Case study of sustainable sanitation projects

UDDTs implemented via CBOs and Water Services Trust Fund, Nyanza, Western and other provinces, Kenya

Fig. 1: Project location

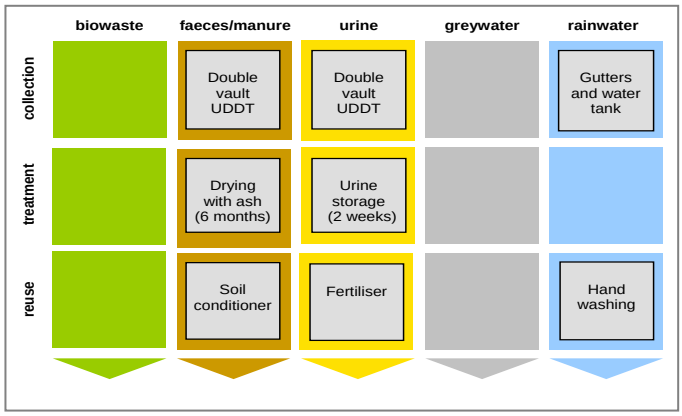

Fig. 2: Applied sanitation components in this project (UDDT stands for urine diversion dehydration toilet).

1 General data

Type of project:
Pilot UDDTs for rural and peri-urban households+schools

Project period:
Start of project: November 2006
Completed UDDTs, start of use: January 2008 onwards
End of external funding for EEP: May 2010
Monitoring by GTZ until Nov 2010 and possibly longer

Project scale:
- 658 double vault UDDTs at households
- 326 double vault UDDTs at schools
- People reached approx. 20,000 (average of 15 people per household and average of 30 students per school)
- Unit cost: average of EUR 500 for hardware, EUR 100 for software activities (such as trainings, workshops, supervision, monitoring and overheads)
- Total costs of approx. EUR 600,000

Address of project location:
Lake Victoria region with Nyanza and Western Province as well as Rift Valley Province, Eastern, North-Eastern, Central and Cost Provinces in Kenya

Planning organisation:
EcoSan Promotion Project (EEP) - supported by the EU, SIDA, GTZ and embedded in the GTZ Water Sector Reform Program) in cooperation with the Ministry of Water and Irrigation in Nairobi

Executing institution:
- Community based organisations (CBOs)
- Kenyan water sector institutions:
  - Water Services Boards (WSBs)
  - Water Services Trust Fund (WSTF)

Supporting agency:
- European Union (EU) – ACP EU Water Facility
- Swedish International Development Agency (SIDA)
- German Technical Corporation (GTZ) - on behalf of German Federal Ministry for Economic Cooperation and Development (BMZ)

2 Objective and motivation of the project

The project described in this case study is part of the much larger EU-SIDA-GTZ EcoSan Promotion Project (EPP). Its objective was to reach a total of 50,000 users with reuse oriented sanitation systems. It piloted reuse oriented sanitation projects through three intervention lines:[1] (1) household toilets in rural and peri-urban areas, (2) institutional toilets at schools and prisons and (3) public toilets in bus parks, markets and recreation areas.

Fig. 3: Rural household UDDT in Nyanza Province (source: Paul Mboya, GTZ-Kenya, Aug. 2009 – Note distance between house and toilet is approx. 20 meters)

This case study describes the activities of the first and partially second intervention lines which had the following objectives:

- Introducing the concept of recycling human waste as fertiliser to small scale farmers as a strategy to generate additional income ("productive sanitation").
- Installation of urine diversion dehydration toilets (UDDTs) to improve public health in cholera affected areas and other areas with high occurrence of water related diseases mostly caused by seasonal flooding.

[1] See also the cases studies for a public toilet in Naivasha and school UDDTs
http://www.susana.org/lang-en/case-studies/region/ssa

- Assisting communities that experience challenges with conventional pit latrines due to flooding, high groundwater table, collapsing soils and rocky soils.
- Building capacity amongst the local communities, artisans, private sector, NGOs and water sector institutions in Kenya to implement UDDTs as an alternative sanitation option.

3 Location and conditions

The project areas are villages in rural and peri-urban areas where farming is practiced. The target areas have frequent cholera outbreaks due to seasonal flooding or generally suffer from other water related diseases. The targeted areas were distributed throughout Kenya in order to include various ethnical groups with diverse learning cultures and social backgrounds. However the area with highest number of implemented UDDTs was Nyanza and Western Provinces surrounding Lake Victoria which are critical cholera hotspots. 60-88% of all diseases in Kenya are linked to insufficient water supply and basic sanitation.[2]

Fig. 4: Overview of 7 project areas in Kenya where UDDTs were implemented (indicated by circles).

In Kenya, the under-five child mortality rate is currently[3] **128 children per 1000**, and sadly there has been an upward trend towards more child deaths since 1985 when the value was 98 child deaths per thousand.

Fig. 5: Household UDDT and shower on the left in the semi-desert area of Wajir, North Eastern Province (source: Paul Mboya, GTZ-Kenya, March 2009).

Generally, the greater Lake Victoria area is characterised by sufficient rainfall for agricultural production. Highland regions around Lake Victoria like Kisii and Bungoma receive heavy rainfall with up to 1,800 mm of annual rainfall whereas the lowland areas receive less rainfall with less than 1,000 mm of annual rainfall. The rainy period is March/May and October/November.

The people in the target areas mostly use simple pit latrines (VIP, covered and uncovered pits). According to the Kenya Integrated Household Budget Survey about 56% of urban households in Kenya use latrines compared to 79% of rural households.[2] Hence open defecation is also a common practice in Kenya.

The majority of the people in the rural target areas are subsistence farmers with an average income of approx. EUR 30 (3,000 Kenyan Shilling) per month. Health statistics from hospitals in the area show that cases of cholera and other water borne diseases like diarrhea, typhoid and parasitic infections occur especially during the rainy season, when pit latrines get flooded and pollute the drinking water resources like wells and rivers.

The average household size is 20 people consisting of a few family generations living on one compound of average 1-5 acres and with one toilet. Thus up to 20 people may share one UDDT. It also occurs that smaller households share one common toilet as it is practiced within the Luo community. To estimate the number of users for this project, we used a figure of 15 people per toilet in household and 30 students in schools.

4 Project history

The Ministry of Water and Irrigation (MWI) has committed itself through the Water Sector Reform Program to facilitate the improvement of water supply, sewerage and sanitation service provision in Kenya. GTZ is supporting the Kenyan Water Sector Reform Program through its Water Program which has several components. The fifth component was the EU-SIDA-GTZ EcoSan Promotion Project (EPP) which was implemented from end of 2006 to mid 2010.

[2] The Water Sector Sanitation Concept – WSSC (Ministry of Water and Irrigation/MWI, Kenya, August 2009).

[3] The under-five mortality rate is the probability (expressed as a rate per 1,000 live births) of a child born in a specified year dying before reaching the age of five if subject to current age-specific mortality rates (http://www.childinfo.org/mortality.html and http://www.childmortality.org/).

The EPP was financed by the ACP-EU Water Facility[4] (EUR 1,734,000) and co-financed by SIDA (EUR 816,000), GTZ-Kenya Water Program (EUR 100,000) and the GTZ-Kenya Agriculture Program (EUR 100,000). The project was implemented by GTZ-Kenya.

The total number of installed UDDT units in May 2010 was 658 at households and 326 in schools implemented directly through CBOs or via channelling funds through the Water Services Trust Fund (WSTF) to the Water Services Boards (WSBs). The WSTF is still in the process of implementing more units with funds that were provided by EPP in advance.

Tab. 1: Total number of constructed UDDTs in rural and peri-urban areas (based on final report of EPP May 2010). The school UDDT are described in a separate case study.

	UDDTs constructed in	
	Households	**Schools**
via CBOs	541	263
via WSTF-WSBs-CBOs	117	63
Sub-total	**658**	**326**
Total		**984**

Ecological sanitation (ecosan) with UDDTs is not new in Kenya. It has been implemented on a small scale through some NGOs such as KWAHO, ALFEF and SANA over the last 10 years. There were positive as well as negative examples which were used to determine the right strategy and approach to promote UDDTs in Kenya.

Process and partners

The EPP offices were located at the Ministry of Water and Irrigation as the main local partner. In the beginning of the project in 2007 the project assigned three sanitation officers (also called regional site managers) that were coordinating the participatory work directly with the communities and community based organisations (CBOs). UDDTs were directly implemented with the CBOs and initial service support from the NGOs KWAHO (Kenyan Water for Health Organisation) [5] and ALDEF (Arid Land Development Focus). This provided firsthand experience to fine tune strategies and concepts for the coordination of ecosan activities with the water sector and other important stakeholders which are important for future up-scaling.

Mid of 2007 the first toilets were constructed directly with CBOs. The approach was to always set up a cluster of 10 to 20 toilets at households and at one local primary school within one community - walking distance of less than 20 minutes to each other was envisaged. The central focus was to include both households and schools as they form one community which can provide much better for a crucial momentum for sanitation improvements instead of focusing only on households or schools individually. In the past it was also observed that "numbers also matter" in order to achieve behaviour change and to increase social acceptance of new development within a community. Moreover schools are fundamental for promoting good hygiene behaviour of children who then try to pass this on to their families at home. This passing on of information and behaviour change from school to households is only fruitful if the community as a whole is part of the process and has access to adequate toilets.

From 2009 onwards the EPP gradually started to work more closely with the water sector institutions that are responsible for water and sanitation infrastructure in Kenya. The two main partners were the Water Services Boards (WSBs) who are the responsible regional institutions for infrastructure development and asset management. Secondly the Water Services Trust Fund (WSTF) is a basket fund for financing water and sanitation infrastructure in low-income urban and rural areas of Kenya (see Section 14 for contact details). Other stakeholders like the Ministry of Health, Ministry of Public Health and Sanitation, Ministry of Agriculture and others were contacted, involved and capacity built on ecological sanitation.

The EPP together with WSTF and WSBs developed a project cycle and implementation programme for the implementation of UDDTs via the water sector institutions in late 2009 (see Annex 1,2). It was based on a demand-responsive approach and a great emphasis was placed on community participation and ownership as according to the experiences gained from the first 2 years of EPP (see Section 5). It was agreed that interested communities after awareness creation direct their letter of interest to the WSBs, who then submit an official application for funding to the WSTF. WSTF is then forwarding the funds to the WSBs, who engage their own human resources and the private sector for the project oversight, training, monitoring and follow up of the sanitation facilities together with the communities. EPP acted as the quality control agent and capacity building partner with its sanitation officers on the ground.

Simultaneously the GTZ Water Program and EPP entrenched basic principles of ecological sanitation (ecosan) in the national sanitation concept of the Ministry of Water and Irrigation that was issued in August 2009 (see Section 13 for available documents). This "mainstreaming" of ecosan and sustainable sanitation systems into governmental structures was an important factor for the desired preparation of up-scaling of sustainable sanitation services beyond the duration of the EPP project.

5 Technologies applied

The toilet technology used under this project in rural areas was the double vault urine diversion dehydration toilet (UDDT). The promotion of this toilet type was chosen to showcase an alternative to the widely used pit latrines that are a source of water contamination as well as not allowing reuse of human waste. Often people have problems with pit latrines after rains due to flooding and instable soils (collapsing of pits). Moreover there are problems with high groundwater tables and rocky soils that make digging of pit latrines very costly and limited.

The toilet owners were not given any other choice of toilet design other than the UDDT type. In other settings more suitable for water based sanitation, the EPP has also implemented pour flush and low flush toilets with waste water

[4] ACP-EU stands for Africa, the Carribean, the Pacific and the European Union. This project was funded under the first call of the first water facility in the category of "improving water management and governance" and "Co-financing water and sanitation infrastructure" in September 2006. http://ec.europa.eu/europeaid/where/acp/regional-cooperation/water/

[5] www.kwaho.org

treatment systems, which is documented in other case studies.[6]

Fig. 6: Back view of household UDDT near Bungoma town in Western Province with two faeces vaults and ventilation pipe (source: Moses Wakala, GTZ-Kenya, Jan. 2010). Note: The inclination of faeces vault doors is not necessary for proper function – see Section 11. Moreover note the toilet is in relative close distance to house.

The main principle of the UDDT is the separation of faeces and urine at source through the installation of a special urine diversion squatting pan or sitting pedestal. In this project only squatting pans were used. The faeces are collected in the vault below the toilet, where the faeces dry over time assisted by a ventilation pipe. After each use the user pours a cup of ash into the faeces vault for absorption of water, fly prevention, pH treatment via pH increase and to cover the fresh faeces which results in a more pleasant look. Alternatively, dry soil or dry leaves can also be used, but they do not provide for pH treatment.

There are two faeces vaults per UDDT, which helps in avoiding handling of raw or insufficiently dried human excreta. When the first vault is full after approximately 3 to 6 months, the first defecation hole is closed and the second defecation hole is opened which lies above the second vault. By the time the second vault has filled up, the first vault's faeces have dried up. It was recommended to the user to work with a 6 month period which has proven as sufficient time for treatment and for a user number of 20.

Fig. 7: Faeces collection vault which is half full (source: David Watako, GTZ-Kenya, July 2009). Note: Sufficient use of ash and appropriate use results in a dry and odour free condition of the vault.

Fig. 8: Inside view of a UDDT with ash container on the right. The squatting pan has two faeces outlets: only the one on the left is currently in use. In the left corner is the ventilation pipe (not visible) (source: Moses Wakala, GTZ-Kenya, June 2008).

Most of the pathogens in the faeces die due to the drying process. Hence the handling is relatively safe, if certain precautionary measures are followed (see Section 7). The user and/or caretaker empty the vault with a shovel or similar tool and transport the dried faeces to the farm for use. In general the farm is located next to the house and toilet at a distance of less than 100 meter.

The urine is diverted via the urine hole of the squatting pan which is connected to a flexible hose pipe or PVC pipe and drains into a standard container (20 Litre jerry can) located in a separate storage vault. Furthermore the toilet has a hand washing facility consisting of a 100 liter plastic tank with tap which is placed on top of the urine storage vault. A rain water harvesting system from the toilet´s roof is also connected to the hand washing facility to provide additional water and to demonstrate usefulness of rainwater harvesting.

Community participation

The EPP developed a strategy on how best to approach the communities for successful implementation of UDDTs. This is described in detail in the project cycle (see Appendix 1). It was based on a demand-responsive approach with strong participatory elements that create ownership within the community. Therefore the project worked in collaboration with Community Based Organisations (CBOs) as legitimate groups

[6] Case study: UDD toilets and Decentralised wastewater treatment systems for schools in Kenya http://susana.org/lang-en/case-studies?view=ccbktypeitem&type=2&id=750

representing the communities at grass-root level. The EPP developed pre-selection criteria for the areas in which the communities should be contacted for UDDT awareness creation. These criteria are related to ground conditions that cause challenges to the use of conventional pit latrines such as frequent flooding, rocky underground, collapsing soils and high groundwater table. The overarching selection criteria were areas with public health problems due to inappropriate sanitation systems.

The acceptance of reuse oriented sanitation systems such as UDDTs depends on people's perception to view treated human waste as a useful resource. This requires a clear understanding of the people's learning culture in order to align the ecosan principles to indigenous practices and knowledge. For example the culture of pouring ash on a pile of faeces from open defecation meant in one area that the person who defecated becomes cursed (bewitched). For fear of this curse people avoided to defecate in the open. Now the Kenyan trainers explained to the people that their cultural handling of open defecation has made perfect sense, since it prevented the dangerous habit of open defecation and at the same time treated the faeces with ash in order to prevent spread of diseases. Once people understand the context, they will not fear witchcraft when pouring ash on faeces but instead realise that the procedure was already common practise in their community for the good of the community (anecdotal evidence).

Moreover the Kenyan trainers developed a special language to get people's attention on ecosan like saying "we are preaching ecosan" and that we talk about "factories" that produce fertiliser instead of a toilet (Blume, 2010).

The future toilet owners were required to provide a contribution equivalent of to at least 20% of the total costs per UDDT by providing locally available building material and unskilled labour. Depending on the capacity of the person, a higher contribution was encouraged in terms of more locally available materials or direct hardware and construction costs. Sometimes more than one family or household share one toilet, depending on cultural preferences. A maximum of 20 users per UDDT is proposed. The average family size is around 10 to 15 members.

In many cases the sanitation officers organised exchange visits for members of the community to other ecosan projects to see firsthand how it works and how productive ecosan can be. This approach of "seeing is believing" has worked very well. After return from such a trip the people were very convinced of UDDTs and acted as strong opinion leaders to change the attitudes amongst their whole community.

The community was also tasked to source suppliers (artisans, hardware shops, brick merchants etc.) and take charge of inventory and quality control under the guidance of the sanitation officer. A Memorandum of Agreement specifying the roles and responsibilities of the different players was developed and signed by the parties as a commitment to roll out the process (see project cycle in Appendix 1 for details).

6 Design information

Each family either has one or two UDDTs (as one toilet block) depending on the number of family members (up to 20 users per toilet). The toilet building is made of masonry from locally available burnt bricks, concrete blocks or in some cases hydraform blocks depending on the availability of materials (see Section 8). A few examples are also known from people who replicated UDDTs on their own by using sun-dried clay bricks. On the outside the masonry is keyed, on the inside plastered and painted in light colors. Roof boards and doors are also painted.

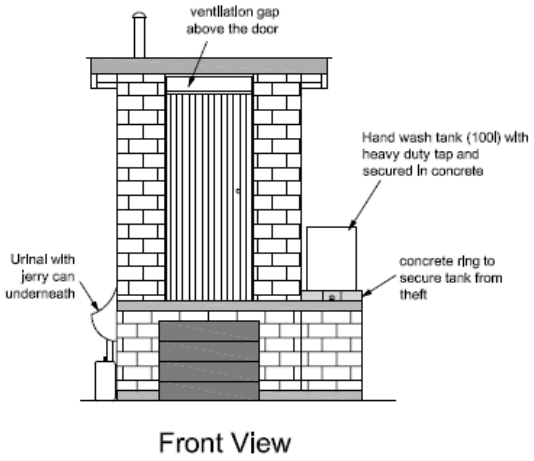

Fig. 9: Design drawings of UDDT (for website link of drawings see Section 13)

The plastic squatting pan is from the local manufacturer Kentainers[7] and was designed in cooperation with GTZ. It was sold for approx. EUR 35. It is a double hole urine diversion squatting pan made from plastic in various colors. Two lids are provided. One lid has a handle for the active vault and can be operated either by foot or by hand. The other lid has no handle and is used to cover the inactive vault. A heavy stone or similar is tied to the lid so that nobody removes the lid by accident. Alternatively a stone or heavy item can be placed on top. The urine pipe is a flexible hose pipe, size 1" (inch), or a 2-3" PVC pipe that leads directly to a plastic container in an attached urine storage vault. Flexible hose pipes have shown high sensibility to blockage and should therefore be avoided.

A sitting pedestal for urine diversion was not developed and installed due to the limited project time frame. Similarly urinals were not installed at the household level. However it might be of interest to the toilet owners to have an urinal in order to increase urine harvest and have a sitting type for more convenience and suitability for elderly and disabled users.

Urinals for the household toilets were not promoted for no certain reason. In preparation for the construction there was no evaluation done on possible demand for urinals and other designs options.

[7] http://www.kentainers.com/kent/home.html

Fig. 10: Various urine diversion plates at the factory of Kentainer. The double vault plate was developed by EPP (source: C.Rieck, GTZ-Kenya, Jan 2010).

The urine container, or so called jerry can, is of standard size (20 liters) and is often a cooking oil container as bought in most supermarkets. It is then re-used for water collection and other domestic purposes. About two to three jerry cans can fit in the urine storage vault, which can be locked to protect the containers from being stolen (see Fig.12). On top of the vault sits the 100 liter plastic water tank with tap for hand washing purposes. The tank is ideally fitted into a concrete ring to protect it from theft.

Fig. 11: Inside of urine storage vault with a number of urine containers (Source: Moses Wakala, GTZ-Kenya, Jan. 2010).

The faeces collection vaults each have a size of approx. 600 litre (length, width and height: 75 x 110 x 75 cm). They are plastered inside (though not strictly necessary) and have a concrete floor that is slanted towards the outside in order to drain excess liquid. The vault doors were initially made of a wood frame and covered with a flat iron sheet, but termites quickly damaged them. Later a metal frame and lid were used for better durability. The doors can be closed with locks, wire or other local methods. Alternatively the doors can be made from concrete slabs or brick work. The faeces collection vault doors were initially inclined and painted black to absorb heat from sunshine for enhancement of the dehydration process. However the inclination is not strictly necessary for dehydration process and not recommended anymore for various reasons (see Section 11).

Each toilet has a bucket with ash, a scoop and a laminated instruction poster inside the toilet. The inclusion of anal cleansing with water was not integrated in the design, since none of the beneficiaries practiced it (toilet paper is only used). The technical drawings and BOQ are freely available (see Section 13).

The toilets were built about 10 to 30 meters away from the houses depending on the preferences of the toilet owners. They were not built adjacent or inside the houses because the EPP this as there were still doubts about the absence of odour.

Fig. 12: Hand wash facility with 100 litre tank and tap secured in concrete located on top of urine tank storage vault (Source: Moses Wakala, GTZ-Kenya, Jan. 2010).

Note that the design described in this section here was optimised later at the end of the project (see section 11 to learn about modified design guidelines).

7 Type and level of reuse

The toilet owners, who are mostly subsistence farmers, were trained on use of urine as fertiliser and use of dried faeces as soil conditioner in agriculture. The urine is directly used in the farms of the respective households once the available jerry cans (2-3 pieces) are full. This means that the users apply the urine frequently depending on the number of storage containers and the number of toilet users. The amount of urine also depends on the male users, who might tend to urinate in the open. Ideally one family of 10 users produces about 10 litre of urine per day (half of standard jerry can) assuming 1 litre of urine per person per day.

A dilution of urine with water is widely practiced and demonstrated during trainings at a rate of 1:1 to 1:10, although urine can also be applied undiluted.[8] The user digs a small shallow depression next to the crop, pours the urine and covers the depression again with soil. Thereby the nitrogen is not lost due to evaporation of ammonia. The crops which have been fertilised using the urine include kales, spinach, maize, mangos and bananas.

The EPP has distributed cultured mangos and tissue culture bananas to some users to initiate the commercial production of fruits with urine fertiliser. The positive effects of ecosan fertiliser on the production were easily seen by the users compared to the plots that did not use fertiliser. In most cases

[8] See GTZ Technology Review: Urine diversion components http://www.gtz.de/en/dokumente/gtz2009-en-technology-review-urine-diversion.pdf

the farmer did not have the financial capacities to buy fertiliser in the first place.

The faeces are used directly in the farm after a drying period of six months. No further treatment (such as external composting) was promoted though it is also practiced. The dried faeces are filled in a shallow pit as a layer and then covered with at least 20 cm of top soil. This protects further contact to humans and animals. It was advised to use the dried faeces for fruit trees like bananas and mangos. Accordingly there should be no cultivation of root vegetables. In May 2010 the first households have started using dried faeces. There is no exact data available on improved yields yet.

Fig. 13: Caroline Atieno using urine for maize and bananas in Rongo District, Nyanza Province (Source: Wycliffe Osumba, GTZ-Kenya, June 2010).

Over a period of three months in early 2010 various samples of urine and dried faeces were collected and analysed at the University of Egerton in Nakuru, Kenya (Kraft, 2010). The results show a sufficient rate of pathogen die off in faeces to levels required by WHO[9] if the toilets are used properly and sufficient storage time is provided. One key element for pathogen die-off has been identified being the addition of ash causing elevation of pH level above 9. However some households were not using the UDDTs the right way by mixing urine and water with faeces resulting in cross-contamination of urine with faeces, slow drying process (odour) and therefore insufficient pathogen die off. Hence the users are advised to apply health risk reduction measures like wearing gloves, rubber boots and washing hands when using the toilet product. Additionally it is important to select the appropriate crops. For example the use of urine and dried faeces for fruit trees reduces the health risk since the edible parts are not getting in touch with the fertiliser. In case of excess urine the users are advised to infiltrate the urine as a fall-back option.

In areas of Mumias in Western Province and parts of Nyanza Province there is plenty of anecdotal evidence showing a very strong and positive uptake of UDDT technology by subsistence farmers. The toilet owners are becoming impatient to wait for the appropriate time to harvest the dried faeces for their farms. They praise their fertiliser and look up their urine and faeces storages for fear of theft by neighbours who have seen the increase of crop yield due to fertilisation with urine and dried faeces.

8 Further project components

The EPP team trained local artisans in the construction of the UDDTs. This qualification might create the possibility of income generation for local artisans in a growing sanitation market. About 50 artisans were invited to a follow-up workshop in Ugunja in March 2009 and each received a certificate from the EPP about the successful attendance. This will help them in acquiring work in the sanitation business.

There were also UDDTs being constructed in primary schools of each cluster. This component is described in another case study (see Section 13).

Furthermore, the project promoted the introduction of an innovative technology, called hydraform blocks, which can be a source of income for young people and also help in making affordable construction of decent housing and sanitation facilities. The advantage of hydraform blocks compared to burned bricks is that no firewood is needed in their production, local materials like specific clay soils can be used under addition of comparatively small amount of cement, which makes production relatively cheap.

The machines to make hydraform blocks were lent from the Ministry of Housing to train young people and government officials as well as produce a certain number of stones.

Fig. 14: Left: Production of hydraform blocks; Right: completed hydraform blocks (Source: Paul Mboya, June 2009).

The EPP has also implemented other ecological sanitation technologies such as pour-flush toilets with decentralized waste water treatment at schools, prison and public place, that produce biogas for cooking purposes and use the treated water for irrigation purposes (not mentioned in this case study)

9 Costs and economics

The capital cost of one UDDT was on average Kenyan Shillings (Ksh) 50,000 (approx. EUR 500). Software costs for awareness creation, trainings and monitoring was assessed with average costs of EUR 100 per toilet. Follow up activities are not included. Operation costs are negligible since it is the owner who collects the products from the toilet and maintains the toilet.

[9] http://www.who.int/water_sanitation_health/wastewater/gsuww/en/index.html

The costs for a conventional pit latrine are EUR 50-250 depending on soil condition, depth of pit, required lining and design. Hence the costs of UDDTs of EUR 500 built under this project are considerably higher than pit latrines. The UDDTs were not built in the cheapest way but rather with high quality and appealing character making it a rather "fancy toilet" with high construction costs. It was the idea of the EPP team to market the UDDTs as modern and uplifting which in turn should create a positive mindset on development and instil pride. The most significant cost items were cement and stones.

Tab. 2: Construction costs of a "fancy" double vault UDDT in Kenya build by the EPP in 2009 according to Blume (2009)

Item category	Costs in Ksh	Costs in Euro	in %
Foundation	4,525	45	9%
Double vaults	6,250	63	12%
Toilet slab	3,789	38	7%
Squatting plate (plastic)	3,500	35	7%
Urine storage vault with slab for water tank	3,900	39	7%
Urine storage vault doors	3,000	30	6%
Ventilation	630	6	1%
Steps	1,425	14	3%
Walls	7,579	76	15%
Doors	1,800	18	3%
Painting	1,000	10	2%
Roofing	3,268	33	6%
Hand washing unit	800	8	2%
Rainwater Harvesting	745	7	1%
skilled labour costs	7,000	70	13%
unskilled labour costs	3,000	30	6%
Total	**52,211**	**522**	100%

However the UDDT can be made cheaper by more than 50% if cheaper and locally available materials are used e.g. sun-dried mudstones, avoiding painting and other simplifications like omitting rainwater harvesting. See the study on costs and economics of UDDTs from Blume (2009) under Section 13. In other countries like Peru or China UDDTs are constructed for less than EUR 150.

Each cluster of about 10 to 20 UDDTs (per community) was provided with a total lump sum subsidy of EUR 5,000 by the EPP. Generally, a subsidy of approx. EUR 400 was allocated per UDDT for purchase of construction materials and skilled labour costs (equals 80% of the total construction cost). The purchases were paid directly by EPP. The provided contribution by the future toilet owner/client had a value of a minimum of 20% or above the total construction costs (see Step 5 of project cycle in Appendix).

The project promoted the linking of UDDTs with banana and mango production, which after two years would start returning about Ksh 5,000 (EUR 50) net per year. Using a basic calculation, this would require about 12 years generating "profit" from the toilet. The toilet design life is 20 years and so the profit would continue for another eight years.

Fig. 15: Young mango and banana plants were distributed for free by the EPP team to the users of UDDTs to support economic gain from urine and faeces use (source: Johannes Odhiambo, GTZ-Kenya, 2010). The users were also trained in production and marketing of the fruit products.

10 Operation and maintenance

The household is responsible for the correct use and maintenance of the toilet. Correct use includes cleaning of the facility, provision of wood ash (or other suitable materials), toilet paper, repairing urine pipe blockages, urine management and removal of dried faeces from the vault approx. every six months. The urine containers fill up on average one to three times a week. Storage space is limited, so application of urine is an ongoing activity for toilet owners. The maintenance includes minor repairs of the water tap (hand washing unit), vault doors (due to rusting, termites), roofing, rainwater harvesting tank and occasional repainting. It has not been identified who is usually doing the operation and maintenance chores in terms of gender.

11 Practical experience and lessons learnt

Project management lessons:

- The large geographical spread of the UDDTs made project management in terms of transport and monitoring very difficult and costly. In addition, health benefits are unlikely to occur when only small fractions of each community are served.
- Experience has shown that the contributions by the toilet owners/clients (materials, labour and/or cash) are essential for ownership of the UDDT. Ownership could be further enhanced by higher percentage of contribution through a less expensive design.
- The general approach of the EPP was to only offer one relatively expensive design with a fixed list of materials (see Section 13). This prescribed high initial standard and the offered subsidies might have created a culture of dependence on subsidies amongst potential clients. It has led to no significant replication and adoption of UDDTs yet. Many interested people are now waiting for subsidies instead of adopting the technology with their local means. In only a few cases spontaneous replication of UDDTs without subsidies has been reported. However it is increasingly noticed and documented that private ecosan entrepreneurs are starting to make an impact by promoting and

successfully selling UDDT technology to institutions and households.

- In future it is advisable to offer more technical options to cater for different user preferences and ability to pay. There should be options for installation of UDDTs inside or adjacent to the house. And of course cheaper UDDTs are also possible and only limited by the creativity of the people (see Section 9). Apart from UDDTs there are also simple and low-cost composting toilets like Arborloos and Fossa Alterna which can work well in rural areas. This way dependence on subsidies could be reduced and spontaneous replication is more likely.
- The community members might also be interested in the combination of toilets with showers and soak pits, greywater use for irrigation purposes or modification of existing toilets or showers. The people should learn and acquire the capacity to modify the design of structures as per their own context, requirement, budget and resources.
- It has been observed that the toilet users require a continuous follow-up for approximately 1.5 years after they have started using the toilets considering the full cycle of faeces recycling. Unfortunately the EPP did not have the resources and time to deliver this service as laid out in Step 11 of the project cycle (see Appendix 1) because it was only a 3-year project which is actually too short for such kind of project. Hence a number of households experienced problems with urine pipe blockages, leakages of rainwater into the faeces collection vault, breakage of water taps from the hand wash facilities and confusion about reuse of urine and faeces. However the GTZ program "Sustainable sanitation – ecosan" is providing some further follow-up from May 2010 onwards (see Section 13 for more information).

Technical design lessons:

- The slanted doors of the faecal collection vault, so called "solar panels", have not shown the desired effect of absorbing heat. The thick masonry walls keep the vaults rather cool. In most cases the toilets were located and orientated according to the toilet owner´s personal preferences and not towards the sun. Hence the alignment to the sun was rarely achieved. It was also observed that the roof overhang has shaded the vault doors considerably in this region close to the equator with almost vertical position of the sun. Moreover there were also problems with leakages of rainwater into the vault due to poor craftsmanship and insufficient material quality (such as untreated wood frame of the vault´s doors being destroyed by termites). In order to address this problem it is recommended to use a straight back for the faeces vaults with minimal risk of rainwater leakage. This design also reduces costs slightly and simplifies the construction process.
- Faeces vault doors should be made of metal, concrete or other material resistant to termites and other degrading and decomposing processes. Alternatively a wooden frame needs to be protected with anti-termites coating. Furthermore the vaults can also be closed with bricks or concrete slabs with the use of weak mortar, though this method requires frequent reconstruction once the vaults are opened for emptying purposes. It involves extra work and money.
- The majority of constructed UDDTs have no urinals for men. This is a disadvantage for men who do not want to squat for urinating or therefore urinate in the squatting pan or pedestal while standing. This bears the risk of male users urinating into the faeces vault (by accident or ignorance), urine splashing into the faeces hole and polluting the toilet interior causing odour and malfunction of the toilet. However this problem was not widely noticed, maybe because tend to urinate outside or the toilets were sufficiently cleaned from the slashed urine. In order to increase the amount of collected urine, it is recommended to provide to the client the choice of fitting a waterless urinal for men outside or inside the toilet.[10]
- The flexible hose pipes of 1 inch for urine collection have constantly blocked due to accidental use of ash, defecation and disposal of toilet paper in the urine section e.g. by untrained visitors or often children. The flexible pipe also develops sharp bends that can also easily block the drainage. Therefore it is recommended to use standard straight PVC pipes with a diameter of 2 or 3 inches. These pipes are also commonly stocked in local hardware shops as compared to the flexible hose pipe which could only be found in bigger cities.

Fig. 16: A double door UDDT with attached shower for a family with more than 20 users in Western Province. The shower was added on initiative of the toilet owner (source: Laura Kraft, 2009)

- The rainwater harvesting system with gutters and down pipes proved to be a rather luxury item. First of all the roof area is too small to provide a sufficient amount of water for hand washing and the 100 liter tank is also too small to store enough rainwater for a sufficient period of time. The toilet users have developed a habit to wait for the rain to fill the tank instead of manually refilling it! To save investment costs and to accustom the users to the manual operation of the hand washing facility (refilling) it could be of advantage to omit rainwater harvesting for household UDDTs.
- The plastic tank of the hand washing facility needs to be secured in a concrete ring to avoid theft and misuse: It was often witnessed that the tanks were missing or used in the household for other purposes due to fear of theft.
- Hardware subsidies should be minimised and only be used for (1) the squatting pan, (2) the hand washing unit and (3) skilled labour costs. Software inputs on the other hand like

[10] See example on flickr http://www.flickr.com/photos/gtzecosan/4874570749/in/set-72157624617691048/ ; or Urine Diversion Technology Review http://www.gtz.de/en/themen/umwelt-infrastruktur/wasser/9397.htm

awareness raising, hygiene education, trainings, construction supervision, monitoring and follow up should be fully subsidised. This way the process will be more demand driven (less subsidy driven) and foster up-scaling of UDDTs in rural and urban areas.

12 Sustainability assessment and long-term impacts

A basic assessment (Table 2) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects were not emphasised.

Tab. 3: Qualitative indication of sustainability of the system. A cross in the respective column shows assessment of the relative sustainability of project (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project).

	collection and transport			treatment			transport and reuse		
Sustainability criteria:	+	o	-	+	o	-	+	o	-
• health and hygiene	X				X			X	
• environmental and natural resources	X			X			X		
• technology and operation		X		X			X		
• finance and economics		X			X		X		
• socio-cultural and institutional	X			X			X		

Sustainability criteria for sanitation:

Health and hygiene include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

Environment and natural resources involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

Technology and operation relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

Financial and economic issues include the capacity of households and communities to cover the costs for sanitation as well as the benefit, such as from fertiliser and the external impact on the economy.

Socio-cultural and institutional aspects refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" (www.susana.org).

The project has increased the interest for productive sanitation as most people were previously not aware of the fertiliser properties of human excreta. The new owners of the UDDTs are very interested in the UDDTs especially because of the fertiliser production and the resulting increase of crop yield. Some communities members have even formed a revolving fund where the additional income from the increased crop production is used for construction of more toilets for the members of the CBO [11]. In other cases toilet owners have joined hands by using urine from their toilets for commercial farming on hired plots.

The expected long term impacts of the project are:

- Enhanced ability of communities to build UDDTs on their own or with the trained artisan.
- Increased capacity at water sector institutions like WSTF and WSBs to implement ecosan in general, or UDDTs in particular in rural and peri-urban areas.
- The pilot projects and units should lead to copying and adaption of the toilet designs by households and institutions
- Increased agricultural production through use of fertiliser from UDDTs by toilet owners on their plots.
- Reduced waterborne diseases through installation of UDDTs and improved awareness on proper hygiene practices like hand washing. It is however practically impossible to prove such health impacts since the UDDTs were only installed in some households of a specific area.

The impacts are being observed by GTZ Kenya and the newly formed ecosan network Kenya which is supported

13 Available documents and references

The following documents are available:

Photos from this project are available on flickr:

- http://www.flickr.com/photos/gtzecosan/sets/72157623181078999/ and other sets under Kenya

Videos from this project are available on youtube:

- Project examples from EU-GTZ-SIDA EcoSan Promotion Project (01/2010) (part 1-4) http://susana.org/lang-en/videos-and-photos/resource-material-video?view=ccbktypeitem&type=3&id=8
- Opap Group, Nyanza province, by Tembea Youth Center for sustainable development (2009) http://www.youtube.com/watch?v=qeW9ZR97bIM
- Johannes Orodi Odhiambo explains the advantages of UDDTs at a new toilet in Ugunja (05/2009) http://www.youtube.com/watch?v=w_MsIuz50eo

Drawings:

- Drawings and BOQ of urine diversion dehydration toilet for households and schools (Kenya), April 2010 http://www.susana.org/lang-en/library/rm-technical-drawings

Publications:

- Blume, S. (2009) Study on costs and economics of UDDTs including BOQ, report for GTZ Eschborn,

[11] This particular CBO in Nyanza Province is well organised and structured due to former projects and capacity building by other organisation that had introduced the idea of a revolving fund. This concept was then modified by the CBO for that purpose. More information from Paul Mboya mboyapaul@gmail.com

Germany
http://www.susana.org/images/documents/07-cap-dev/a-material-topic-wg/wg02/blume-2009-cost-optimization-uddts-kenya-final-draft.pdf

- Kraft, L. (2010) Final sampling report for products from double-vault UDDTs, report for GTZ Eschborn, Germany http://www2.gtz.de/Dokumente/oe44/ecosan/en-eu-sida-gtz-ecosan-promotion-project-final-report-2010.pdf
- Miyona, J. (2008) Instruction poster for use of UDDT, consultant for GTZ Kenya http://susana.org/images/documents/07-cap-dev/e-visual-aids-drawing/posters/en-using-ecosan-toilet.pdf
- Odhiambo, J.O. (2008) Example of a Memorandum of Agreement, GTZ-Kenya http://www2.gtz.de/Dokumente/oe44/ecosan/en-memorandum-of-agreement-2009.pdf
- Mboya, P. (2010) Map of GTZ ecosan project sites, GTZ-Kenya http://www.susana.org/lang-en/resource-material?view=ccbktypeitem&type=2&id=733
- Onyango, P., Odhiambo, J.O. and Oduor, A. (2010) Technical Guide to EcoSan Promotion, GTZ-Kenya http://susana.org/images/documents/07-cap-dev/e-visual-aids-drawing/technical-drawings/en-technical-guide-ecosan-promotion2.pdf
- Blume, S. and Rieck, C. (2010) "Ecosan storying telling" - preaching ecosan by Johannes O.Odhiambo http://ecosankenya.blogspot.com/2010/06/sing-ing-gosp-el-of-ecosan-k-enyan.html
- MWI (2009) The Water Sector Sanitation Concept – WSSC, Ministry of Water and Irrigation (MWI) Kenya http://www2.gtz.de/Dokumente/oe44/ecosan/en-mwi-kenya-sanitation-concept-2009.pdf
- Kraft, L. (2010) Case study of UDDTs in schools, Kenya http://susana.org/lang-en/case-studies?view=ccbktypeitem&type=2&id=750
- Rieck, C.: Sanitation project cycle for rural areas, Kenya http://www.susana.org/'.JRoute::_('index.php?option=com_ccbk&view=ccbktypeitem&Itemid='.397.'&type=2&id='.812)
- Implementation programme of EPP/WSTF/WSB, http://www.susana.org/'.JRoute::_('index.php?option=com_ccbk&view=ccbktypeitem&Itemid='.397.'&type=2&id='.813)

Continuous updates about the project sites and follow up activities are available on this blog http://ecosankenya.blogspot.com/ .

More communication is available on the facebook page http://www.facebook.com/ecosan.kenya .

14 Institutions, organisations and contact persons

Technical Planning and Implementing Support
EPP (EU-SIDA-GTZ EcoSan Promotion Project), Kenya
(during Nov. 2007 to May 2010
Ministry of Water and Irrigation (MWI)
3rd Floor/Suite 316, Maji House
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Contact 5: Christian Rieck
Former GTZ Technical Advisor
E: christian.rieck@gtz.de

Partner organisation:
Ministry of Water and Irrigation, Nairobi, Kenya
Contact: Eng. Ombogo
E: patrick_ombogo@yahoo.com
Contact: Rose Ngure
E: ngure_rose@yahoo.com

Executing organisation:
Various Community Based Organisations (CBOs) and private construction companies (e.g. Comila in Kisumu)

Executing institutions:
Lake Victoria South Water Services Board, Kisumu (http://www.lvswaterboard.com/)
Lake Victoria North Water Services Board, Kagamega (http://www.lvnwsb.go.ke/)
Athi Water Services Board (http://www.awsboard.go.ke/)
Tanathi Water Services Board (http://www.tanathi.go.ke/)

Financing agencies:
Water Services Trust Fund (WSTF)
Engineer John Orwa
Engineer Mr. Macharia
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Email: orwa@wstfkenya.org
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Web: www.wstfkenya.org
T: +254 20 713020
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Supplier of sanitary ware:
aquasantec (Kentainers Kenya)
Embakasi Office
Off Airport North Rd
P.O Box 42168,GPO Nairobi, Kenya.
T: +254 20 2519098/99
E: info@aquasantec.com
Contact: Paul Madoc
E: paul_madoc@kentainers.com

Web: http://www.kentainers.com/kent/kentainers.html

Local organisations implementing ecosan projects in Kenya:

- KWAHO (NGO) http://www.kwaho.org/
- ALDEF (NGO) aldef@nbnet.co.ke
- German Red Cross Kenya (NGO) http://www.kenyaredcross.org/
- German Agro Aid (NGO) http://www.welthungerhilfe.de/kenia-hilfsprojekt-wasser.html
- CDTF (GO) http://www.cdtfkenya.org/
- Engineers without Borders of Spain (NGO)
- Maji na Ufanisi (NGO) http://www.majinaufanisi.org/
- KARI (Kenya Agricultural Research Institute) http://www.kari.org/
- Rotary club Nairobi West (Sanitation group)
- KEWI (Kenya Water Institute) http://www.kewi.or.ke/
- EU UDISM - Integrated Sanitation Management Master program (nele.foerch@uni-siegen.de)

Case study of SuSanA projects

UDDTs implemented via CBOs and Water Services Trust Fund, Nyanza, Western and other provinces, Kenya

SuSanA 2010

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This document is available from:
www.susana.org

Appendix 1: Sanitation project cycle for rural areas

This project cycle was developed by the EU-Sida-GTZ EcoSan Promotion Project (EPP) in Kenya to provide a structured procedure to communities, clients, trainers and involved institutions in order to give clear roles and responsibilities of the involved partners as well as to ensure participation and ownership. All financial issues are managed by the support agency (SA) being the relevant executing institution being the Water Services Board (WSB) who receives the funds from the Water Services Trust Fund (WSTF). Alternatively such a project cycle can also be directly implemented by NGOs and donor organisations. The community based organisation (CBO) does not handle financial issues. The CBO acts as the grass-root implementing partner responsible to establish collective ownership of the process. The detailed project cycle with all the main planning and implementation steps used in Kenya by EPP is illustrated in Table A-1 and explained in more detail below. A similar project cycle could be used for other donor-funded sanitation programs. However the lessons learnt from EPP should be integrated.

Step 1

Pre-selection of target areas by support agency. In the first step the support agencies (SA), here EPP or EPP-WSTF-WSB, who offer financial and/or implementation support, have to pre-select target areas, where demand for improving sanitation is expected. Alternatively CBOs can directly request

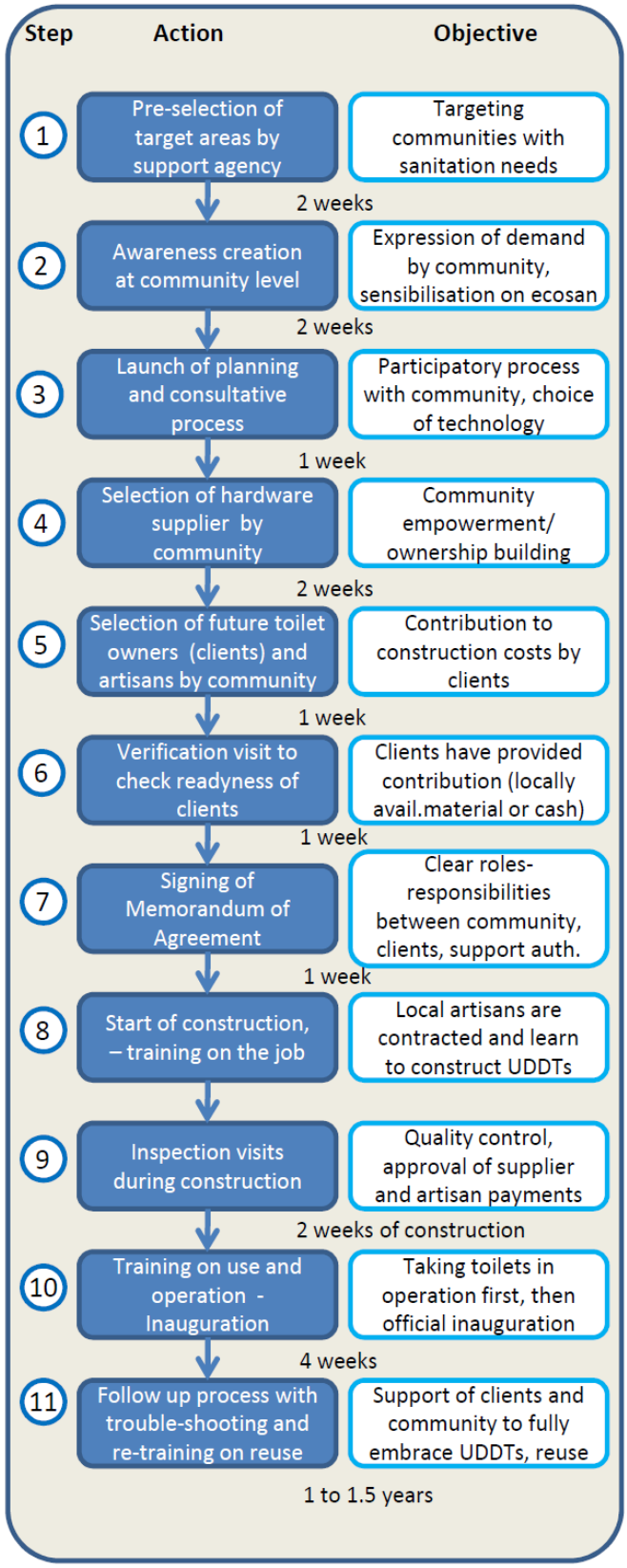
Generally communities are favourable and open-minded to change of their toilet system if they experience problems with their conventional systems like pit latrines that are not appropriate in the area due to reasons of seasonal flooding, rocky underground, collapsing soils and high groundwater tables among other things. Another driver can be poor soils in agricultural areas and lack of available or affordable fertiliser. Here farmers welcome a free fertiliser to improve their yields. Open defecation is also problematic and could also be a good reason for communities to change habits and directly adopt UDDTs or other suitable toilets.

Step 2

Awareness creation at community level. The communities are contacted directly or through the relevant Water Service Boards or provincial administration and invited to an awareness creation meeting carried out by the sanitation officer of the support agencies. A convenient location within the community (such as a school or church) is used for the half day meeting. The community is taken through a problem identification process, followed by a needs assessment exercise and general awareness creation on hygiene and sanitation education.

By raising awareness that common pit latrines bear the risk of disease through flooding and pollution of groundwater as well as ecosan providing fertiliser for improved food production, the community may generate the necessary desire for change. The ecosan concept can be tied to poverty reduction which means improvement of livelihood through increased agricultural production and better health through better hygiene. In order for the communities to be supported, they need to be or get registered as a CBO which is a standard procedure. Then the communities may send a letter of interest to the support agency for further action.

Table A-1: Project cycle for UDDT implementation in rural areas of Kenya, developed by EPP – time information indicates an approximate duration of one step.



Step 3

Launch of planning and consultative process. Once the community expresses their interest for new or improved sanitation systems (like UDDTs), the sanitation officer returns for a workshop on further awareness creation, triggering of willingness to participate, to contribute and to explain on how the planning, design and implementation stages of sanitation projects will work. It is important to provide the community with all the necessary information on the process and the available options so that they can make informed decisions.

The community analyses their situation through discussions and other means like "mapping exercise" and walks through the village, so called "transect walks". Thereby the whole community is engaged in drawing a sketch of the village (mapping exercise) showing houses, toilets, roads, wells, rivers, pipelines and also open defecation areas, if they exist.

Subsequently a transect walk of the whole community through their village follows to support the understanding of the identified problems. This joint community activity is important to get all community members engaged and generate ownership of the process. This mapping exercise is extensively used and described by the Community Led Total Sanitation (CLTS) approach, which was developed by Kamal Kar.[12]

Furthermore, the sanitation officer emphasises the necessary ownership of the future toilets, which is a prerequisite for the success of a sanitation project. Ownership is built through active participation of the community during the whole project process and the contribution of each future UDDT owner (client) to the construction costs. This must be clear and accepted by the community.

It is also recommended to organise an exchange visit for members of the community to see other ecosan projects (e.g. UDDTs). This approach of "*seeing and not smelling is believing*" has worked very well so far. When they return from the exchange visit they can pass on the message much better to the community and act as opinion leaders.

Step 4

Selection of hardware supplier by community. The materials for toilet construction which are not locally available from the clients need to be provided as a direct subsidy by the support agency (SA). The materials should be sourced from local hardware supplier(s). A hardware supplier is a private company that is selling and distributing construction materials and tools. The CBO is tasked to get quotations from three different local hardware suppliers including transport costs to the future toilet owner.[13] Then the CBO recommends one hardware supplier and sends all the quotations and the rationale for the chosen hardware supplier to the SA. This is part of the participatory and ownership building process and it also meant to support the local economy. Thereupon the SA visits the hardware supplier to check for reliability, professionalism, costs and capacity to deliver in bulk (many materials delivered at once). Nevertheless it might happen later that a hardware supplier becomes unable to supply due to various reasons, delaying the implementation process greatly.

Therefore it is important to know if the hardware supplier has sufficient financial capacities to deliver in advance because the materials must be delivered for one toilet at once or in two batches. This makes the accounting and payment process easy and construction fast since there won't be any delays caused by undelivered materials. It can be of advantage to award more than one supplier, especially when the suppliers are small and cannot pre-finance the materials fully. After approval of the hardware supplier by the SA and signing of the MOA (Step 7), the SA issues a local purchase order so that the hardware supplier can start delivering materials to the construction site.

Step 5

Selection of toilet owners (clients) and artisans by community. To ensure ownership, the interested communities are normally led by the sanitation officer (SA) through a visioning exercise to collectively and individually assess, identify and allocate resources required for the construction and management of the units. This would involve indication of the willingness of the intended future toilet owners to contribute locally available materials, unskilled labour and depending on the capacity of the person the direct hardware and construction costs.

The selection of future toilet owners is done by the CBO with the aim of selecting willing families and local champions as well as opinion leaders. It is up to the negotiation within the community to select the future toilet owner without causing conflict. More than one family or household may share one toilet, depending on cultural preferences. A maximum of 20 users per UDDT is proposed. The future toilet owners have to provide a contribution of at least 20% of the total costs per UDDT. The contribution of the future toilet owners can be either done through providing locally available materials like stones, sand, wood, or in-kind support of unskilled labour or cash. The contribution is indicated in a Bill of Quantity, which shows all the necessary materials and labour costs for UDDT construction, and is signed by the beneficiary and CBO.

Moreover the community is required to select several local artisans, who will be trained on the construction of UDDTs. This should foster ownership and lead to future replication of the technology.

Step 6

Verification visit to check readiness of future clients. After the community has selected the future toilet owners, artisans and hardware suppliers, the sanitation officer checks if the future toilet owners have provided their contribution of locally available construction materials. It is very important to have all materials ready before the construction starts in order to avoid delays. At this stage the future toilet owners are further informed about the coming steps and their roles and responsibilities. The SA starts to prepare the MOA according to the feedback from the future toilet owners and community from the previous steps.

Step 7

Signing of Memorandum of Agreement (MOA). This document clearly indicates all the roles and responsibilities between the CBO - as a representative of the community - and the support agency as well as other involved partners. It lists all the future toilet owners, their individual

[12] http://www.communityledtotalsanitation.org/

[13] Requirement according to EU regulations

contributions, the amount of subsidies per toilet, the names of the selected artisans and the costs for the hardware for each toilet (from the selected hardware supplier). In order for the entire process to be transparent and effective, enough checks and balances need to be included in the MOA. The payment process of the artisans and hardware suppliers needs to be very clear and transparent for everybody (see Step 8). Finally the MOA is jointly signed during a formal meeting (a standardised MOA was used; see Section 13 of case study).

Step8

Start of construction; training on-the-job. Before construction starts, the hardware supplier must deliver the materials for each toilet, either all at once or in two batches. This is verified by a signature from the sanitation officer and toilet owner on a delivery note. The toilet owner is responsible for the security of the materials. The supplier issues an invoice for each toilet, which is sent together with the delivery note to the support agency for payment. The invoices are compared with the agreed Bills of Quantities as per the MOA and if identical a cheque is issued accordingly. The payments should be done quickly to enable the suppliers to purchase more materials in times.

In preparation for the construction the selected artisans are first jointly trained on the construction of one toilet. Technical drawings, the Bills of Quantities (BoQs) and manuals are distributed. The artisans learn the skills of construction and also the background of ecosan. Later each artisan will construct a certain number of toilets alone as agreed in the MOA. Ideally the artisans should gain the ability to build UDDTs on their own as a business venture. The construction is closely supervised by the sanitation officer, CBOs and the future toilet owner who is usually contributing unskilled labor (Step 9).

Step 9

Inspection visits during construction. The supervision of the construction is jointly executed by the CBO, sanitation officer (support agency) and the future toilet owner (client). There are two stages of construction. First the artisan constructs up to the floor slab level which takes approximately 5-7 days as per experience and allowing for necessary curing time. The artisan then receives the first payment in cash from the sanitation officer (SA) after the signature of the half-completion certificate by the sanitation officer, CBO and client whereby confirming the quality of the structure.

After approximately another 7 days the toilets should be finished and ready for use. Now a completion certificate is signed and the remaining payment handed over to the artisan by the sanitation officer. However the construction was often delayed due to delayed delivery of materials. That is why it is very important that the hardware supplier is providing the materials on time and also that the client have all their materials (contribution) ready prior to start of construction. All payments to the artisan are done directly through the support agency to ensure transparency and avoid money disputes at community level.

Step 10

Training on use and operation; inauguration. After completion of construction, the sanitation officer should immediately provide an individual training session for the users of each toilet. This takes approximately one hour and includes all the main issues on use, maintenance and reuse. It is recommended to directly start using the toilets after completion and individual training. An official inauguration or a joint community training should only come after all constructed toilets are in full operation.

The official inauguration of all new UDDTs in one community is carried out with the CBO, local administration like public health officers, politicians and other stakeholders and only takes place once all toilets are in use (this should be stated in the MOA). This official inauguration is useful to build the confidence and ownership among the toilet owners who must understand that they fully own their toilets. The support of the official stakeholders is very crucial to gain support, instil pride and promote the ecosan approach in the region (even though some politicians may tend to misuse the occasion to elaborate on politics).

Step 11

Follow up process with trouble shooting and re-training on reuse. After approximately 1-2 weeks of operation the sanitation officer shall visit each toilet owner again to ensure proper use of the facility and safe reuse practice of the urine as well as to provide support and confidence to the toilet owner.

This visit entails individual re-training on certain issues and assistance for trouble shooting. It is crucial to provide such a timely follow-up support since during the first days and weeks of operation the users might experience problems and adjustment difficulties. The proper use of urine is an important issue. They are advised to use all urine on their plot; infiltration of urine should not be encouraged unless only limited agricultural area is available. A documentation of the follow-up should be done for future reference. Ideally the follow-up process should be continued for about 1.5 years in order to complete the full ecosan cycle of filling the faeces vault (6 months), storage in vault (6 months), application in soil and first harvest (3-6 months).

Hence the second visit should be done after approx. 6 months to ensure the toilet owners change the vault in time and to address any other arising issue. The next visit should be done after approx. one year at the time of the application of the dried faeces to the soil. This is a crucial step that can only be demonstrated on the ground. A few months afterwards the toilet owners can witness the positive effects on the crop production. Once they understand the benefits of the fertiliser and a clean, odourless toilet they will fully appreciate UDDTs as a source of fertiliser, good health and comfort. Therefore the sanitation officer should agree on a follow up schedule with the CBO for regular visits. The costs for follow up should be provided by the support agency.