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Two Years after Donor Funding Ended: Success Factors for Schools to Keep their Urine-Diverting Dry Toilets (UDDTs) Clean and Well Maintained

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In order to evaluate the performance of Urine-Diverting Dry Toilets (UDDTs) in schools a number of nine schools were selected and visited in Nyanza and Western Provinces in Kenya in early 2012. The toilets were built by the Ecosan Promotion Project (EPP) and some also independently self-sponsored by schools between 2008 and 2010. These school UDDTs were evaluated approximately two years after their constructions. The schools were selected for this research on the basis of reasonable performance in operation and maintenance (O&M), cleanliness and good structural condition of their UDDTs. The main aspect of the evaluation was to find the key factors for success that led to good maintenance of UDDTs. Results indicate that benefits gained from the UDDTs were an important factor for ongoing motivation and success: the new UDDTs were in principle preferred to the old pit latrines in all the monitored schools, as they are comfortable to use, clean, not smelly and there were no risks of collapse of the toilet structure. These benefits were the major factors encouraging some schools to continue maintaining their UDDT facilities and to even construct new ones. Main problems observed were however gradual or sudden disappearance of ecosan (ecological sanitation) knowledge at the school, blockages of urine pipes and an insufficient ratio of toilets to pupils.

Keywords: *ecosan, operation and maintenance, school sanitation, UDDTs, WASH*

Introduction

According to the World Health Organization (2004), every year 1.6 million children die due to unsafe water and lack of basic sanitation. School sanitation is a highly important issue for public health; nevertheless its importance is often neglected. Children under five years old are the most vulnerable victims of poor sanitation conditions and sanitation related diseases, particularly diarrhoea and worm infections, which hinder children´s physical and intellectual development (WHO, 2004). Up to two thirds of the schools in developing countries do not have sanitation facilities, and where facilities do exist, they are often inadequate and therefore causing health and environmental risks (CARE et al., 2010). Several evaluations in a number of countries have shown that pupils are dropping out of the school due to bad toilet conditions. This seems to be particularly the case for adolescent girls and leads to lower educational standards and attainment (Deegener et al., 2009).

The Ecosan Promotion Project (EPP) was funded by the European Union, GIZ (formerly GTZ) and SIDA in order to promote ecological sanitation (ecosan) technologies during the project period of 2006 to 2010 (Onyango et al., 2009). As one component of EPP, Urine-Diverting Dry Toilets (UDDTs) with double dehydration vaults were built in 72 primary schools and one secondary school mainly in Western Kenya with four cubicles (2 cubicles per toilet block) in each school. For

more detailed information on these UDDTs for schools see the case study by Kraft and Rieck (2011). The construction of the UDDTs were fully financed by EPP but maintenance is organised and funded by the schools themselves. A common problem for sanitation projects has been managing and financing the long term operation and maintenance of the facilities, after the donor funding by the project has stopped.

The aim of this research was to evaluate these school UDDTs in terms of physical condition, acceptance and use, operation and maintenance (O&M) and utilisation of urine and faeces as well as to analyse challenges and key factors for successful upkeep of the toilet facilities after about two years of operation.

Materials and Methods

For this research altogether nine schools were visited and evaluated in Nyanza and Western provinces of Kenya in November 2011 to January 2012 (the names of the schools are given in Table 1). The schools were selected on the basis of pre-evaluated good performance in operation and maintenance (O&M) of their UDDTs by two former regional implementing officers of EPP.

The evaluation was done by visiting each school together with the relevant former regional EPP officer. The conditions of the facilities were evaluated by visual inspections, interviews and focus group discussions using semi-structured questionnaires and monitoring sheets. The questionnaires and sheets were adapted from previous monitoring activities by GIZ (Kraft & Rieck, 2011). The technical information collected covered items like the conditions of the structure, such as walls, doors, floors, vaults, doors of the vaults, water harvesting systems, hand washing equipment, stairs, urine tanks, possible urine pipe blockages, cleanliness and presence of flies and odours. Interviews were done with principals, head teachers or persons in charge of the toilets (often agricultural teachers or other school employees like caretakers). Pupils from the age of 12 to 15 were interviewed with focus group discussions. See Pynnönen (2012) for more details on the methodology. This qualitative data related to toilet usage and management, success of project implementation, operation and maintenance, utilisation of the UDDT products urine and faecal matter and information about social and cultural issues.

Figure 21. *UDDT unit in Kakichuma Primary School. The hand washing tank is on the left side of the toilets, placed on the urine collection chamber. Behind the toilet cubicle a ventilation pipe can be seen.*

Figure 12. *A view inside a UDDT cubicle, Kendu Muslim Secondary School with an explanatory poster on the wall, squatting pan with urinating hole and two holes for faeces leading to two vaults that are used alternately. On the right corner is a bucket for dehydration material, which is ash in this case.*

Results and Discussion

Of the 73 primary and secondary schools who received UDDTs during the EPP only very few schools are managing them ideally. The set of schools selected for this research (in the end nine schools) were all performing relatively well, but were probably almost the only ones according to the two former EPP officers. In addition, even though all these schools were selected on the basis of good O&M practice, there were still several shortcomings on their performance. Figure 1 and 2 show the type of double vault UDDT units used in EPP for the schools. Each school received two UDDT toilet blocks with each 2 cubicles, in total 4 cubicles per school. Each cubicle is located above two separate faeces vaults as it is typical for UDDTs with double vaults. Unfortunately no urinals were built except a few exemptions.

Analysis of results

Table 1 summarises the results of the evaluation visits at the schools. In the beginning of the EPP project each school received two UDDT toilet blocks with 2 cubicles each. Usually one toilet block was meant for boys and the other for girls. In some cases also teachers occupied one entire block. In general the number of UDDT cubicles was insufficient to cater for all pupils. However the aim of the EPP was to demonstrate UDDTs only and not to provide sufficient ratio as it was assumed that schools are responsible to add more cubicles themselves later on. The recommended ratio of school toilets, according to the guidelines of the Ministry of Public Health and Sanitation (2005), is one for 25 girls and one for 30 boys. This was not reached in all evaluated schools. The general conditions of the UDDTs is shown in Table 1 as good / ok / poor, according to the cleanliness, condition of the superstructure and necessity for repairs. Existence of the required equipment and handwashing facilities are dealt with separately.

The evaluation shows in general that schools have problems maintaining the UDDTs correctly and keeping them functioning. Often the reason for closing a facility was a blockage in the urine pipe. Two schools had built more UDDTs, Kendu Muslim Secondary School and Hope and Kindness (latter self sponsored), indicating that they preferred them to pit latrines, even though more effort to maintain UDDTs is needed as compared to commonly used pit latrines. However the conditions of the UDDTs varied a lot between the nine schools, even though all the schools were classified as well-performing according to a basic pre-evaluation. Some general conclusions can be drawn from the evaluation of the collected data:

- The size of the school: small schools were performing better than big ones.
- Self-sponsored school UDDTs being managed better.
- Employed grounds man/ cleaner seems to be leading to better general condition of the facilities.
- Schools that have only UDDTs in the school and not old existing pit latrines are doing well.
- The best performing schools showed a good utilization of urine and faeces in practise. This connection probably holds true in rural places where farming, even in schools, is common, and fertilizers need for improving the crops.

Table 1. Comparison of the toilets at the monitored schools

School	Size of the school (pupils)	Number of UDDT cubicles in use	General condition of the UDDT facilities	Functioning old pit latrines	Equipment of the UDDT facilities	Functioning hand washing?	In charge of O&M	Proven reuse of urine or faeces?
NYANZA PROVINCE								
Kendu Muslim Secondary	400	3 for girls 2 for boys 1 for teachers	ok	yes (8)	A[1]	Yes, but not next to the UDDTs	Employed caretaker	No
Hope and	170	2 for boys	very good	no	A, LB, TP,	Yes, the only	Two	Yes, treated

Kindness[2]		2 for girls 1 for teachers			S	one with soap	employees	faeces for agriculture
Kachan Primary	400	2 for boys 2 for girls	ok	yes (8)	A, LB	Water tanks, no rain water harvesting	Health Club	No
Siany Mixed Secondary	160	2 for girls 2 for teachers	good	yes (2 for boys)	LB	Yes, a rainwater harvesting system	Employed grounds man	Yes, urine for tree planting
Radienya Primary	330	2for boys 1for girls 1 for teachers	poor	yes (4)	A, LB	No, water tank was stolen	Health Club	Yes, vegetables
WESTERN PROVINCE								
Kakichuma Primary	900	2 for boys 2 for teachers	poor	yes (4)	A	No	No one	No, but banana trees
Eldoret Educational Centre[2]	180	1 for boys 2 for girls	very good	no	A, LB, TP	Yes, but no rainwater harvesting	Employed caretakers	yes, urine for agriculture
Khaimba Primary	900	1 for boys 1 for girls 2 for teachers	ok	yes (10)	LB[3]	Yes, but	Health Club	yes, tree planting
Mumias Muslim Primary	1400	2 for boys 2 for teachers	poor	yes (20)	A[3]	Yes, a water pump	Health Club	no

[1] A refers to ash, LB for litter bins, TP for toilet paper, S for soap.
[2] Self-sponsored schools; UDDTs built without any funding from the EPP
[3] Not available in each cubicle in these cases

Acceptance, social and cultural aspects

Acceptance and popularity of the UDDTs was high. Interviewed teachers and pupils appreciated the design of the UDDTs, the convenience of usage and absence of odours and flies. UDDTs were always preferred to pit latrines. UDDTs are also safer and more reliable to use as there is no danger of collapsing or sinking, as it has happened in some cases with pit latrines, especially during the rain seasons. Cultural issues did not seem to be affecting acceptance or implementation of the UDDTs. In some cases pupils were sceptical in the beginning of the implementation, but convinced in the end, also about utilization of urine and faeces. As people are facing noticeable problems with poor hygiene and sanitation in their day-to-day life, cultural issues seemed to have minor importance.

Challenges

Despite high acceptance and popularity of UDDTs, also problems were observed. Main issues were blockages in urine pipes and absence of hand washing facilities or lack of water and soap. This was also indicated by Wakala and Wycliffe (2010) in addition to the overflow of urine tanks, misuse by visitors and/or men and occasional lack of ash as dry covering material.

The main challenges and things that need improving:

- Blockages in urine pipes, often leading to closing the UDDT facilities.
- Minor worn outs on the superstructures were observed, e.g. fainted paint as well as broken or disordered doors and vault doors.
- Hand washing facilities were not always in good condition. Entire facilities or parts of them (water tanks, valves or diverting pipes) were too often missing. Dry seasons are challenging for getting the water itself.
- Soap was available only in one of the visited schools
- All the schools had too few UDDTs to cover the recommended ratio which led to overload, quicker untidiness and unsoundness of the facilities.

- Schools found the stairs of UDDTs the major design problem, as small or disabled children, and also old teachers, find it hard to enter the toilets.
- Misuse was often caused by visitors, who were not trained to use UDDTs correctly.
- Keeping gained ecosan and hygiene knowledge and motivation in the school despite the exchange of pupils and teachers is one of the main challenges, as teachers transfer is common.
- Often schools were depending or relying on the GIZ implementation team for support and help in any case of problems after the end of the EPP project, even though they presented a strong ownership of their UDDTs during the evaluations.

Figure 3 presents an impact chain of the main observed challenges and their relations.

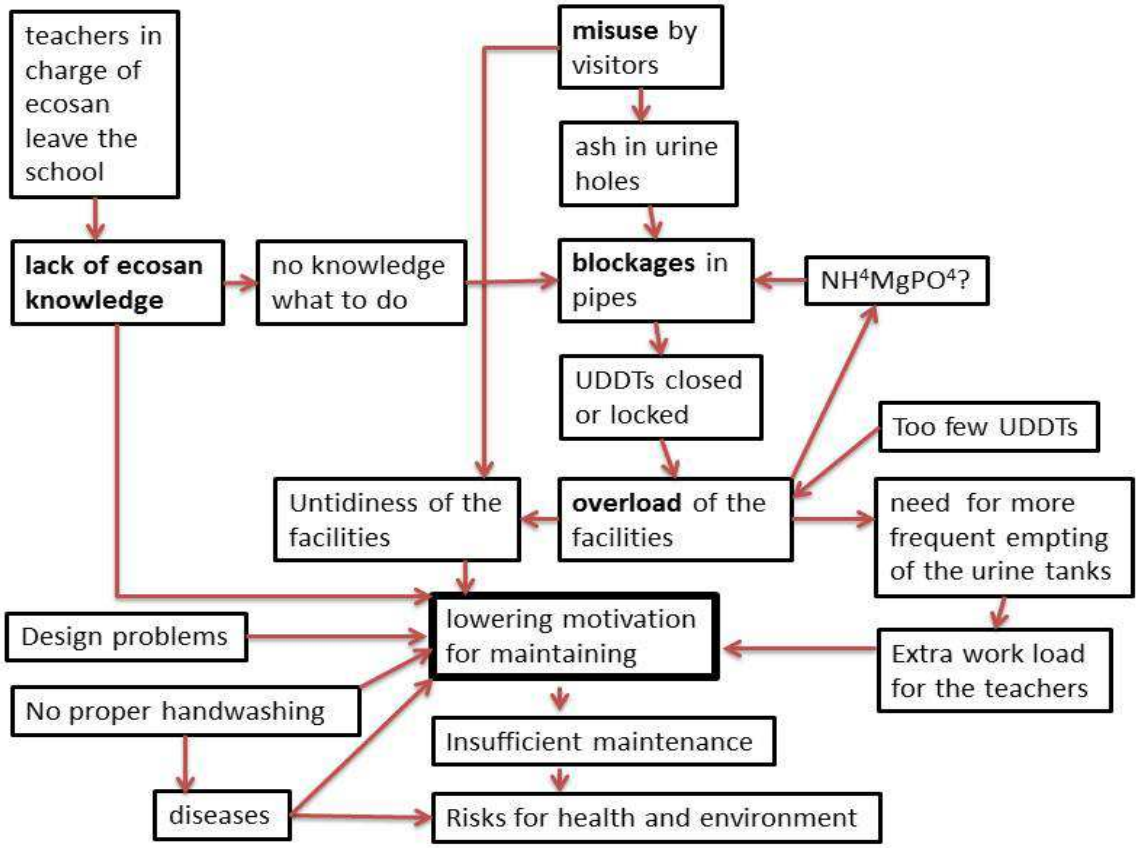

Figure 3. *Challenges of UDDTs in a chain diagram*

Operation and maintenance

One main objective under evaluation in this research was operation and maintenance of the UDDT facilities, as it is often the stumbling stone of the project sustainability. Common challenge is to create sufficient methods, incentives and motivation for maintaining the facilities, keeping them clean and functioning, managing and sustaining the systems. Two different options for organizing O&M were observed; either an employed caretaker (grounds man, cleaner) or students together with help of their teachers were in charge of cleaning, litter disposal, small repairs, unblocking the pipes in case of blockages, provision of ash and possibly other activities like emptying the urine containers and vaults, and utilizing fertilizers on the field.

According to Deegener et al. (2009) the best results are usually reported when at least one full-time-caretaker is responsible for the facilities or a team of caretakers cleaning in shifts. For bigger schools, a minimum of two trained caretakers should be available to balance cases of illness and holidays. One other option is that pupils clean the toilets (partly) themselves, but special care, training and monitoring are needed to secure the success. Therefore EPP had provided one day

training for pupils and teachers but actually failed to agree on O&M plans with the schools. The schools with an employed caretaker responsible for O&M actually were the best performing schools in this research thus confirming the conclusion of Deegener. But the fact is that all the schools cannot afford this, and on the other hand involving pupils (e.g. via Health Clubs) in the sanitation projects has several benefits, for example teaches them to take responsibility and involves them into important issues of hygiene and sanitation.

Extent of utilization

Utilization of the UDDT products varied a lot among the schools. Some schools utilized urine for tree planting, some for large scale farming. Some schools preferred using treated faeces as soil conditioner for fields. According to many interviewed teachers UDDT products were used on the school farm, but in practise it did not always seemed to be true. The best performing schools had large scale agricultural activities (Hope and Kindness, Eldoret Educational Centre, both self-sponsored), or were utilizing UDDT products in tree planting (Siany Mixed Secondary School). These schools valued naturally produced and free fertilizer highly and considered it as a very important benefit of the UDDTs. These schools proved that visible and felt benefits in practice lead to good motivation, which leads to deeper engagement and to continuity. Interestingly these schools had in common that they employed one or more caretaker for managing O&M and had a comparatively higher ratio of toilets to pupils than less performing schools.

Keys for success

In practice factors such as more convenient and hygienic toilets, healthier environment and saved space on the school yard were the driving factors motivating the schools to maintain and take care of their UDDT facilities. The benefits from reuse of urine and faecal matter seemed to be important factors for motivating and engaging the schools initially but this was often perhaps only the idea in theory and not in practice (see previous paragraph). Figure 4 presents the main keys for success and their relations.

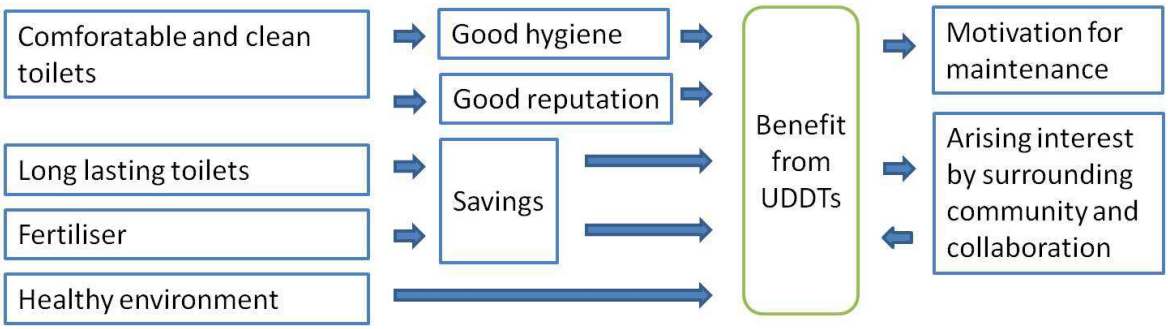

Figure 4. *Factors leading to benefits of UDDTs*

This research has identified a wide range of success factors leading to good performance of school sanitation. Below is a list of key success factors which uses the indicators of the toilet guideline by WHO/UNICEF (WHO, 2009) as a structure including a few additional criteria.

1. Sufficient toilets are available (according to the Kenyan standards)
    - It was observed that in bigger schools the 4 toilets were exposed to an overload of users due to the low total numbers of toilets available in the school. Additionally pupils were interested to use new facilities instead of existing ones. The overload of facilities led to quicker untidiness and unsoundness of the facilities e.g. blockages of urine pipes. On the contrary the two self-sponsored smaller schools of “Hope and Kindness” and “Eldoret” as well as Siani Mixed Secondary have a ratio of UDDTs to pupils of about 1: 40 which is close to the recommended standards. Here the overload of facilities was rarely observed.

In addition to the Kenyan standards the authors recommend to implement also girls urinals.

2. Toilets are easily accessible
   - The access to the toilets was in general sufficient, even though smaller kids and older persons had problems with climbing the stairs.

3. Toilets provide privacy and security
   - Doors had functional locks inside providing privacy, were gender separated and located appropriately.

4. Toilets are appropriate to local conditions
   - UDDTs are clearly a better solution considering the local environment with (e.g. flooding or rocky soil)
   - Saved space on the school yard due to permanent toilets.
   - Clean communication and high expectations on the benefits of utilization of UDDT fertilizer in agriculture since subsistence agriculture is the main income source in rural Kenya.
   - Involvement of surrounding communities

5. Toilets are hygienic to use and easy to clean
   - UDDT facilities are more comfortable (no odors, flies, no risks of collapsing) compared to the commonly used pit latrines.
   - Hygiene has improved thanks to UDDTs and the included hand washing facilities.

6. Toilets must have convenient hand washing facilities nearby
   - Hand washing facilities were attached to toilets by placement on the urine collection chamber. When hand washing facilities were firmly fixed it avoided stealing or misplacement. However the timely purchase of soap for handwashing, which is crucial for effectively executing hand washing, was only witnessed in one school.

7. O&M - A cleaning and maintenance routine is in operation
   - Employed caretakers have provided the best results
   - Schools were able to mobilize resources for repair of facilities

With regard to the shortcomings and challenges in the schools there are additional factors that seem to have great importance for the success of school sanitation:

8. Affordability of facilities
   - Some schools had started to built more UDDT facilities, and many would like to do the same, but the question is finding sufficient funding. The provided design by EPP was meant to promote the technology with attractive features and high quality. However for schools to replicate the technology it is necessary to showcase low-cost options that are more affordable to schools and their communities, but are still attractive.
   - All schools that have constructed their UDDTs themselves, thus were toilets could be afforded, the ownership was high and the performance was comparatively the best. In the GIZ supported schools with no contribution by the school or parents-teachers association the performance was comparatively lower.

9. Keeping the knowledge of O&M in the school despite teacher exchange
    - Several teachers should be trained and in charge of sanitation
    - Provision of a manual or a simple handbook about ecological sanitation and operation and maintenance routines should be easily available in the schools – this was lacking in the all schools, but was frequently demanded.

10. Keep additional work load of the teachers and school in general low
    - Reducing O&M tasks of UDDTs by e.g. infiltration of urine might be a good option.
    - Employed caretakers take over responsibility (see point on O&M)
    - Modification of technical design to reduce urine pipe blockages

11. Community involvement through training and awareness raising activities
    - Involving community was observed as an important factor for example in Siany Mixed Secondary School, where teachers' committee of the community was supporting the school and their ecosan project and therefore the surrounding community was also linked to the ecological sanitation issues, and good results were observed. Besides teachers and pupils all the other stakeholders (caretakers, parents and community members as well as farmers) should attend to trainings and be involved into ecological sanitation in order to result in good maintenance and correct treatment and utilization of the UDDT products.

In addition the main economic benefits of UDDTs in the long run should be underlined for school administration, as many principals and head teachers considered UDDTs as an expensive option compared to traditional sanitation methods, i.e. pit latrines, which do have lower expenses in the beginning, but, as they last only a relatively short time, the total costs will be higher compared to UDDTs.

Motivation arrived from success

The success factors lead to appreciation of UDDTs and their superiority to pit latrines, which in turn generates extra motivation to maintain toilets well. This has also lead to the situation that schools have gained a good reputation on ecosan in surrounding communities which they want to preserve :It was also observed that some teachers and Health Clubs were highly motivated by the fact that they could take over responsibility of ecological sanitation.

Role of ecosan

The prospect of benefitting UDDT fertilizers in school farms and surrounding agriculture has initially led to a high motivation but did not show a noticeable effect during the evaluation visits. In fact most of the 73 schools have not implemented the reuse of human excreta from UDDTs even though this was the primary interest at the outset of the project (personal communication with GIZ Kenya).

Reliability of the results

Field researches that are based only on few interviews and observations have limitation of representative results. Moreover the results from the interviews should be concerned with a hint of caution. Teachers wanted perhaps to give a bit too positive picture about functioning of their ecosan systems as the former EPP implementing officer was present. For example utilization of urine and faeces was not as large scale as the teachers often claimed. Also condition of the UDDT facilities did not always support the statements that the interviewed teachers gave about the maintenance. Therefore, the quantitative field observations and the qualitative focus group discussion with pupils are the firm basis of this research and less the interviews. In order to get a more realistic overview about the actual situation in the field, more research and detective work

should be done. More specified and detailed questions, preferably for a wider range of stakeholders and focus group discussions carried out by local experts, should be carried out.

Conclusions

In general only a small portion of the constructed UDDTs in 73 schools are performing well. The 10 monitored schools that were expected to manage well were also not performing all very good in practise. The main challenges originate from various problems like the exchange of teachers leading to disappearance of the UDDT knowledge from the schools, overload of the facilities due to insufficient number of toilets leading to incorrect use and untidiness, few technical shortcomings and lack of ownership by schools. The research has also shown that certain success factors play vital role for the sustainability of a school sanitation project in rural Kenya. These are (a) sufficient amount of toilets for pupils, (b) affordability of toilet construction by the school (leads to ownership as shown by self-sponsored schools) and (c) the employment of grounds man / cleaners for regular daily cleaning and operation of the facilities.

All the involved stakeholders such as schools, pupils, teachers, parents and other community members as well as local administration have heard and also seen in practise how ecological sanitation works and are convinced about its goodness. Few built more UDDT facilities, and many would like to so as well, but the question of funding remains due to insufficient financial capacities by schools and the expensive design of the toilets. As the aim of the Ecosan Promotion Project was to promote and introduce ecological sanitation and not to upscale there is a lack of an enabling environment to provide interested households, schools and public institutions with the right incentives to invest in alternative sanitation solutions.

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