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**THE FUTURE OF WATER, SANITATION AND HYGIENE:  
INNOVATION, ADAPTATION AND ENGAGEMENT IN A CHANGING WORLD**

**Ecological sanitation in low income countries:  
assessment of social acceptance and scope of scaling up**

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*Ecological sanitation (EcoSan) is one of the effective concepts of sustainable sanitation for both water-rich and water-poor areas. Urine diversion dehydration toilet (UDDT) is a toilet system under this concept which can be used to recover resources such as nutrients and can also be an alternative to improve the sanitary situation in low income countries. A reconnaissance survey, structured questionnaire survey, key informant interviews, participatory approaches such as focus group discussion (FGD) and mass gathering were carried out in Kenya to assess social acceptance and scope of scaling up of UDDTs. The results showed that almost all respondents among UDDT users and non-users have overcome social and cultural barriers to accept UDDTs. Users were spontaneously applying EcoSan products as fertilizers to their agricultural lands. It is recommended to develop a strong interlinked and a coordinated system with market creation among the stakeholders to replicate UDDTs.*

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## **Introduction**

Forty percent (40%) of the global population does not have access to improved sanitation (WHO, 2010) and over 90% untreated sewage is discharged to the environment polluting surface water bodies such as rivers, lakes and coastal areas (Langergraber and Muelegger, 2005). Traditional ways of defecation such as pit latrines and open air toilets or bush including flying toilets are still dominantly used in many low income countries which follow the 'drop and store' (Esrey *et al.*, 2001) or 'drop to forget' principal and pollute the environment seriously by spreading pathogens.

Most of the low income countries in Sub-Sahara Africa will not be able to reach the sanitation target as stated in the Millennium Development Goals (MDGs), which is to halve the number of people without access to adequate sanitation by 2015 (Zurbrugg and Tilley, 2009). For reducing the number of people without access to safe drinking water and sanitation to achieve the MDGs, new ideas and concepts on sustainable and economically feasible sanitation systems rather than expensive conventional technologies are needed (Werner *et al.*, 2009).

Urine diversion dehydration toilets (UDDTs) might be one of the alternatives and affordable options to solve the sanitation problems because they follow the basic principle of closing the nutrient cycle between sanitation and agriculture. UDDTs comprise not only toilets but also enable recovery of resources such as organic fertilizers and fish foods from human feces and urine for the benefit of agriculture, thus helping to preserve soil fertility, assure food security, minimize water pollution, reduce waterborne diseases, reduce water consumption in a sustainable way and recover bio-energy. UDDTs have the prospect to protect both ground and surface water from pollution by hindering infiltration and surface runoff and properly treating pathogens and hence are an effective on-site treatment process.

In both urban and rural areas of low income countries in the world, UDDTs are being introduced as sustainable sanitation technologies through various types of projects such as community EcoSan projects, public sharing EcoSan projects and school EcoSan projects with the help of international, national, and local organizations, research institutions, as well as different government agencies. High level of awareness about this technology among the users, professionals and policy makers will help to increase social acceptance and to replicate it among the non-users (Water Aid, 2008). For example, in Nepal people have set up the first

'Human urine bank' in the world for improving their farmlands which had degraded seriously due to excessive use of chemical fertilizers (NGO Forum, 2010).

Kenya, where the current study was conducted, is one of the low income countries in the world having 50% poverty level (CIA, 2000). In Kenya, on average only 42% of the population is using improved sanitation facilities (UNICEF, 2010). The conventional sewage treatment system is very expensive and not affordable for the poor people in Kenya. Ecological sanitation is a relatively new concept in Kenya. It started being introduced in the last ten years on a pilot scale. It is considered that there is still low awareness about UDDTs among Kenyan people and those covered by the pilot projects area are still learning the new technology. Limited awareness and socio-cultural barriers on handling human waste have been identified as some of the key constraints to large-scale adaptation of UDDTs (Drangert, 2004). Scaling up and social acceptance of the UDDTs will be great challenges for rural, peri-urban and urban areas in Kenya.

This study was conducted in a rural area of Rachuonyo District, Nyanza Province of Kenya which is one of the areas where UDDTs have been introduced on a pilot scale. An intensive field survey including a questionnaire survey and focus group discussion (FDG) were carried out to assess the social acceptance of UDDTs. The study also tried to assess the scope of scaling up of UDDTs. Social, cultural and economic aspects regarding the replication and acceptability of the UDDTs were also considered.

## **Methodology**

### **Study area selection**

The study area was selected because it is one of the areas where UDDTs have been tried for a long time in Kenya (since 2004). The area provided sufficient numbers of samples from both UDDT users and non-users. Besides, the area was reported to have achieved a high rate of social acceptance of UDDTs and therefore it was considered that the area would provide useful lessons to learn.

### **Study area description**

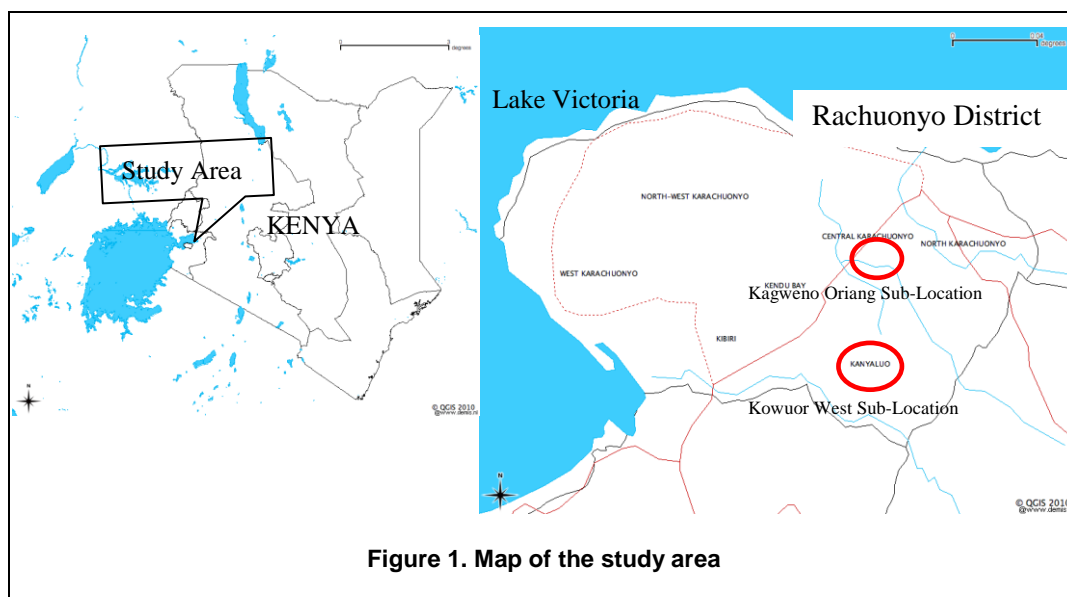
The study area is located in Rachuonyo District of Nyanza Province in Kenya near the shores of Lake Victoria (Figure 1). Three villages in two Sub-Locations were selected (Table 1). Several EcoSan projects funded by Adventist Development and Relief Agency (ADRA) Finland, Canadian International Development Agency (CIDA), European Union and German International Cooperation Agency (EU-GTZ), and Swedish International Development Cooperation Agency (SIDA) have been implemented in the study area since 2004. OSIENALA (Friends of Lake Victoria), a local Non Governmental Organization (NGO), has been involved in implementation and promotion of some of the EcoSan projects in the area.

### ***Climate and topography***

There are two main rainy seasons in the study area, short and long rainy seasons. During long rainy season (March-May and October-December) heavy rainfall occurs and there is sufficient water. However, during the rest of the year the area experiences water scarcity and rivers dry up. The area is located on a low lying flood plain that surrounds Lake Victoria and is prone to flooding in the rainy season. The soils are coarse sandy structured and are prone to erosion. Because of the coarse sandy structure of soils, pit latrines do not last long in the area due to soil collapse.

### ***Socio-cultural situation***

Most of the people in the study area are Christians. The rural people are very religious and socio-culturally they have strong bonding with each other. There are many traditional beliefs that affect the way of life of people in the area. For example, some believe that a second wife is not allowed to sow before the first wife. This factor may lead to poor timing of rain which may affect agricultural production. Some beliefs relate to sanitation issues as discussed below.



### Demography

Total population of the study area is about 1,856 and total Household (HH) units are 547. Table 1 shows the population and household units of the study area.

Table 1. Population of the study area, Rachuoonyo District, Kenya (Source: Local Government Office, 2010)					
Location	Sub-Location	Village	HH Units	Population	Total population
East Kanyaluo	Kowuor West	Ouya	260	1155	1,856
Kagweno Oriang	Kagweno Oriang West	Katuola	155	380	
		Waumi	132	321	

### Crop seasons

Residents in the study area cultivate crops only once a year during the long rains. Generally, the land in the area is fertile for agriculture. The main agricultural products include maize, groundnuts, several types of fruits and vegetables. There is a scope to adapt organic fertilizers by using animal manure and products from UDDTs.

### Water sources

The main sources of water are river, rain and well. River Sare is the only river in the study area and it is seasonal, drying up when there are no rains. The water from these sources is used for drinking purposes mainly in raw form without any form of treatment. As a consequence, waterborne diseases are common in the area.

### Environmental problems

The main environmental problems in the study area are water pollution and water scarcity, deforestation, soil erosion, and waterborne diseases. The area is experiencing severe soil erosion that has affected agricultural productivity of the land. In some areas large erosion gullies as deep as 30 m are visible. Photograph 1 shows some major environmental problems in the study area.



**Photograph 1. Major environmental problems in the study area (September 2010)**

### Survey methods

Both primary and secondary data were collected in this study. Primary data were collected through reconnaissance survey, structured questionnaire survey and key informant interviews in the period of August - September 2010. Some Participatory Rural Appraisal (PRA) tools such as rapport building, focus group discussion (FGD) and mass gathering, among others were applied in this regard. A total of 245 samples consisting of 118 UDDT users and 127 non-users were selected for the structured questionnaire survey. The 118 samples of users represented all (100%) UDDT users in the area. As for non-users random sampling method was applied. Table 2 shows village wise number of samples collected.

Table 2. Questionnaire survey samples collected					
Location	Sub-Location	Village	UDDT users	UDDT non-users	Total samples
East Kanyaluo	Kowuor West	Ouya	86	62	245
Kagweno Oriang	Kagweno Oriang West	Katuola	32	65	
		Waumi			

In addition, informal and formal interviews were conducted through key informant interviews with government and NGO officials, community leaders, Women Groups, school teachers, religious leaders, etc. Several FGDs and mass gatherings were arranged with UDDT users and non-users, and Women Groups to validate the data that were collected through the questionnaire survey. Different levels of target groups based on income and social status were considered. Relevant secondary data were obtained from Government and NGOs, and published and unpublished literature.

## Results and discussions

### Community initiatives and role of women groups

Local Women Groups in the study area play a leading role in promoting community development activities, including UDDTs promotion. There are three active Women Groups in the study area, namely, Kanyonje, Tang'lweti and Nyochoo Women Groups. The origin of the Women Groups dates back to 1993 when around 10 women made the first group (Kanyonje Women Group) some of whose objectives were to ensure safe drinking water and to clean the environment in the study area. Currently the total number of members of the three Women Groups is 78.

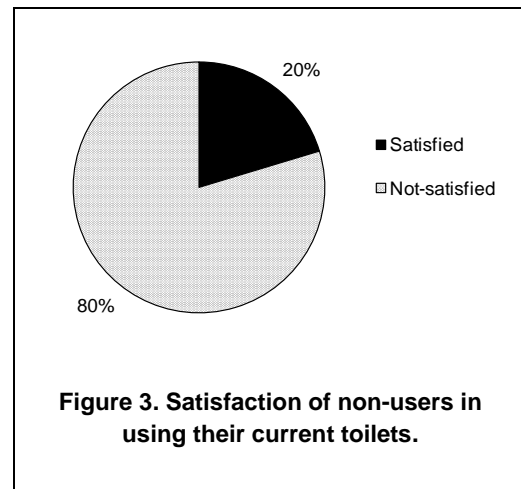
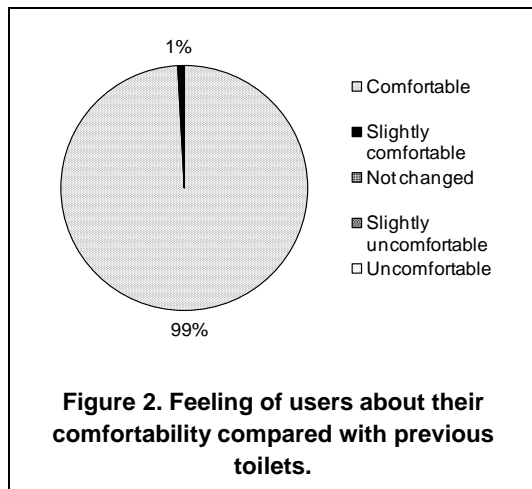
The Women Groups have been conducting surveys in the study area since 2002 on various issues. Among their findings is that 50-75% of the children were affected by different waterborne diseases such as bilharzias (urinal bleeding), typhoid, amoebiasis, dysentery, and cholera. Another finding on the condition of pit latrines in the study area is that from 2002 to 2009, of a total of 661 pit latrines surveyed, 471 (67%) had collapsed. The high rate of collapse of pit latrines is attributed to the coarse sandy soil structure in the study area. The above two findings are some of the major driving forces for the Women Groups to think about possible alternatives to address the sanitation problem in the study area.

### Toilet situation

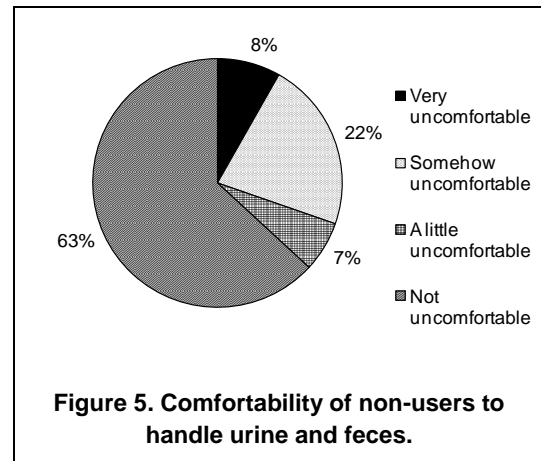
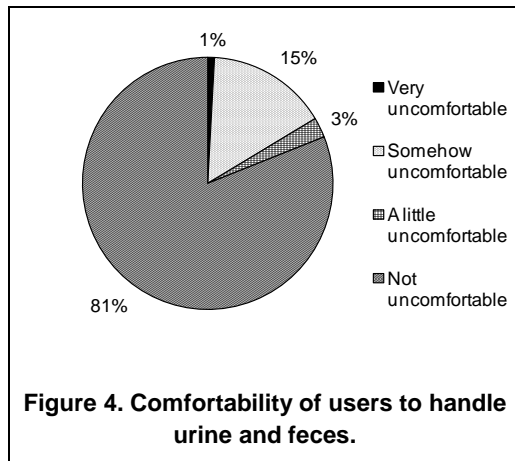
The questionnaire survey results showed that 53% of the respondents among non-users of UDDTs have pit latrines. The remaining 47% do not have toilets so they use open defecation in bushes, river banks or in open spaces. Open defecation negatively impacts on the hygiene of the study area and pollutes surface and ground water. It is also highly possible that pit latrines too pollute both surface and groundwater because of the sandy soil structure that allows easy seepage, shallow water table, and frequent floods. On the other hand, UDDTs if properly managed do not have these disadvantages even during heavy rains or floods.

### Social acceptance of UDDTs

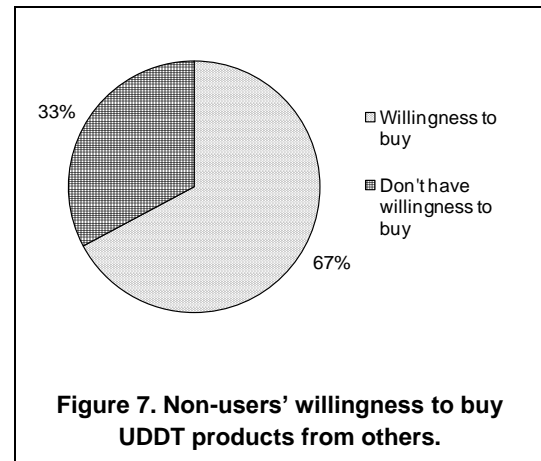
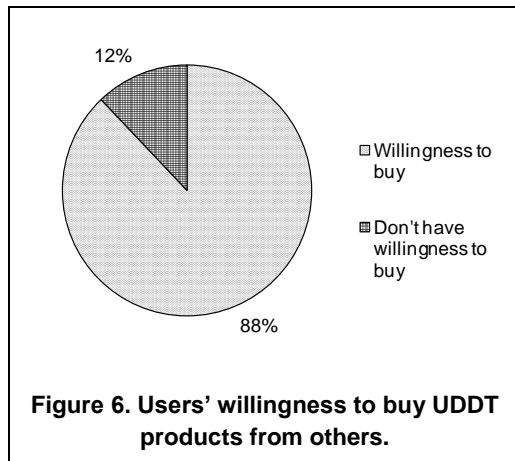
The study found that almost all (99%) UDDT users think that UDDTs are more comfortable compared to the previous toilets (pit latrines and open defecation) as shown in Figure 2. As for the non-users, 97% want to construct UDDTs and 80% (Figure 3) are not satisfied with their current toilets and they are also willing to contribute labor, materials and money towards the construction of UDDTs. Thus, it can be said that both users and non-users have widely accepted UDDTs. The other reasons cited for accepting UDDTs are high frequency of collapsing of pit latrines due to coarse sandy soil structure, less or no bad smell or infestation with flies in UDDTs and provision of organic fertilizers.



All (100%) respondents among both users and non-users have their own farms to use UDDT products as organic fertilizers. Figures 4 and 5 show that 81% of respondents among users and 63% among non-users do not feel uncomfortable to handle urine and feces. Many people have overcome the social barrier of handling urine and feces that existed in the study area when UDDTs were first introduced (discussed below). This has been achieved through awareness raising, training and education by the implementing organizations of EcoSan projects so many people know about the use and safe handling of urine and feces.



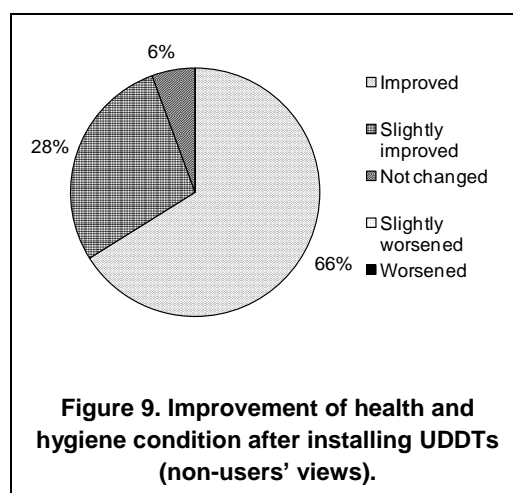
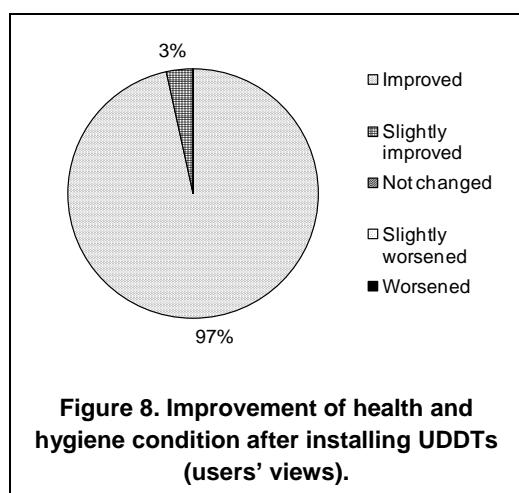
In Figures 6 and 7, it is shown that 88% of the users have willingness to buy UDDT products (urine and feces) from others, but the rest of them don't have willingness to buy due to social status and lack of awareness. On the other hand, 67% of non-users have willingness to buy UDDTs products from others. The difference between users and non-users may be due to relatively less knowledge about the products of UDDTs among non-users.



The above results suggest that, generally, UDDTs are socially accepted by both users and non-users in the study area. Although there were some misconceptions before installation of UDDTs, later many people overcame those barriers. The barriers include the belief that applying ash on feces causes stomachache, the belief that those who use UDDTs are at high risk of being bewitched, or that it is unacceptable (taboo) to touch the feces of daughter- or son-in-laws. With awareness raising and public education conducted by local Women's Groups and NGOs, the social and cultural barriers were overcome.

### Replication of UDDTs

All (100%) users and 94% of non-users think UDDTs are good for Kenya and even are interested to encourage community members to install them. The factors cited are that UDDTs provide organic fertilizers, are long lasting compared with pit latrines, do not pollute water, and improve health status. Figures 8 and 9 show that 97% of the users and 66% of the non-users thought that health and hygiene conditions have improved after installation of UDDTs in the study area. All these factors point to the high potential for replication of UDDTs in the study area and beyond.



### Cost analysis

The average construction cost of an UDDT in the study area is Kenya Shillings (KES) 60,000 (United States Dollars (USD) 744 at the time of the survey) while the average construction cost of a pit latrine is KES 12,000 (USD 148). As for the UDDTs, the projects contributed about 70% of the total cost while the beneficiaries contributed the remaining 30%.

The average income of the UDDTs users is around KES 12,000/month (USD 148/month). Somehow they can afford the 30% beneficiary contribution of the construction cost which is about KES 18,000 (USD 223) and is mainly in kind in form of unskilled labor and some locally available materials such as stones, gravel, sand and timber. About the construction cost, 53% of the respondents among users thought that it is cheap, 34% thought it is affordable and the remaining 13% thought it is expensive. But all of them were of the opinion that there is need to reduce the current construction cost to make UDDTs affordable to low income earners. On the other hand, the average income of non-users is about KES 4,000/month (USD 50/month) which means that the construction cost of UDDTs is comparatively high and not affordable for them. It is noted that the UDDTs constructed in the study area are of very high quality and are constructed to last for long. With some modifications in the construction methods and more use of locally available materials, it is possible to reduce the construction cost.

### Conclusion

Although there were some social barriers before installation of UDDTs in the study area such as fecophobia, belief that sprinkling ash on feces causes stomach trouble, and social taboos such as touching daughter- or son-in-law's feces, these barriers have been largely overcome through awareness raising, training and education activities by local Women Groups and NGOs. The rate of acceptance of UDDTs in the study area was very high due to high incidences of collapse of pit latrines and high rates of waterborne diseases which led the people to easily accept UDDTs a better alternative.

### Recommendation

Although there were some challenges or social barriers in the study area regarding the acceptance of UDDTs, the toilets have been accepted widely in the study area. The major factors contributing to the wide acceptance are considered to be the loose sandy soil type in the study area that makes pit latrines unattractive due to frequent collapse, flooding and high frequency of occurrence of waterborne diseases, and the prominent role played by Women Groups and NGOs. These factors may not be applicable to all areas in Kenya or in other low income countries in the world. The driving forces leading to acceptance and replicability of UDDTs may vary depending on location, geographical settings, religious and cultural beliefs, social barriers, among others. There is therefore need to properly assess the driving forces while introducing EcoSan to an area. Although the initial cost of UDDTs may be higher than that of pit latrines, in the long run UDDT users can get added benefits such as fertilizers, low maintenance cost, comfort, and prevention of water pollution. For more acceptance and replication of UDDTs in rural, peri-urban and urban areas in low income countries, there is need to promote creation of networks for sharing of lessons and experiences

globally. This will go a long way to overcoming many of the challenges facing introduction of UDDTs such as cultural and social barriers, training for proper maintenance, and creation of markets for UDDT products.

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## Acknowledgements

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## References

- CIA (2000) The World Fact Book, Population Below Poverty Line, Website:  
<https://www.cia.gov/library/publications/the-world-factbook/fields/2046.html>. Last access July 2010.
- Drangert, J.O. (2004) *Norms and Attitudes Towards Ecosan and Other Sanitation Systems*. EcoSanRes Publications Series. Stockholm Environment Institute: Stockholm, Sweden.
- Esrey, S., Andersson, I., Hillers, A. and Sawyer, R. (2001) *Closing the Loop: Ecological Sanitation for Food Security*. Publications on Water Resources No. 18, Swedish International Development Corporation Agency: Mexico.
- Langereraber, G. and Muellegger, E. (2005) *Ecological Sanitation - A Way to Solve Global Sanitation Problem?* Environment International Vol. 31, pp.433-444.
- NGO Forum (2010) *Farmers set up first 'human urine bank.'* News of NGO Forum for Urban Water & Sanitation: Nepal. Website:([http://www.ngoforum.net/index.php?option=com\\_content&task=view&id=8667&Itemid=6](http://www.ngoforum.net/index.php?option=com_content&task=view&id=8667&Itemid=6)). Last access, November 2010.
- UNICEF (2010) Website:  
([http://webcache.googleusercontent.com/search?q=cache:http://www.unicef.org/infobycountry/kenya\\_statistics.html](http://webcache.googleusercontent.com/search?q=cache:http://www.unicef.org/infobycountry/kenya_statistics.html)). Last access July 2010.
- Water Aid (2008) *Assessment of UDDTs in Nepal*. Water Aid: Nepal.
- Werner, C., Panesar, A., Rud, S.B. and Olt, C.U. (2009) *Ecological Sanitation: Principles, Technologies and Project Examples for Sustainable Wastewater and Excreta Management*. Desalination Vol. 248, No 1-3, pp.392-401.
- WHO (2010) *World Health Statistics*. World Health Organization: Switzerland.
- Zurbrugg, C. and Tilley, E. (2009) *A System Perspective in the Sanitation - Human Waste from Cradle to Grave and Reincarnation*. Desalination Vol. 248, No 1-3, pp. 410-417.

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## Key words

UDDT, ecological sanitation, social acceptance, scaling up.

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