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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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Nine schools were selected and visited in Nyanza and Western Provinces in Kenya in early 2012 in order to evaluate the performance of urine-diverting dry toilets (UDDTs) in schools a number of. The toilets had been built by the Ecosan Promotion Project (EPP) or had been independently self-sponsored by schools between 2008 and 2010. These school UDDTs were evaluated approximately two years after their construction. The schools were selected for this research on the basis of reasonable performance in operation and maintenance, 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 indicated 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 was no risk 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. The main problems observed were 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 (Deegener et al., 2009). 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 the EPP, Urine-Diverting Dry Toilets (UDDTs) with double dehydration vaults were built in 72 primary schools and one secondary school mainly in Western Kenya. These toilets had four cubicles (2 cubicles per toilet

block) in each school. For more detailed information on these UDDTs for schools see Kraft and Rieck (2011). The construction of the UDDTs was fully financed by the 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 for 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 maintenance 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 the EPP.

The evaluation was done by visiting each school together with their 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 monitoring sheets were adapted from previous monitoring activities by GIZ (Kraft and Rieck, 2011). Information was collected on 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 carried out 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 in focus group discussions. See Pynnönen (2012) for more details on the methodology. This qualitative data related to toilet usage and management, operation and maintenance, utilisation of the UDDT products i.e. urine and faecal matter, and information about social and cultural issues.

Reliability of the results

Field research that is based only on few interviews and observations is often not very representative. Moreover the results from the interviews should be taken with caution. The teachers perhaps wanted to give too positive picture about functioning of their ecosan systems as the former EPP implementing officer was present. For example utilisation of urine and faeces was not as extensive as the teachers often claimed. Also the condition of the UDDTs did not always support the statements that the interviewed teachers gave about the maintenance. Therefore, the quantitative field observations and the qualitative focus group discussions with pupils are probably more reliable than the interviews and are therefore the main foundation of this research. In order to get a more accurate overview about the actual situation in the field, more research should be done: More specified and detailed questions, preferably for a wider range of stakeholders and more focus group discussions should be carried out by local experts. Also, more of the 73 schools should be visited.



Figure 2. Double vault UDDT unit with 2 cubicles and 4 faeces vaults in Kakichuma Primary School. The hand washing tank is on the left side of the toilets, placed on the urine collection chamber. At the back of the toilet cubicle a ventilation pipe can be seen.



Figure 1. View inside a UDDT cubicle, at 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. In the right corner is a bucket for ash as dehydration material. The lids for the two faeces holes are also visible.

Basic data on the nine schools

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

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 second one 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 a sufficient ratio of toilets to pupils as it was wrongly assumed that schools would be able to add more cubicles themselves later on. The recommended ratio of school toilets, according to the guidelines of WHO (2009), is one toilet for 25 girls and one for 30 boys. The EPP-supported schools had a ratio of 1:40 to 1:450. The two self-sponsored schools had a better ratio of 1:40 to 1:90 respectively. 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 also shown in Table 1, but this is not specific for UDDTs.

The evaluation shows in general that schools have problems maintaining the UDDTs correctly and keeping them functioning. Often the reason for temporary closure of a facility was a blockage in the urine pipe. Two schools had built more UDDTs, namely Kendu Muslim Secondary School and Hope and Kindness (the latter school was self sponsored), indicating that they preferred them over pit latrines, even though more effort to maintain UDDTs is needed as compared to pit latrines. The

conditions of the UDDTs varied a lot between the nine schools, even though all the schools had been classified as well-performing according to a basic pre-evaluation.

- Some general conclusions had been drawn from the evaluation of the collected data, regarding maintenance of school UDDTs: Small schools were performing better than big ones.
- UDDTs at self-sponsored schools are better maintained than at the EPP supported schools.
- Employed grounds man or cleaner leads to better general condition of the facilities.
- Schools that have only UDDTs and not also pit latrines are maintaining their UDDTs better than schools that have both types of toilets.
- The best performing schools showed a good utilisation of urine and faeces. This connection probably holds true in rural places where farming, even in schools, is common and fertilisers are needed for improving the yields.

Table 1. Comparison of the condition of the toilets at the nine monitored schools

School	Size of the school (pupils)	Number of UDDT cubicles	General condition of the UDDTs	Functioning old pit latrines	Equipment at 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 Kindness²	170	2 for boys 2 for girls 1 for teachers	very good	no	A, LB, TP, S	Yes, the only one with soap	Two employees	Yes, treated 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	2 for boys 1 for girls 1 for teachers	poor	yes (4)	A, LB	No, water tank was stolen	Health Club	Yes, urine for fertilising vegetables
WESTERN PROVINCE								
Kakichuma Primary	900	2 for boys 2 for teachers	poor	yes (4)	A	No	Nobody	banana trees have been fertilized with urine before
Eldoret Educational Centre²	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 some tanks were missing	Health Club	Yes, urine for 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

The acceptance and popularity of the UDDTs was generally high. Interviewed teachers and pupils appreciated the design of the UDDTs, the convenience of usage and absence of odour and flies.

UDDTs were always preferred to pit latrines. UDDTs are also safer to use as there is no danger of collapsing or sinking, which 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, but later convinced, also about reuse of urine and faeces.

Challenges

Despite high acceptance and popularity of UDDTs, also some problems were observed.

The main challenges and issues that need improving:

- Blockages in urine pipes, often leading to temporary closing of the UDDT facilities. Blockages were caused by ash particles in the urine pipes or by struvite precipitation. Unblocking could be done i.e. with a brush. Mbalo and Brand (2012) found out that blockages in urine pipes were a problem also in the EPP's household UDDTs.
- Minor damages on the superstructures were observed, e.g. discolored paint as well as broken doors and vault doors.
- Hand washing facilities were not always in good condition. Entire facilities or parts of them (water tanks, valves or rainwater pipes) were often missing. In the dry season it is difficult to obtain water.
- Soap was available only in one of the visited schools.
- All the schools had too few UDDTs for the number of pupils, which led to overload and quicker untidiness of the facilities.
- Schools found the steep stairs of the UDDTs a major design problem, as small children, children with disabilities and also older teachers, find it hard to climb these stairs to enter the toilets.
- Misuse (e.g. urinating in the faeces hole) was often caused by visitors, who were not trained to use UDDTs correctly.
- Keeping ecosan and hygiene knowledge and motivation in the school despite the rotation of pupils and teachers is a big challenge.
- Often schools were relying on the GIZ implementation team for support and help in case of problems after the end of the EPP project, even though they indicated a relatively strong ownership of their UDDTs during the interviews.

The factors mentioned above were also indicated by Wakala and Osumba (2010)¹ in addition to the overflow of urine tanks and occasional lack of ash as dry covering material.

Figure 3 presents an impact chain of the main observed challenges and their relationships for maintenance of school UDDTs.

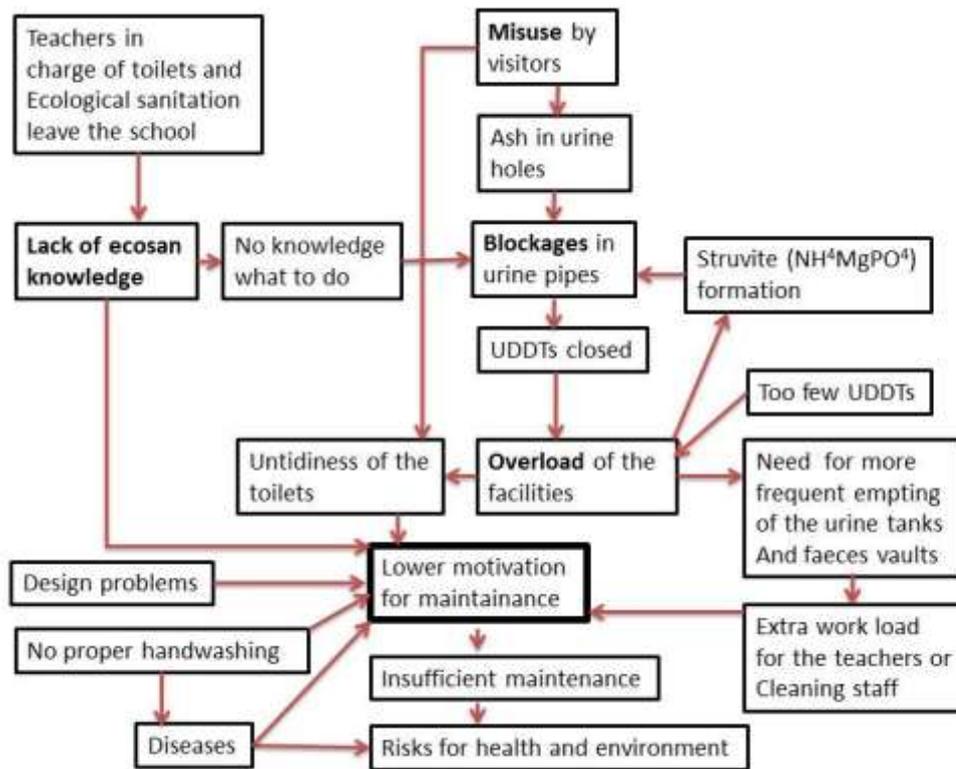


Figure 3. Challenges of UDDTs in a chain diagram

Responsibility for operation and maintenance

One main objective under evaluation in this research was operation and maintenance of the UDDTs, as it is often the stumbling block for the sustainability of many school projects. It is a common challenge to create sufficient, incentives and motivation for maintaining the toilets, keeping them clean and functioning. Two different options for organising 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 faeces vaults, and utilising fertilizers on the field.

According to Deegener et al. (2009) the best results for school toilets are usually reported when at least one full-time caretaker is responsible for the toilets or a team of caretakers are working in shifts. For bigger schools, a minimum of two trained caretakers should be available in case of illness and holidays. Another option is that pupils clean the toilets fully or partially themselves, but special training and monitoring are needed to secure the success of this setup. The EPP had provided one day of training for pupils and teachers but failed to set up proper O&M plans with the schools. The schools with an employed caretaker responsible for O&M actually were found to be the best performing schools in this research thus confirming the conclusions of Deegener et al.(2009). But the fact is that many schools simply cannot afford this. Also, the involvement of pupils (e.g. via Health Clubs) in sanitation projects can have several benefits, for example it can teach them to take responsibility and can involve them in important issues of hygiene and sanitation. Thus, the ideal scenario might be a mixture of the two approaches.

Extent of reuse of UDDT products

Reuse of the UDDT products varied a lot among the schools. Some schools utilised urine for tree planting, some for large scale farming (see Table 1). Some schools used treated faeces as soil conditioner. According to many interviews with teachers, UDDT products were used on the school farms, but in practice it did not always seem to be true. The best performing schools had large scale agricultural activities (Hope and Kindness, Eldoret Educational Centre, both were self-sponsored), or were utilising UDDT products in tree planting (Siany Mixed Secondary School). These schools valued the naturally produced and free fertiliser highly and considered it as a very important benefit of the UDDTs. These schools proved that reuse benefits demonstrated in practice can lead to good motivation, deeper engagement and long term interest. These three schools had in common that they employed one or more caretaker for maintaining the UDDTs and had a higher ratio of toilets to pupils than the other six schools, where the UDDTs were in worse condition.

The prospect of using UDDT fertilisers in school farms and surrounding agriculture had initially led to a high motivation but did not show any noticeable effect anymore during the evaluation visits. In fact most of the 73 schools in the EPP 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).

Key factors for success

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 UDDTs. The benefits from utilisation of urine and faecal matter as fertilizer seemed to be important factors for motivating and engaging the schools initially but this was often only the idea in theory and not in practice (see previous paragraph). Figure 4 presents the main key factors for success of school UDDTs and their relationships.

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

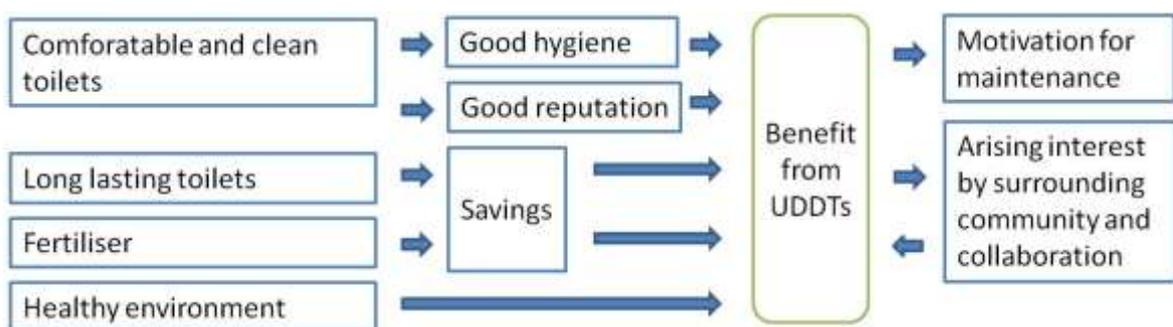


Figure 4. Factors leading to benefits of school UDDTs and successful maintenance.

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

1. Toilets are easily accessible

- The access to the toilets was in general sufficient, even though smaller children and older persons had problems with climbing the stairs. The youngest children using the UDDTs are only three years old.
 - In all of the nine schools the UDDTs were located in the school yard, so the distance from the class rooms to the toilets was not much.
2. Toilets provide privacy and security
- Doors had functional locks inside providing privacy. Toilets were also gender separated.
3. Toilets are appropriate to local conditions
- UDDTs are clearly a better solution than pit latrines for this local environment where flooding or rocky soil are common.
 - Saved space on the school yard due to toilets being permanent; no need to dig new pits and rebuild toilets.
 - Clear communication and high expectations on the benefits of utilisation of UDDT fertiliser in agriculture since subsistence agriculture is the main income source in rural Kenya.
 - Involvement of surrounding communities.
4. Toilets are hygienic to use and easy to clean
- UDDTs are more comfortable (no odours, flies, no risks of collapsing) compared to the commonly used pit latrines.
 - Hygiene has improved thanks to the included hand washing facilities.
5. Toilets must have convenient hand washing facilities nearby
- Hand washing facilities were attached to the toilets by placement on the urine collection chamber. These hand washing facilities need to be firmly fixed to avoid theft or misplacement. However the regularly purchase of soap for handwashing, which is crucial for effective executing hand washing, was only witnessed in one school (Hope and Kindness).
6. A cleaning and maintenance routine is enforced and followed
- Schools which employ caretakers had the best UDDT maintenance (see Table 1)
 - Schools were able to mobilise 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 UDDTs at schools:

7. Sufficient toilets are available (according to the Kenyan standards)
- It was observed that in almost all of the schools the 4 toilets were used by too many users due to the low total numbers of toilets available in the school. Additionally, the pupils were keen to use the new facilities instead of existing ones. The overload of the UDDTs led to quicker untidiness and malfunctioning of the facilities such as blockages of urine pipes. On the contrary the two self-sponsored smaller schools of “Hope and Kindness” and “Eldoret” as well as Siany Mixed Secondary have a ratio of UDDTs to pupils of about 1:40 which is close to the Kenyan school toilet standards (1:25 for girls and 1:30 for boys). Here an over-use of facilities was not reported. In addition to the Kenyan standards the authors recommend to implement also girls’ urinals (Freeman et al., 2012).
8. Affordability of toilets
- Some schools had started to build more UDDTs, and many would like to do so, but the problem is finding sufficient funding. The provided design by the EPP was meant to promote the technology with attractive features and high quality. However for schools to

replicate the technology it is necessary to know about low-cost options that are more affordable to schools and their communities, but are still attractive.

- At the two schools that have constructed their UDDTs on their own accord, thus where toilets could be afforded, the ownership was high and the performance was comparatively very good. In the GIZ supported schools with no contribution by the school or parents-teachers association the performance was lower.
- In addition the economic benefits of UDDTs in the long run should be explained to the school administration. Many principals and head teachers considered UDDTs as an expensive option compared to traditional pit latrines. UDDTs have higher costs in the beginning, but, as they last longer, the total whole-of-life costs will be lower compared to pit latrines.

9. Keeping the knowledge of O&M in the school despite teacher rotations

- Several teachers should be trained and in charge of sanitation
- A manual or simple handbook about the UDDTs and operation and maintenance routines should be easily available in the schools – this was lacking in all of the visited schools, but was frequently demanded.

10. Reduce additional work load for the teachers and school staff

- Reducing O&M tasks of UDDTs by infiltration of urine might be a good option.
- Employed caretakers take over responsibility for the toilets
- Modification of technical design to reduce urine pipe blockages.

11. Community involvement through training and awareness raising activities

- Involving the community was found to be an important factor for example in Siany Mixed Secondary School, where a teachers' committee of the community was supporting the school and their ecosan project, and therefore the surrounding community was also linked to the ecosan issues. Good results were observed at the school. Besides teachers and pupils all the other stakeholders (caretakers, parents and community members as well as farmers) should attend training sessions and be involved in ecosan in order to result in good maintenance of the school toilets and correct treatment and utilisation of the UDDT products.

Conclusions

In general only a small portion of the constructed UDDTs in 73 schools are maintained well. The 10 monitored schools that were expected to manage their UDDTs well were also not all performing well in actual fact. The main challenges originate from various problems like the rotation 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, some technical shortcomings and lack of ownership by schools. The research has also shown that certain success factors play a vital role for the sustainability of school sanitation projects in rural Kenya. These are i) sufficient amount of toilets for pupils, ii) affordability of toilet construction by the school (leads to ownership as shown by self-sponsored schools) and iii) the employment of cleaners or maintenance staff for regular daily cleaning and operation of the facilities.

All the involved stakeholders such as schools administration, pupils, teachers, parents and other community members as well as the local administration have seen in practise how ecological sanitation works and are convinced about its benefits. Few built more UDDTs, and many would like to do so as well, but the question of funding remains due to insufficient financial capacities of the 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 incentives for interested schools to invest in ecological sanitation solutions.

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