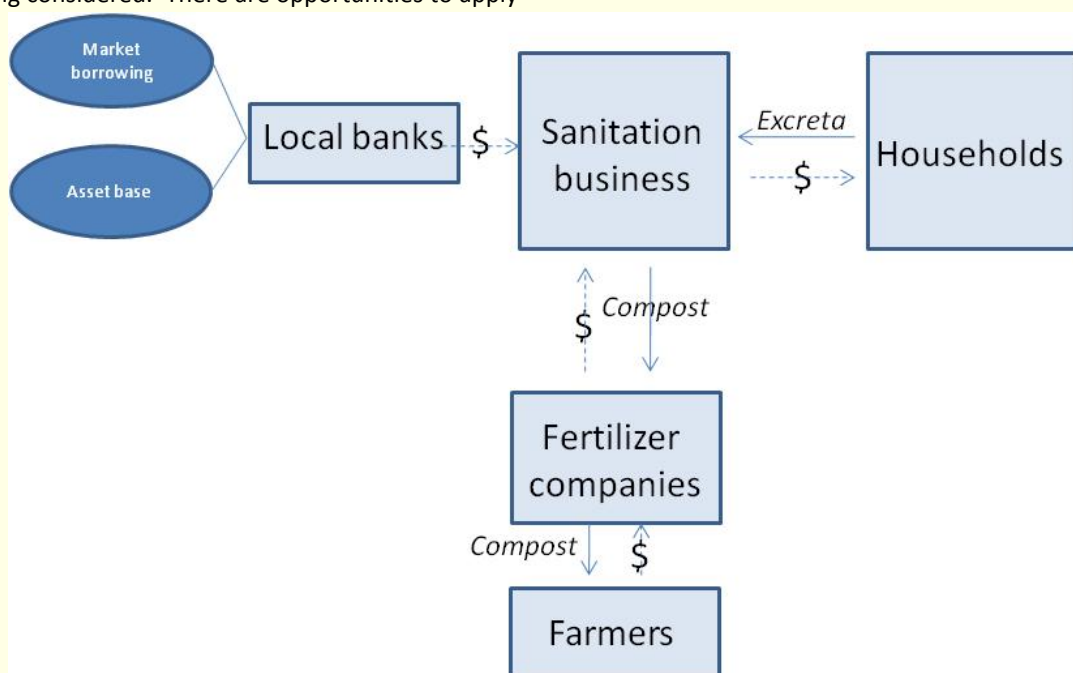


Figure 1. Diagram of the rural *Sanitation as a Business* model in Malawi.

Water For People is trying to help sanitation entrepreneurs build a market for 50-kg bags of fertilizer at a price that will sustain sanitation businesses. This market building is being done in a number of ways:

1. A chemical analysis of compost has been completed. The compost was considerably richer in nutrient value than the soil that people plant in at present, which was to be expected.
2. The development of a series of demonstration plots that show that human compost is more effective for agricultural production than commercial fertilizers, rain-fed agriculture without fertilizers, and fields with animal feces as the fertilizer (goat and cow).
3. The development of advertising campaigns and marketing to promote the compost as a valuable product. The goal is to demonstrate that the compost is a viable but cheaper alternative to commercial fertilizers.
4. Experimenting with chemical additives and animal fertilizers to increase the nutrient content of latrine compost, and thus make it more valuable. Similarly, Sanitation entrepreneurs believe that the value of the compost could be dramatically improved if made into more manageable pellets

To further stimulate the fertilizer market, in one rural area, Water For People bought eight bags of compost. Shortly thereafter, one of the sanitation entrepreneurs made a deal with Hope Village Project, an orphanage with an agriculture project that supports orphans, to sell 40 50-kg of compost. Hope Village will use the bags as a test run, and if the results are good is willing to pay more for the compost in the future. Other compost buyers, to date, include the Blantyre City Assembly, which is buying compost for their landscape contractors and at least two tree nurseries.

Recommendations

- Think like a business: Sanitation as a Business gets beyond selling slabs and relying on NGOs to train every mason. As such, it's critical that sanitation entrepreneurs develop business plans that will make for viable businesses. The type of technology matters less than the service that the entrepreneur is providing, and that that service model earns the entrepreneur enough money to sustain the business. For example, shallow pit latrines will need to be emptied more frequently than deep ones, thus allowing for regular cash flow in the business.

- Know your market: Sanitation as a Business relies on there being a market for ongoing service. It is recommended that sanitation entrepreneurs access market analyses to know what types of services their customers would like, what fertilizers sells for (in the case of composting latrines), how much customers are able to pay, and how many potential customers are within reach of the business.
- Get out of the way: There is a tendency for businesses to look back to the NGO for further support. If the business is set up properly, there will be no reason for the entrepreneur to look to the NGO for additional funding. If the entrepreneur isn't making enough money to maintain his or her service contracts, then the business model is flawed and needs to be adjusted.

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Operation and Maintenance of sanitation systems in two public institutions: Experiences from Uganda

The O&M of sanitation systems in two Ugandan institutions works sustainably because the stakeholders were involved in the planning and decision making and are benefitting from the introduction of the sanitation systems.

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Abstract

In this article two examples of resource-oriented sanitation systems in Ugandan institutions are presented. The implementation of these systems led to an improvement of the sanitation situation in these institutions; the human waste is now safely disposed of and reused. In the Kalungu Girls Secondary School pupils are responsible for operating the urine diverting dry toilets. In the Maracha Hospital three attendants are employed to operate the sanitation system. Both institutions are gaining an extra benefit by selling the compost (Maracha) or using it in the own gardens (Kalungu).

Introduction and Background

Good sanitation in schools is crucial for the well being and school performance of children. It directly benefits a vulnerable segment of the population, communicates public health concerns to the community and lay the foundation to sustain demand for improved sanitation (Rwamwanja, 2009).

In Uganda almost all schools do not meet the minimum school standards on sanitation and hygiene (Ministry of Education and Sports, 2006). Only 72% provide separate facilities for boys and girls, and over a quarter offered shared facilities. The lack of separated facilities is a big factor for the high drop out rate of female teenage students. On average, 69 students shares one toilet, which are often in defective condition (Ministry of Water and Environment, 2007).

The safe disposal and reuse of human waste is also

essential in institutions like health centres and hospitals.

Materials and Methods

Kalungu Girls Secondary School

The boarding school of the “Sacred Heart Sisters” is located in the hilly areas of Masaka District, Southwest of Kampala near the town Masaka. The school is located near Kalungu, a small rural village, surrounded by farm land. Around 450 girls between 14 and 18 years are attending the school and about 50 teachers and sisters are employed while the latter are either in the school’s administration and/or teachers. Further staffs are responsible for diverse house keeping duties, like O&M of the toilets, gardening, animal keeping, etc.

After preparing a feasibility study, various meetings with the school administration and a workshop with the teachers, the water and sanitation infrastructure was improved sustainably

Key factors for sustainable O&M systems:

- Responsibilities for O&M were clearly defined right from the beginning.
- Both institutions see the benefit of the systems and are gaining extra income.
- All stakeholders were involved in the planning from the beginning of the project; critical design decisions were made by the users.
- Before and during construction of the sanitation system, users were sensitized and trained.
- In Kalungu teachers and students use the same type of toilets and the teaching personnel is convinced of this new technology.



Figure 2. Urine diverting dry toilets in Kalungu Girls Secondary. School.

in 2003. The implemented system consists of: 45 single vault urine diverting dry toilets (UDDTs) for the pupils (Figure 1), a UDDT for teachers, which also serves as demonstration unit for visitors, a drying / composting area for further dehydration of faeces, a horizontal sub-surface flow constructed wetland for greywater and blackwater treatment as well as rehabilitation of the water supply system. A detailed description of the system is available on the SuSanA website (SuSanA, 2008).

Maracha Hospital

In Maracha, a small trading centre in the Northwest of Uganda, near the borders of Sudan and Congo, the Arua Catholic Diocese operates a small rural hospital. It has a bed capacity of 200 patients and about 150 employees.



Figure 1: Urine diverting dry toilets in Maracha Hospital.

The sanitation infrastructure was rehabilitated in 2001/2002 with single vault urine diverting dry toilets (Figure 2) for the hospital staff (two blocks with 8 toilets each), a drying / composting area for faeces and sludge, a vertical-flow constructed wetland system with filter baskets as pre-treatment for black- and greywater and a low cost incinerator for medical waste.

are emptied after every school term (every three months).

Urine from the pupils' toilets is either led to an underground tank, which is situated behind the toilets, or to soak pits for infiltration into the ground. The four soak pits are next to the toilets. Urine from the teachers' / demonstration toilet is collected in 20l jerry cans (Figure 3). This unit is additionally equipped with a waterless urinal.

Greywater and some blackwater from two flush toilets from the sisters' house, is collected via

Results and Discussion

O&M strategy in Kalungu

Collection and storage / pre-treatment

Faeces, ash and toilet paper from the pupils' as well as from the teachers' toilet are collected in wooden containers (Figure 3) located in the dehydration chambers underneath the squatting pan. These containers

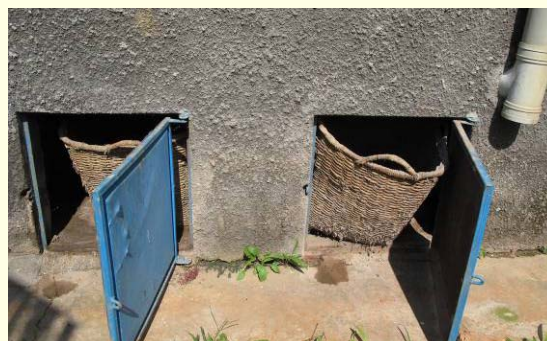


Figure 3: Wooden collection container for faeces and urine collection in 20l jerry cans.

gravity in a sewer system and pre-treated in a septic tank. The tank shall be cleaned at least once a year, but experiences showed irregular maintenance.

Transportation

The containers with the faecal matter are either carried by two pupils manually or transported in a wheelbarrow to the drying area. The baskets have handles on the side walls for easy movement. The transportation of the jerry cans with urine is identical to the containers. The urine from the underground tank is filled in small drums before the transport.

Centralised treatment

The centralised drying and storage area is situated behind the school, close to the emptying doors of the toilets, to avoid long transporting distances. It is a paved area, fenced with mesh wire and a simple roof.

After a drying period of at least six month the dried faecal material (Figure 4) is screened via a coarse-meshed sieve to remove toilet paper and sanitary pads. The sieved-out material is burnt and the remaining material used as a fertilizer and soil conditioner in the school garden. (Figure 4)

Urine is not stored for a certain time; it is used when there is need for.

The pre-treated wastewater is flowing via gravity to the constructed wetland

system. The bed is planted with elephant grass, which is harvested two times a year and fed to cows.

Use

Mainly bananas and matoke are fertilised with dried faecal material. The urine is used as a liquid fertilizer in agriculture with a dilution of 1:5 (1 part urine to 5 parts water). Fertilized cultures are banana trees, pepper, cabbage, carrots and spinach. However, exact application of these fertilizers, if they are worked into the ground or under the top soil cover, is not quantified by the school. Agricultural products are not sold but entirely consumed at the school itself.



Figure 4: Drying and storage area for faecal material.

Table 1: Summary of O&M activities in Kalungu Girls Secondary. School.

| Product | Treatment steps | Activity | Interval | Responsibility | Costs | Benefits |
|--|---|---|--------------|---|----------------------------|---|
| Faeces | 45 UDDTs (pupils) 2 UDDTs (teachers) | Empty the dehydration chambers and transport to drying area | 3 months | Students (supervision by teachers); O&M staff | Personnel costs; materials | - |
| | Drying area | Store dried faecal matter, sieve and burn sieved out materials | 6 months | Students (supervision by teachers); O&M staff | Personnel costs; materials | - |
| | School garden | Apply the dried and sieved faecal matter to the school garden | on demand | Students (supervision by teachers); O&M staff | Personnel costs; materials | Improvement of agricultural production (self consumption) |
| Urine | 45 UDDTs (pupils) | Decant from underground tank into small drums, transport to school garden | on demand | Students (supervision by teachers); O&M staff | Personnel costs; materials | - |
| | 2 UDDTs (teachers) 1 Urinal (teachers) | Replace jerrycan and transport to school garden | when full | Students (supervision by teachers); O&M staff | Personnel costs; materials | - |
| | School garden | Apply the urine to school garden | on demand | Students (supervision by teachers); O&M staff | Personnel costs; materials | Improvement of agricultural production (self consumption) |
| Greywater (kitchen, laundry, showers) and Wastewater (two flush toilets) | Septic tank | Clean pre-treatment tank | once a year | O&M staff | Personnel costs; materials | - |
| | Constructed wetland | Check distribution pipes; Harvest elephant gras | 2 times/year | O&M staff | Personnel costs; materials | Fooder for cows |

The treated greywater is infiltrated into the ground and is not reused as the amount of water is very little and the school never admitted demand for irrigation water.

Responsibilities for O&M

Teachers and students were trained in principles and proper operation of the sanitation system. The involvement of the teaching personnel responsible for health issues was particularly emphasized. The responsible personnel for operation and maintenance were trained both on-site and in a training course for sanitation personnel. However students are fully involved in operation and maintenance activities. They are organized in groups which have different tasks. Among other activities they are responsible for cleaning the toilets, removing containers, and fertilization of plants.

Income generation

Since the sanitation system has been implemented, the school became "famous" in Uganda and worldwide for the innovative sanitation concept. Delegations from all over the country and from abroad come to visit the school toilets regularly. The number of students increased to their maximum capacity from 350 to 450 over the last years. Furthermore the school administration even introduced an admission fee between 50.000 – 100.000 UGX (~18 and 37€ at a rate of 2700 UGX), depending on the type of visiting delegation. That fee is used to maintain the sanitation system, especially to keep the infrastructure in a good working condition.

O&M strategy in Maracha

Collection and storage / pre-treatment

Faeces, ash and toilet paper are collected in the dehydration chambers directly. Emptying takes place whenever there is need for, by an average of six months.

Wastewater, consisting of blackwater from flush toilets, urine from the UDDTs and greywater is collected via gravity in a sewer system and pre-treated in filter baskets. The pre-treatment allows dehydration and stabilisation of the

retained organic



Figure 5: Filter baskets for pre-treatment of wastewater.

solids. Wastewater is intermittently fed to two filter baskets (Figure 5), constructed from welded mesh, lined with filter textile and elephant grass as filter material at the bottom. Every six months the baskets are emptied.

Transportation

The filter baskets are emptied by the O&M attendants of the sanitation system by using a spade and a wheelbarrow to transport the material to the centralised treatment area.

Centralised treatment

The centralised composting area is situated in the backyard of the hospital. It is paved, fenced and roofed. Dried sludge from the pre-treatment filter of the constructed wetland system is used for co-composting. The material (Figure 6) is stored at the composting area for 6 months and during this time turned frequently. The compost is then sold to local farmers.

The sludge from pit latrines is transported to a sludge drying bed next to the composting area, stored there for 6 months together with the faecal-ash mixture from the UDDTs and then applied to the hospital's fields (Figure 6)



Figure 6: Centralised co-composting area and maize fertilisation with co-compost.



Figure 7: Vertical-flow constructed wetland.

The pre-treated wastewater is collected in a distribution unit, equipped with pipe valves. This tank is designed according to the necessary discharge intervals (4-6 intervals/day). The wastewater is discharged to the beds (Figure 7) without energy in intervals depending on the inflow rate to the discharge tank. The tank is cleaned regularly, at least two times a year, to avoid blockages.

Use

The compost is sold to local farmers; material from the sludge drying bed is used in the hospital's garden. In the hospital it is used as fertiliser for various types of crops like bananas, pineapples, maize, cassava, sorghum, jackfruits and passion fruits, which are cultivated in the fenced area of the treatment system. The composted material is mixed with soil (one spade for one plant), between one and three months before sowing. The cultivated fruits and vegetables are consumed by the hospitals' staff and workers.

The treated wastewater in Maracha Hospital is infiltrated outside the hospital's compound without any further use.

Responsibilities for O&M

Three attendants are employed by the hospital, who are among other duties responsible for operation and maintenance of the sanitation system. They have been trained on-site and in a training course for sanitation personal.

Table 2: Summary of O&M activities in Maracha Hospital

| Product | Treatment steps | Activity | Interval | Responsibility | Costs | Benefits |
|---|--|---|--------------|--------------------------|----------------------|---|
| Faeces | 16 UDDTs (staff) | Empty the dehydration chambers and transport to sludge drying bed | 6 months | Staff for their own ones | Personnel, Materials | - |
| | Pit latrines (patients and attendents) | Empty pits and transport to sludge drying bed | on demand | 3 O&M attendants | Personnel, Materials | - |
| | Sludge drying bed | Store the dried faeces-ash mixture, remove plastics and turn frequently | 6 months | 3 O&M attendants | Personnel, Materials | - |
| | Hospital's fields | Apply dried faeces- ash mixture for agricultural production | 6 months | 3 O&M attendants | Personnel, Materials | Improvement of agricultural production (self consumption) |
| Sewage Sludge | Sewer line | Empty the pre-treatment chambers and transport to the co-composting area | 6 months | 3 O&M attendants | Personnel, Materials | - |
| Urine (UDDTs), Greywater (kitchen, laundry), Wastewater (flush toilets) | Filter baskets | Empty the pre-treatment chambers and transport to the co-composting area | 6 months | 3 O&M attendants | Personnel, Materials | - |
| | Distribution unit | Clean distribution unit | twice a year | 3 O&M attendants | Personnel, Materials | - |
| | Constructed wetland | Check distribution pipes; Harvest elephant grass | 6 months | 3 O&M attendants | Personnel, Materials | Fodder for cows |
| | Co-composting area | Store the dried sludge, co-compost with kitchen wastes, turn frequently | 6 months | 3 O&M attendants | Personnel, Materials | - |
| | Hospital's fields, local farms | Sell compost to local farmers or use for the hospital's agricultural production | on demand | 3 O&M attendants | Personnel, Materials | Improvement of agricultural production/ Income generation |

The staff is responsible for the cleaning and emptying of their own UDDTs, sometimes they pay the O&M attendants for the emptying of the dehydration chambers.

Income generation

Since operation in 2002 the demand for compost is continuously rising. At the beginning, compost was only used within the hospital but the community around realised the impact. Currently 100kg bags of compost are sold at 40.000 UGX / bag (~15€ at a rate of 2700 UGX) to local farmers.

Conclusions

The success of these projects can be explained by two reasons:

- On the one hand all the important stakeholders were involved in the planning from the very beginning. In this manner the system was designed as wished by the institutions and a strong feeling of ownership and responsibility for the facilities was created.
- On the other hand the people are benefiting from the system. Income is generated by selling the compost in the case of Maracha hospital and by charging a fee for visitors of the school's toilets in Kalungu. The yield in the fields and gardens of the two institutions was increased by the application of compost, faecal matter and urine.

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Private sector involvement in operating a sanitation system with urine diversion dry toilets in Nakuru, Kenya.

This paper describes the implementation of an O&M system for UDD toilets that involves the private sector.

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Abstract

Benefits of urine diversion dry toilets (UDDTs) can only be achieved when the sanitation facilities operate continuously and to full capacity in conformity with acceptable standards of quantity and quality. However, there is a demonstrated link between long term sustainability of a sanitation system and the effective operation and maintenance (O&M) of the system. Problems with O&M are recognized as a key constraint to sustainability while efficient O&M is identified as a key in enhancing the sustainability of systems. Traditionally, municipalities and utilities are responsible for centralised O&M systems, which apparently have failed in many developing countries. Increasingly, donors, government departments and NGO's working with communities in infrastructure, water and sanitation development projects are encouraging the stakeholders or the service users to take up management responsibility of their systems and ensure they are running and in good condition. This paper demonstrates one such arrangement in Nakuru where a private sector service provider (PSSP) is involved in a holistic service provision and O&M of UDDTs, which is hoped to improve the efficiency, resource recovery, increased acceptance and rise in demand for the UDDTs in Nakuru Municipality.

Introduction and Background

Sanitation coverage in Kenya

The situation of sanitation system throughout Kenya is a source of concern. Most urban and peri-urban areas lack adequate sanitation, while the available facilities are misused, poorly maintained and associated with public health and environmental risks. According to the Ministry of Water and Irrigation (2007), the national sanitation coverage increased from 45% in 1990 to 48% in 2006. This clearly indicates that approximately 50% of the 34 million Kenyan do not have access to adequate sanitation. However Kenya is categorised in the group of sub Saharan countries not on track to meet the Millennium Development Goals (MDGs) sanitation target (WHO/UNICEF, 2006) and therefore the need to intervene in alternative

sanitation options and sustainable operation and maintenance.

Sanitation situation in Nakuru

Nakuru is the 4th-largest town in Kenya with ca. 400,000 inhabitants, located about 150 km north-west of Nairobi. The prevailing sanitation systems in Nakuru are water-borne sewer system and on-site sanitation systems. Sewer system covers 19% of the build area and there are about 9,600 registered sewer connections and the recorded average daily sewage flow is 8,991 m³/day (NAWASCO, 2008). In spite of the low sanitation coverage of sewer network, accessibility to some form of sanitation is as high as 98%. The predominant being the traditional pit latrine that covers 50% while the ventilated pit latrine (VIP) covers 14%. Septic tank system is used by 12% of the population while 6% have pour-flush system. A small fraction (2%) lack sanitation facilities at their

Key factors for successful O&M:

- Partnership approach in O&M is key.
- Stakeholders/partners need clear roles and responsibilities.
- Information on O&M to both the service provider and users must be available.
- Continuous awareness creation on UDDT and O&M is crucial.

households and uses the neighbour's toilet, or practice open defecation and flying toilets at night.

Operation and maintenance (O&M) of the sewerage systems and the two wastewater treatment plants in Nakuru is the responsibility of NAWASSCO. On the other hand, O&M of on-site sanitation is mainly the responsibility of heads of the household, while landlords/landladies and agents are responsible for construction and general management for rental residential plots. For shared excreta disposal facilities where landlords/landladies are not present, the users (tenants) contribute towards the O&M by either making financial contributions wherever required or by maintaining the daily hygienic conditions themselves. The O&M of sanitation facilities in schools, churches and other institutions is the responsibility of the respective institutions.

Recently, the Municipal Council of Nakuru (MCN) involved CBOs (community based organisations) and the private sector in collection, transportation and disposal of solid waste, recycling and composting. MCN also licensed CBOs to vend water in water kiosks and private sector in emptying pit latrines. At present a total of 17 private collectors have been licensed to collect and transport solid waste from designated areas within the 14 zones of operation. The MCN still maintains waste collection services in the more lucrative areas, where the private sector remains with the poorer areas within the town.

The ROSA project

The work described in this paper, is part of the ROSA project (Langergraber et al., 2008), an ongoing EU funded project that proposes resources-oriented concepts as a route to sustainable sanitation. These concepts are being applied in four pilot cities in Eastern Africa, namely Arba Minch (Ethiopia); Nakuru (Kenya); Arusha (Tanzania) and Kitgum (Uganda). In all these cities the local project consortium comprises the municipality administration for implementation working jointly with a local university responsible for the research. In Nakuru, the local university involved is Egerton University.

Materials and Methods

Research Overview

One of the major research topics within the project focuses on O&M of resources-oriented sanitation concepts, with the main goal to develop sustainable O&M management strategies for urine diversion dry toilets (UDDTs) in Nakuru. In order to

develop these strategies, a three-step approach was chosen:

1. Baseline study
2. Demonstration of UDDT systems
3. Development / Implementation of O&M strategies

The data collection tools for the baseline study included document review, interviews, stakeholders/focus group meetings, participant observations, seminars and workshops. A survey was also conducted where 215 structured questionnaires were administered to participants to determine the knowledge and willingness to adopt and to use the products from UDDTs to fertilize crops and whether the participants were willing to eat food grown using the products. Most importantly the study sought to find out whether use and up-scaling of UDDTs would be influenced by the responsibility for operation and maintenance of the toilets. Furthermore, meetings with different stakeholders including MCN's Department of Environment, landlords/landladies, tenants, CBOs and private sector service providers were conducted to identify the most suitable method for O&M of UDDTs and also to lay out key roles and responsibilities of each stakeholder.

The demonstration of UDDT systems included a first screening of potential pilot sites, various meetings with stakeholders (resulting in memorandum of understandings), awareness rising campaigns, workshops with artisans, construction and monitoring.

The implementation of O&M strategies was mainly based on a detailed survey on O&M requirements (literature and experiences from other countries), intensive discussions with potential stakeholders and finally implementation of the strategies.

Results and Discussion

Base line study

The responsibility of operation and maintenance of the existing sanitation facilities was undertaken by various players. The survey (ROSA project, 2007) identified responsibility of the players as follows: landlords/landladies (35%), own household (38%), housing agents (7%), MCN (2%) and tenants (18%). This outcome showed that although O&M has a partnership approach, the landlords/landladies and household owners are the main stakeholders to target for any meaningful responsibility. The study pointed out where landlords/landladies provide adequate and improved sanitation facilities, tenants tend to stay longer and hence



Figure 1: Sanitation facility constructed for the Crater View Secondary School.

landlords/landladies benefit from rent fees charged.

One of the crucial outcomes of the study was that 86% of respondents answered, that they are interested in using an UDDT if they are not responsible for O&M. Another important result was that 61% of the respondents were willing to use urine and treated faecal matter in their gardens.

A specific study was conducted to identify CBOs and service providers who are currently involved in solid waste management within the municipality and who may be interested in providing service for the households with UDDTs. Detailed awareness creation and discussion on UDDT systems and their required O&M were held to engage interest in offering the service.

Demonstration of UDDT systems

Pilot 1 - Church and nursery school

The first pilot UDDT was constructed at a church and nursery compound to serve the church congregation of about 50 members and a pre-primary nursery school with an enrolment of 25 children handled by three teachers. The facility consists of two single vault UDDTs, one urinal cubicle with five waterless urinal bowls (three of them are especially designed for children) and one double vault UDDT with solar drying at the back. The faeces are collected directly in the vault underneath the toilet chamber. The material is stored in 50 litres open containers. The space is enough to allow up to three 50 litre containers to fit in. Once a container fills, it is pushed aside to allow an empty bucket to be placed below the hole and the full one to dry. Urine is collected in a 30 litres plastic container. Provision is made for

discharging the excess urine through an over flow pipe into a soak away pit, with the possibility to collect the urine for a later use.

Furthermore roof water is harvested into a 250 litre tank which is connected to ceramic hand washing basins in both the male and female unit.

Pilot 2 - Residential plot

The UDDT is constructed of masonry and consists of three stance single vaults UDDTs to serve a plot with 28 tenants. One is for female users, one for children while the third, which is also fitted with a urinal bowl, is allocated for male. The construction is similar to church toilets.

Pilot 3 - Crater View Secondary School

The facility caters for 200 students and consists of eight single vaults UDDTs, five for girls and 3 for boys and a urinal with ten urinal bowls (Figure 1). Each vault holds three 50 litre containers for faecal matter. The girls section is fitted with 4 girl's urinal chambers each with a urine channel. The urine is collected and stored into a 2000 litre underground tank constructed of masonry urine storage. When the urine fills in the container it overflows to a soak away pit. Rainwater is harvested from the corrugated iron roof into two 250 litre plastic water tanks.

Drying shed

Two drying sheds were constructed in the project area. The first - to close the loop within the school's compound - at Crater View Secondary School with an area of 22m². The school utilizes both the urine and the dried faecal matter as fertilizer to grow trees, nippier grass and food crop in their farm. Rain water is harvested from the drying shed roof for hand washing.

The second drying shed is bigger in size (40m²) and is located at the dump site (Figure 2) next to MEWAREMA's composting shed. The group members of MEWAREMA (Menengai Waste Recycling Management Group) were involved in site selection, setting up and construction. The MEWAREMA group will dispose the dry faeces in this shed for further drying and treatment into compost. The group will be fully in charge of the drying and its management.



Figure 2: Drying shed at the dump site for centralised composting.

Operation and maintenance strategy

MEWAREMA

MEWAREMA is a community based organised group licensed to collect solid waste from Hilton area, where the pilot UDDTs are located. The group is also involved in making compost at the dump site. After consultancy meetings with the group, they took over the responsibility to provide holistic service including collection, transportation and treatment of faecal matter from UDDTs.

Collection and transportation

After awareness creation and training on the business opportunities arising from the UDDTs in terms of collection and composting, MEWAREMA agreed to undertake the activity of collecting and transporting dry faecal matter from households within London and Hilton to the drying shed at the dump site at a cost of between 100 and 200 Kshs (Kenyan Shillings) per household per trip.

Landlords/landladies interviewed on the fee were positive and indicated they were willing to pay between 100 and 200 Kshs per collection.

Method of transportation

Currently only two pilot UDDT facilities are in use and therefore only small quantities of faecal matter are produced and available for transportation. However, six landlords/landladies are in the process of constructing UDDTs in the area and it's expected the up scaling to increase in time.

Considering the low quantity of faecal matter, the most appropriate and affordable method of transportation is a donkey drawn cart. The cost of investment on the initial transport system is calculated at 55,000 Kshs. The system will include a towing cart of a capacity of 500-600 kg and two donkeys.

MEWAREMA is in the process of applying for a 50,000 Kshs loan from the Family Bank for acquiring the donkeys and the cart.

Treatment and Reuse

The collected faecal material is further co-composted together with organic waste at the dump site and afterwards sold to NAWACOM. NAWACOM is an NGO based in NAKURU that has a joint venture with MEWAREMA and is responsible for marketing and compost selling.

Financial point of view

The collection fee suggested by MEWAREMA (100-200 Kshs) is moderate considering that emptying will be done once per 3 to 6 months depending on the number of users. Furthermore landlords/landladies interviewed were willing to pay up to 100 Kshs per month for collection service. For MEWAREMA the O&M service is anyhow a win-win situation: they are getting paid for collection and transport and are earning further income from selling the compost to NAWACOM.

Up-scaling

MCN, NAWASSCO and ITDG are in the process of developing a five year business plan to facilitate up-scaling of on-site sanitation in peri-urban areas. The bankable business plan is aimed to be funded by the Dutch SPA (Sanitation Program Africa) program on a fifty-fifty basis (50% loan and 50% grant). The loan part will go in operating accessible revolving loaning scheme in partnership with a local bank for landlords/landladies and institutions who aim to construct appropriate sanitation facilities in selected peri-urban areas. Despite a mix of appropriate sanitation options being promoted, UDDTs will be given priority.

Up-scaling of UDDT implementation is already on progress and approximately 15 landlords/landladies have benefited the loan and constructed improved sanitation (Figure 3); 10 landlords/landladies decided to construct UDDTs.



Figure 3: Two examples of privately constructed UDDTs.

Conclusion

This paper demonstrates that sustainable O&M for a sanitation system based on UDDTs and consequently well maintained sanitation facilities can be achieved by involving private sector service providers to collect and transport the dry faeces to a centralised shed for further treatment into compost. The service providers shall also be fully in charge of selling the compost and its management. The potential for up scaling UDDTs in the future is very high due to the ongoing SPA programme where so far 75% of loan beneficiaries opted for UDDTs. The main challenge for the future will be the capacity to operate and maintain the increased number of UDDTs and to increase the demand of compost.

Acknowledgement

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Operation and Maintenance of water and sanitation systems in northern Uganda

Successful operation and maintenance of water supply and sanitation systems in rural areas affected by complex emergency can relevantly contribute to the sustainable implementation of projects.

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Abstract

The main purpose of this paper is to identify possible challenges that can severely affect the selection and implementation of successful operation and maintenance strategies. For this a case study from AVSI's work in Northern Uganda is used. This selected area of Northern Uganda is affected by the consequences of a twenty years civil war. Recommendations on how to implement good operation and maintenance strategies are given.

Introduction

The article focuses on operation and maintenance (O&M) strategies implemented in rural areas affected by complex emergencies. The important role of O&M in making project more sustainable is highlighted. Common challenges to successful O&M are identified and feasible ways forward are proposed. A case study from Northern Uganda will be used. In particular, the work of AVSI, focusing on one of its projects related to water and sanitation services improvement, will be described. It shows how AVSI has planned and implemented O&M strategies in Northern Uganda between 2004 and 2009 and how O&M has contributed to make the project more sustainable.

AVSI is a non-profit, non-governmental organization, founded in Italy in 1972 and working in Uganda since 1984. From 2005 till today AVSI has been implanting in the Acholi Region the project "Improvement of water and sanitation services for people living in displacement in Northern Uganda". Headed by the WatSan Sector of AVSI Kitgum base, the project has aimed at contributing to an increase in water availability and



Figure 8 Map of Districts Affected by the Conflict

improvement of the hygienic and sanitation conditions through various interventions.

Key factors for successful O&M of water and sanitation systems in rural areas affected by complex emergency:

- Flexibility;
- Participation of local authorities and communities;
- Awareness of local culture, beliefs and attitudes related to water, hygiene and sanitation;
- Awareness of existing policies and O&M systems;
- Efficient calculation of capital, start-up and O&M costs before selecting technologies and O&M strategies;
- Clear responsibilities for O&M activities;
- Implementation of preventive rather than reactive O&M strategies.

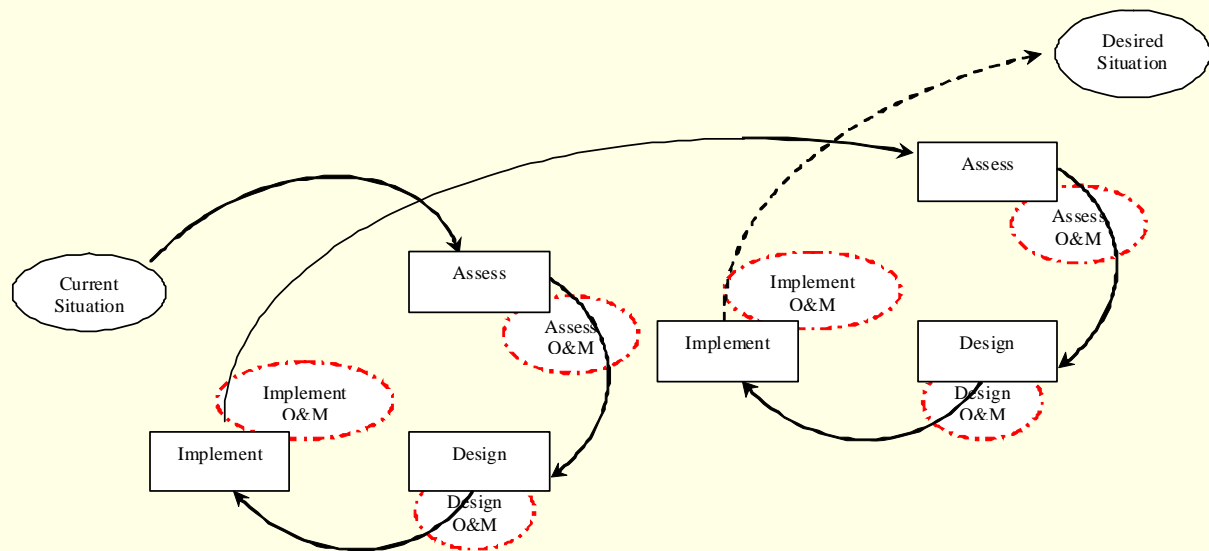


Figure 2: Project Cycle, revision of UNHCR (1999) model (UNHCR (1999)).

The Ugandan Civil War

For more than two decades, Uganda has been disrupted by a bloody civil war between the rebel group Lord's Resistance Army (LRA) and the Government of Uganda (GoU). As many contemporary conflicts, even the Ugandan Civil War can be defined as a complex and multi-levelled emergency (DFID, 2002) (A humanitarian crises where there is a considerable breakdown of authority resulting from internal or external conflict and may lead to extensive loss of life, massive displacements, and widespread damage to societies and economies. (House, 2007)). Through the fighting almost two million people have been displaced and forced to seek refuge in IDP (Internally Displaced People) camps, in urban and quasi-urban settings (these people usually depend on outside aid to sustain their basic needs) while others have become night commuters (people that leave their homes and spend the night in more secure areas such as urban centres, hospitals, churches, etc.) .

Soon the camps were over crowded. However, little plan for provision of services was carried out and existing facilities in IDPs' camps were overstretched (AVSI, 2005) with on average water availability of 5 litres per person per day and more than 2000 people sharing one latrine stance. As a consequence, limited water and sanitation services severely affected the displaced population (ECHO, 2007).

After a truce was signed between conflicting parties the resettlement/return processes began to take place. Therefore, NGOs and Agencies activities started to shift their interventions from IDPs camps

to satellite camps/return sites where support for new water supplies, sanitation and health services was required (Bjørkhaug et al., 2007).

Theoretical background on O&M

O&M is a term commonly used to identify all activities implemented in order to run and keep in good conditions provided facilities (House, 2007). If considered in relation to water and sanitation projects, O&M generally includes four major areas of intervention (this contribution only considers the first two):

- water supply,
- excreta disposal,
- solid waste management,
- drainage.

For each area of intervention, O&M includes activities that aim to prevent breakdowns and misuse of facilities (preventive maintenance) together with actions necessary to bring the system back into operation once breakdowns/misuse have happened (reactive maintenance) (House, 2007). Nevertheless, in order to implement effective and efficient O&M strategies, it is fundamental to consider them in each phase of the project cycle (Fig. 2). As a consequence, first of all feasibility of O&M needs to be assessed during the project assessment phase. Secondly, O&M strategies need to be designed and planned while planning the project itself. Finally, the selected strategies need to be implemented in coordination with all other activities. In particular, preventive O&M will be implemented before water systems and sanitation infrastructures are completed while reactive O&M only when needed.

However, it is this degree of complexity that allows several challenges to severely affect O&M. The challenges to O&M can be divided in technical, economical, social and managerial. In addition, they can be further separated in relation to the phases of the project when they are most likely to occur. (Table 1)

Technical challenges are generally related to physical construction of facilities. First of all, appropriate technologies have to be selected together with local communities and authorities. Beneficiaries should be informed on systems' options and costs in order to decide what responds better to their needs (Windblad and Kilama, 1980). Moreover, implications in terms of responsibilities, tasks and resources should be extensively explained in order to avoid misunderstandings and misuse of facilities. Secondly, good services have to be guaranteed. Low skilled labour and poor quality materials will affect the quality of construction and facilities, once completed, might need frequent repairs (Nkongo, 2003). Finally, handover manuals and/or special trainings regarding selected technologies, construction techniques and O&M strategies should be provided to all actors. If not considered, this three elements will severely affect O&M once facilities are completed. Even, calculation of correct services' costs is as

important as getting the technical design right (Deverill et al., 2002). In fact, without a real understanding of the systems' costs, financial sustainability of O&M cannot be guaranteed.

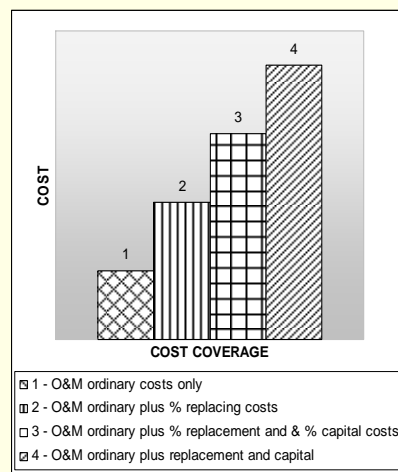


Figure 3: Financial sustainability of O&M (House, 2007)

Therefore, the first step is to understand what humanitarian actors and communities are expected to budget for in terms of capital and O&M costs. In addition, all involved actors should collaborate in order to identify and implement a source of income or revenue system appropriate to the context of implementation (Sutton, 2004). Figure 3 shows how the price of community contribution would increase on the basis of the type of costs beneficiaries are asked to cover. Therefore, good understanding of the type and use of communities' contribution will help NGOs/Agencies to better organize a successful revenue system. However, in an emergency context it is often difficult to put in place revenue

Table 1: Challenges and Constraints to O&M

| | PLANNING | IMPLEMENTATION & Handover | OPERATION & MAINTENANCE |
|-------------------|--|---|---|
| TECHINCAL | <ul style="list-style-type: none"> • Appropriate technology • Appropriate technical design | <ul style="list-style-type: none"> • Quality of construction • Appropriate service level • O&M manuals | <ul style="list-style-type: none"> • Baseline skills • Availability of spares • Availability of skilled labor • Availability of tools |
| ECONOMICAL | <ul style="list-style-type: none"> • Budgeting • Organization & management of financial flows • Financial administration • Financial control and monitoring | <ul style="list-style-type: none"> • Capital costs: • construction costs, • training costs, • start-up costs; • system appropriate to livelihoods of communities' members. | <ul style="list-style-type: none"> • Ordinary maintenance • Extraordinary maintenance: • refit, • replacement, • Up-grading; • Community ability to pay; • Community ability to raise money. |
| SOCIAL | <ul style="list-style-type: none"> • Risks from natural disaster and conflicts • Ethnical/religious division • Gender division • Inequity & social cohesion • Community commitment to the project | | <ul style="list-style-type: none"> • Community sense of ownership & legal ownership • Community willingness to pay • Community willingness to raise money • Relevance of the project |
| MANAGERIAL | <ul style="list-style-type: none"> • O&M legislation and policies • Appropriate management system | <ul style="list-style-type: none"> • Standardization of approaches across the sector. • Coordination • Training of implementing partners | <ul style="list-style-type: none"> • Efficiency of intermediate level actors – Govt, NGOs, private sector, community organizations |

systems and NGO/Agencies might be required to subsidize all capital and O&M costs. In this case clear plan should be designed and agreed on by all involved actors in order to move from an NGO supported system to a self-sustainable one as soon as the emergency phase ends.

Additional challenges to O&M can be the result of the social environment. As a consequence, implementing actors should develop a good understanding of existing needs, cultural behaviours, and ethnical/religious division/cohesion (Barakat, 2004). Consultation with and participation of the community is therefore strongly recommended especially if communities members are considered as consumers and producers of infrastructure services. In addition, if involved in all phases of the project, communities' sense of ownership and commitment to O&M activities are more likely to last in the long term (ACF, 2007).

Finally, managerial challenges can affect O&M in all its parts. As a consequence, some preventive measures need to be considered. First of all, planning of O&M should be carried out before facilities have been constructed. In order to do that, it is important that local authorities and community based organizations are prepared to accomplish managerial tasks and that existing policies can regulate O&M activities. Secondly, agreements with local authorities/communities should be reached regarding managerial responsibilities, services' use and users' contribution (Brikké, 2000). Participation plays therefore an important role especially if considered that local actors are equipped with knowledge often ignored by international NGOs/Agencies. Once planning is completed, managerial trainings should be organized for all

involved actors. Finally, supervision/monitoring of O&M activities has to be carried out from humanitarian actors even after facilities have been handed over.

The AVSI project in Northern Uganda

WatSan systems and facilities: Selection of technologies

A limited number of technologies were selected in collaboration with local authorities and communities. Nevertheless, these were adapted to the sites of implementation, the evolving context and the functions they were expected to fulfil. Regarding excretal disposal, AVSI avoided all types of prefabricated latrines and pit latrines were constructed using local materials for the superstructure. In resettlement sites, AVSI workers promoted the construction of facilities at household level. Finally, in institutions AVSI generally constructed more permanent facilities in order to provide a more regular service with higher standards of quality. For example, latrines were characterized by reinforced pits, cement superstructures, and ventilation systems.

O&M strategies

O&M is a complex task. As a consequence, during the planning phase AVSI tried to select context-effective technologies easy to construct and, when possible, to operate and maintain in the short and long term. In addition, services' costs were calculated and budgeted into the overall project costs due to the emergency context and the disrupted livelihoods of displaced people. During the project, preventive measures were undertaken in order to increase sense of ownership and capacity building. Local manpower was trained in construction techniques and

communities were involved in the selection, construction and maintenance of facilities.

From Figure 4 it is immediately clear that AVSI has mainly invested donors' funds in preventive, rather than reactive maintenance in order to reduce systems' breakdown and quick deterioration of facilities. For instance, regular community

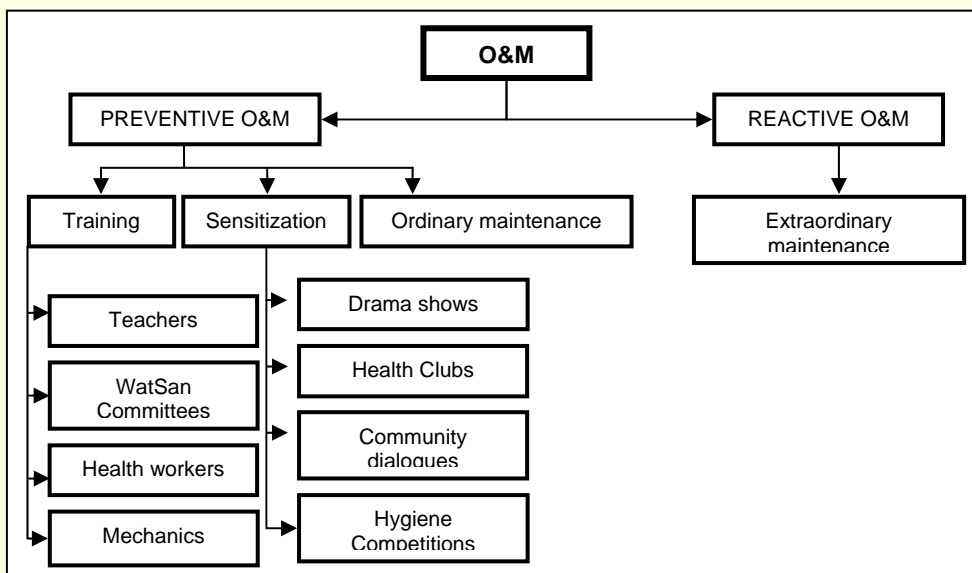


Figure 4: O&M strategies implemented by AVSI in Northern Uganda.

dialogues were organized by AVSI together with local authorities and WatSan committees. However, when preventive maintenance was not enough, AVSI carried out activities of reactive maintenance. For example, AVSI replaced damaged spares in collaboration with district mechanics., Nevertheless, although AVSI planned and implemented O&M activities during the entire project life, several challenges have been experienced.

Challenges experienced

Technical challenges

Participation of communities and authorities in technologies selection has been stressed by AVSI throughout the project. Decisions and technical designs have been agreed with all stakeholders when possible, and local manpower has been used for construction and O&M. As a result, selected technologies have in general effectively responded to IDPs and returnees' needs. However, two main technical challenges have been faced by: on one hand, selected technologies have been often misused or even vandalized by the users and on the other hand, lack of spares, tools and fuel have severely affected O&M of provided services. Community and institutional latrines' doors have been often stolen as well as hand wash facilities. Community leaders and key stakeholders explained that vandalism has been frequently the result of land disputes and users resentments towards schools and health units' workers. As a consequence, AVSI has replaced damaged/stolen components when possible and held community dialogues in order to reduce misuse of infrastructures. However results have not been yet assessed. In addition, regarding lack of spares, local authorities have frequently promised to organize districts' stores and to fund purchase of spares. However, this seldom happened.

Economical challenges

Economical challenges have been one of the main constraints to the implementation of successful O&M. As previously explained, AVSI has decided to fund all capital and start-up costs due to the inability of users to pay for water consumption and sanitation facilities. All provided facilities are therefore not self-sustainable.

In coordination with local authorities and NGOs/Agencies, AVSI has promoted a campaign of sensitization in order to introduce a revenue system. However, majority of pilot projects have failed. Local authorities have recently guaranteed that fees for consumption of water will be soon

introduced although communities will take a while to get used to the new policy. Nevertheless, no preventive measure seems to be used in order to avoid additional economical constraints.

Social challenges

Even cultural behaviours, attitudes and beliefs have sometimes affected O&M of provided facilities. Hygiene behaviours are difficult to become a common practice and frequently people prefer to defecate in the bush. In addition, women and men are not allowed to share the same latrine while pregnant women believe that using latrines could harm the foetus. Furthermore, during the evaluation, majority of interviewees declared that construction of household latrines is not a priority with only the 37% of the entire sample owning one (Figure 5).

In institutions, cleaning rotation systems seems to be in place. However, due to poor sense of ownership, maintenance was rarely implemented. In addition, people enthusiasm seemed to quickly decrease once facilities have been completed. Additional voluntary work for operation and maintenance is therefore perceived as unnecessary. To these challenges, AVSI responded promoting sensitization at community level.

Managerial challenges

Good management of WatSan facilities should be the result of interaction and collaboration between local authorities, communities and humanitarian actors. While communities have in general participated in WatSan facilities management, local authorities were seldom able to effectively do it. In addition, coordination between international NGOs/Agencies was quite poor affecting projects' results due to overlapping and lack of shared strategies. However, towards the end of the project, coordination and cluster meetings have been organized regularly. Nevertheless, some challenges to good management of WatSan facilities still need to be considered. First of all common strategies are not yet in place. Secondly,

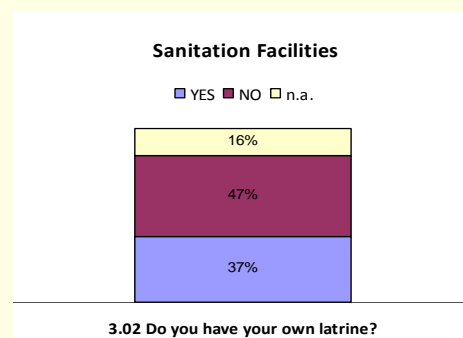


Figure 5: Household latrines distribution

national and local O&M policies are still underdeveloped and often unclear. Finally, although involved in all phases of the project, local authorities are still not able to take over NGOs and Agencies managerial role.

Conclusion

In the project in Northern Uganda AVSI has directed available funds to preventive rather than to reactive O&M. Selected preventive strategies have been training, sensitization and ordinary maintenance and have been implemented in schools, health facilities, IDPs camps and resettlement/return sites. Nevertheless, a number of challenges have been experienced by the AVSI WatSan team. First of all, provided facilities have been often misused or even vandalized. Secondly, self-sustainability of provided facilities has been affected due to AVSI decision to fund all capital and start-up costs for the construction, operation and maintenance. However, implementation of a revenue system was seen by AVSI as a non-feasible option due to the emergency context. Thirdly, cultural behaviours and attitudes have severely affected good hygienic and sanitation behaviours. Finally, local authorities have repeatedly proved not to be able to manage and run O&M activities due to poor policies, lack of funds, lack of established revenue systems and poorly trained staff. To all these challenges, AVSI has responded with additional training, sensitization and direct collaboration with communities and local authorities. However, as the project is ending at the time of writing, it is still too early to evaluate if selected responses have been effective.

Recommendations

In order to implement successful O&M it is important:

- to select, plan and implement O&M throughout the entire project and even later;
- to prioritize preventive rather than to reactive O&M;
- that communities and local authorities participate in the selection of technologies and of O&M strategies;
- to carry out KAP (Knowledge, Attitudes and Practice) assessment in order to provide culturally sensitive facilities;
- to select O&M managerial responsibilities and tasks in collaboration with local authorities and communities
- to assist local authorities and communities in order to acquire needed skills and to put in place appropriate managerial measures;

- to provide local authorities and communities with hand over manuals and/or special trainings on facilities design and O&M procedures;
- to carry out assessment and sensitization in order to select and implement appropriate revenue systems;
- to guarantee support and supervision even after the project ends in order to quickly respond to additional challenges.

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