

# The Value of Environmental Sanitation – Case studies

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**Case study 7 and 8 were provided by WASTE (<http://www.waste.nl>)**

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## List of abbreviations

BCSIR	Bangladesh Council for Science and Industrial Research
CAPS	Center for Advanced Philippines Studies
CBOs	Community Based Organisations
CCAP	Central Church of Africa Presbyterian
CDOs	Community Development Officers
CEAMA	State Water and Environment Commission
CMC	Community Management Committee
DCC	Dhaka City Corporation
DWASA	Dhaka Water Supply and Sewerage Authority
ECODESS	Ecology and Development with Sustainable Sanitation
ECOSAN	Ecological Sanitation
EEPCO	Environmental Engineering and Pollution Control Organisation
FSM	Faecal sludge management
FSTP	Faecal Sludge Treatment Plant
HCES	Household Centered Environmental Sanitation Approach
HH	Households
INEI	National Statistical Institute
ISWM	Integrated Sustainable Waste Management
LGED	Local Government Engineering Department
MDGs	Millennium Development Goals
NCCR-N/S	National Center for Competency in Research- North/South (Switzerland)
NGO	Non-governmental organisation
PAMS	Partnership Actions for Mitigating Syndromes of Global Change
PCWS-ITNF	Philippine Center for Water and Sanitation- International Training Network Foundation
PSTC	Population Services and Training Centre
SBMC	Sanitation Block Management Committee
SBMCs	Sanitation Block Management Committees
SMEs	Small and medium enterprises
SSP	Strategic Sanitation Planning
SWOT	Strength, Weakness, Opportunity and Threat analysis
UH	Urban Urine Harvesting
UWEP	Urban Waste Management Expertise Program
WTP	Willingness to pay



## Introduction

Sanitation continues to be the weak partner, the poor step-child of the drinking water & sanitation sector. By the mid-1990s, 71% of the people in developing countries had access to safe drinking water while only 42% had adequate sanitation. In absolute terms, 2.7 billion people still do not have adequate sanitation (DFID, 1998). More specifically in UNICEF-WES programmes<sup>1</sup>, far less than 10% of the budgets are usually dedicated to sanitation and hygiene/health education. The irony is that sanitation facilities and related hygiene behaviour provide a great dividend in terms of health benefits and human dignity, particularly for women. Despite this, sanitation suffers from having a low priority among governments, donors and most “water-and-sanitation” programmes.

It is now becoming evident that the most effective intervention against water and sanitation-related diseases is *safe excreta disposal*, particularly in low-income urban areas and densely- populated rural areas, where the focus of environmental sanitation also includes solid waste management and stormwater and wastewater disposal. Experiences show that:

- The most effective intervention against water and sanitation-related diseases is safe excreta disposal
- Special approaches are needed to ensure that people are motivated so that they consistently use latrines
- Construction of water supply and sanitation facilities alone is not enough

‘Sanitation’ is taken to mean the safe management of human excreta. It therefore includes both the ‘hardware’ (e.g. latrines and sewers) and the ‘software’ (e.g. regulation, education and hygiene promotion) needed to reduce faecal-oral disease transmission. This definition also refers to re-use and ultimate disposal of human excreta. The term ‘environmental sanitation’ is used to cover the wide concept of controlling all the factors in the physical environment which may have an impact on human health and well-being. In developing countries, environmental sanitation normally includes drainage, solid waste management, and vector control, in addition to the activities covered by sanitation (DFID, 1998).

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<sup>1</sup> UNICEF has been involved in water, environment and sanitation (WES) issues since the 1960s. Its first major sectoral interventions were in response to a devastating drought in northern India in 1967. Since then, UNICEF has supported longer-term WES programming initiatives in some 90 countries in Asia, Africa and the Americas.

What has been going wrong?

Sanitation is acknowledged as an important issue, but this theoretical understanding is rarely applied in programmes. There are a number of reasons why this is a highly challenging subject:

- Sanitation is not particularly appealing and people find it a difficult subject, both personally and culturally.
- The technical aspects of low-cost sanitation are often not very interesting for engineers.
- Levels of finance and project time-lines are less attractive in sanitation than for water for Departments of Public Health and some donors.
- Sanitation programmes are challenging to organise and control as they involve small expenditures over scattered areas, and require changes in repeated private individual behaviour.
- Low-cost sanitation and hygiene are sometimes perceived as being more a 'women's subject' than is water supply.
- Sanitation has not been seen as a compelling political issue or a 'vote-catcher' although there are interesting exceptions<sup>2</sup>.

This paper hopes to stimulate those who are interested and directly involved in environmental sanitation programmes. It will also be of use to those who would like a greater insight into what is happening in other countries. Readers should be aware that the paper is an on-going exercise and a follow-up publication will possibly be prepared in the next year. It is hoped that this document will inspire and help others who are working in the area of environmental sanitation.

This paper is divided into case studies from Africa, Asia and South America. Three case studies come from Africa. The first focuses on experiences in eco-sanitation in Malawi. The Central Church of Africa Presbyterian (CCAP) in partnership with WaterAid has been developing a latrine building programme at Embangweni in the Northern Region of Malawi. So far, 250 latrines have been constructed using small-scale private sector organisations and a social marketing approach. This study outlines some of the experiences of the project to date and reflects on how the demand for eco-sanitation latrines has added to the possibilities of developing a truly sustainable latrine building programme, where latrines continue to be built after subsidies and external support have ended.

The second study focuses on "SanPlat" (Sanitation Platform) promotion: private sector participation in peri-urban and rural sanitation in Tanzania. Coverage seems good, with

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<sup>2</sup> For example, large national programmes have been mounted in countries such as Bangladesh and Vietnam. In Kerala, southern India, the household and school latrine/sanitation programme is a focal and entry point in a community within Kerala's current effort to decentralize government functions, budgets and decision-making. In this case, sanitation is politically appealing, as a mass programme that delivers a product desired by most families and delivers it with some efficiency at the local level.



98% and 86% of the urban and rural populations served with sanitation facilities (WHO/AFRO, 2000, TWSSFS, 2003). However, the suitability of those facilities is another issue. Many latrines are built without proper design, materials or technical assistance in areas with high water tables, and the resulting poor and collapsed structures create hygienic problems rather than sanitary solutions. Latrine slabs are often difficult to clean and unsafe to use. In the 1990s, Environmental Engineering and Pollution Control Organization (EPCO) - supported by UNICEF - chose "SanPlats" as one of the sustainable solutions for a latrine slab. The main aims of promoting the SanPlat design were to improve the condition of existing and new latrines and to improve hygiene conditions. Small and medium enterprises (SMEs) were involved in the production and sale of the SanPlat slabs for peri-urban and rural settings. They received theoretical and on-the-job-training for slab production before starting their businesses. By 2002, 418 trainees had attended these workshops. Although many trainees have since left the job, they trained others who took over from them. Over the period 1995-2003, SanPlat slabs had improved latrine conditions in 23% of households in the rural and peri-urban study areas where the SanPlat promotion was done and artisans were trained. A crackdown on street sellers in Dar-es-Salaam affected sales points for SanPlat slabs, but the paper describes the dynamic role played by the private sector in the implementation of SanPlat promotion in Tanzania.

The final case study in this section looks at a scheme that address the need for sanitation services in Africa to go beyond technological fixes, and focus on appropriate financial and institutional arrangements to reach sustainability irrespective of financial support from donors. The adaptation of the ecosan concept to faecal sludge management (FSM) in West African is the focus of this study. Although FSM issues are tackled well in Kumasi, Ghana, sustainability is still a problem because of a high Government subsidy. Improved financial and institutional arrangements can contribute to economical and ecological sustainability, as reflected in this study. It shows how the city's FSM system can be independent from donors if the full potential of households and farmers is realised.

The next set of case studies comes from Asia. The first focuses on the reuse of human excreta in the Bagerhat, Faridpur, and Rajshahi districts of Bangladesh. The study looked at the use of human excreta by sowing plants on 'saturated' latrine pits, the mixing of human excreta with poultry, animal and other organic solid waste and wastewater for fertilizer. For this study, interviews were conducted with 14 Regional Managers from the NGO Forum covering various parts of Bangladesh; with staff members of national and international agencies engaged in water and sanitation activities; and with consultants directly involved in water and sanitation programs. Based on these interviews and group discussions, study areas were chosen in Bagerhat, Faridpur Rajshahi and districts. In these areas, the study examined 18 household schemes where human excreta is reused. This comprised 6 households where plants are grown on saturated latrine pits; 4 households where compost made from human excreta is used to nurture vegetables, fruit, nuts and trees; and 8 households where biogas is produced.

The second case study is on community management of slum neighbourhood sanitation services. It focuses on the Population Services & Training Centre (PSTC), a non-governmental organization based in Dhaka, Bangladesh, which has been implementing a community based water supply, sanitation and hygiene promotion project since October 1998 in the poor urban slums of Dhaka city. To date, the project covers 22 slums of the city with financial and technical support from WaterAid Bangladesh (WAB). The aim of the programme is to develop a replicable model for water supply and sanitation services to the urban poor, based on self-management in the communities themselves. PSTC's experience shows that community based management system can be a highly effective strategy to help urban slum neighbourhoods gain access to water and sanitation and improve their hygienic practices. The project has brought about significant changes in power relationships between slum dwellers, landlords, the water utility and city authorities. This study documents the process through which PSTC facilitated a CBO managed sanitation programme in one of the slum neighbourhoods of Dhaka City

The final case study in this section is entitled 'Tingloy EcoSan Pilot Project' which was a joint undertaking of PCWS-ITNF and the Center for Advanced Philippine Studies (CAPS). It was executed in the Municipality of Tingloy, Maricanban Island, Batangas province, under an Integrated Sustainable Waste Management (ISWM) program. Between July 2002 and March 2003 this project involved the construction of EcoSan (urine diversion) toilets; training on operation and maintenance of these sanitation facilities; monitoring on their use and performance; and extraction of lessons learned and recommendations. Advocacy material has been produced on ecological sanitation facilities as an alternative for 'conventional' sanitation systems. This case study highlights important about what should be looked at when undertaking such a project.

The final set of case studies is from South America. The first looks at a project using ecological sanitation as an alternative solution in slum areas of Mexico City. The TepozEco system, unlike other ecosan pilot projects which primarily develop new systems, works in an established settlement. It competes against conventional systems and faces obstacles because the dwellings were not conceived with ecosan in mind. This project is unusual because it focuses on a holistic treatment of separate domestic and community "waste" flows such as human excreta, greywater and organic solid waste. This study provides an interesting perspective on the involvement of different local governments.

The second case study, from Peru, aims to understand the use of eco-sanitation systems that two NGOs, Cenca and Alternativa, had implemented in Lima. The main research questions that this case study aimed to answer were: (1) Which key ecosan technologies contributed most to the success of the systems?; and (2) What are the main interventions and planning strategies needed to solve the principal problems in implementating and managing the ecosan technology so that it can be successfully replicated in other places?

Table 1 gives a summary of case studies found in this paper and the specific interventions taking place.

**Table 1. Case study intervention summary**

Case study title	Period	No of latrines involved	Specific interventions
<b>Eco-sanitation project (Malawi)</b>	2005	250 latrines	Ecological sanitation Development of a sustainable delivery system. Ecological sanitation social marketing.
<b>* Private sector participation in peri-urban and rural sanitation (Tanzania)</b>	1995-2005	Up to 700 sanplat slabs	Sanplat promotion. Balancing public and private sector in the promotion of sanplats.
<b>* Institutional and financial aspects of faecal sludge management (Ghana)</b>	2005		Orientation of farmers and households and effective decentralisation to make faecal sludge management an integral part of the Ecosan approach in Kumasi.
<b>Reuse of human excreta (Bangladesh)</b>	2005	6 household users of saturated latrine pits for growing plans; 4 household users of compost consisting of human excreta for producing vegetable and fruits; and 8 household users of biogas plants	Reuse of human excreta and compost consisting of human and animal excreta and other organic waste used in cultivating plans.
<b>Slum neighbourhood sanitation services (Bangladesh)</b>	1998-2005	Two sanitation blocks	Community awareness raising, mobilisation, and capacity building for sanitation blocks.
<b>* Tingloy Ecological Sanitation project (Philippines)</b>	2002-2003	3 ecological sanitation facilities for 3 households	Community mobilisation in ecological sanitation. Training on operation and maintenance of these sanitation facilities. Adapting prototype to local situation and preferences.
<b>* Ecological sanitation in semi urban areas on Tepoztlan, Morelos (Mexico)</b>	2003- on going	35 households with ecological sanitation facilities: urine-diverting dry toilets, grey water mulch systems, faeces compost- urine harvesting and on-site use. 3 grey water reed bed filters. Low cost shallow pit composting sanitation system, 3 alternating pit toilets, 1 arborloo. School and institutional urine harvesting Portable waterless male & female urinals service	Closed-loop systems approach which focuses on sustainable management of separate domestic residue flows (urine, faeces, greywater, organic and non-organic solid waste), radically reducing water consumption while safely recycling valuable nutrients into the soil
<b>Ecological sanitation technology (Peru)</b>	1998-2002	36 ecological sanitation facilities	Alternative approaches to developing ecological sanitation technologies

Although each of the case studies in this paper is unique, the overall goals reflect the need for further insight into the development of alternative sanitation options both in rural and urban areas. We would like the reader to be aware that the style of each case study is different. Some read more informally while others use a slightly more academic style. In addition, every case study has its own introduction so that the reader can “dip into” a number of case studies without reading the occasional paper in its entirety. It is our hope that the case studies will stimulate discussion among those who are interested in the subject. We must continue to learn from past and current experiences and act on this information. That in itself, especially within the sanitation sector, may be one of our biggest

challenges in the continual improvement towards more effective and efficient sanitation programmes.

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# 1. Malawi – One step close to sustainable sanitation: experiences of an eco-sanitation project

Steven Sugden

## Introduction

Many cultures have understood the value of urine and faeces for agricultural purposes, and latrine designs based on the concepts of ecological sanitation have been used in Asia and parts of Africa for hundreds of years.

Eco-sanitation is based on three main principles:

- it offers a safe sanitation solution that prevents disease and promotes health by successfully and hygienically removing pathogen-rich excreta from the immediate environment
- it is environmentally sound as it doesn't contaminate groundwater or use scarce water resources
- it creates a valuable resource from what is usually regarded as a waste product.

It is interesting to note that a person produces about 500 litres of both faeces and urine in a year and human urine contains about the same levels of nitrogen, phosphorus and potassium as commercially produced fertilizers.

## Types of ecological latrines

All the eco-sanitation latrines promoted and built at Embangweni work on the principle that when soil and ash are added to faeces, the mixture rapidly breaks down to produce compost that is an asset to any farm or garden. The mixture is odourless, as long as it is not too wet. Eco-sanitation latrines are permanent, cheap and easy to build, and over time generate an easy to handle, rich compost.

There are three types of eco-sanitation built locally, the Arborloo, the Fossa Alterna and the Skyloo. They work as follows:

### **The Arborloo**

This is the simplest type of latrine and the one that involves the least amount of behaviour change from someone used to using a conventional pit latrine. Anybody who has planted a tree in a full latrine pit can be said to be practising eco-sanitation.

A shallow pit (1.2 m recommended) is dug and a slab and easily movable superstructure placed on top of it. The family uses the latrine, adding the mixture of soil and ash after each use, until it is three quarters full (usually between 4 and 9 months). After this the slab

and the superstructure are moved to another pit. A layer of soil is added to the full pit and a sapling placed into the soil. The tree grows and utilises the compost to produce large, succulent fruit. After a few years of latrine movement the result is an orchard that produces fruit with a real economic value.

### **Fossa Alterna**

Similar to an Arborloo except two shallow pits are dug and used like a twin pit latrine i.e. one is being filled whilst the other is maturing, when the second is full, the first is emptied and used again. If a thin layer of soil is placed on the maturing pit, it becomes ideal for growing tomato or pepper plants. Watering the plants helps the composting process. When the second pit is full, the contents of the first pit are placed on to the garden or farm and the fertility of the land is increased.

### **Skyloo**

This latrine is constructed by building two brick and rendered vaults above ground level, placing latrine squatting slabs on top of the vaults and building a superstructure on top of the slab. The faeces drops through a squat hole into the vaults where it is left to mature into manure. The vaults are rotated in a similar manner to the Fossa Alterna. After a suitable retention time, the contents of the vaults are placed on to the garden or farm.

Each design uses an 80cm diameter domed slab as the basic building unit. This was been chosen because it means that cement is the only raw material that needs to be bought and brought into the project area. The slabs do not contain any iron reinforcement bars which are expensive and only available in the major cities within Malawi. The weight and size of the slab make it relatively easy to transport using low cost technology transport i.e. hand carts.

Experience to date of eco-sanitation at Embangweni

#### *Gaining initial acceptance of eco-sanitation*

Eco-sanitation has sometimes been regarded as a revolutionary new approach to latrine building. However, during the initial phase of the Embangweni project, the baseline survey showed that to some extent eco-sanitation was already practiced as 47% of households said they planted banana trees on their old latrine pits. Eco-sanitation is therefore only revolutionary in the eyes of the development professionals and not perhaps to the communities who have been practicing it for generations.

When the composting process was explained to householders in a little more detail, it was found that 38% of those interviewed accepted the concept of eco-sanitation without reservation, 30% with some reservations about smell and the thought of handling faeces, while 32% said they would not use eco-sanitation.

### **Comparing levels of subsidy – a word of caution**

The arguments surrounding the use and need of subsidies can be complex and confusing. Some programmes claim to build zero subsidy latrines on the basis that the householders pay for every part of the latrine construction cost. This is a laudable claim, however it often disregards the costs of promoting the process and mobilising the householders. These costs can be significant whilst the rate at which latrines are constructed using this approach can be slow. Another approach is to factor in household labour costs e.g. for digging the pit, which in most projects is carried out for no financial remuneration by the householder. Factoring in these costs has the effect of (over) emphasising the household contribution and making the external agencies contribution appear appealingly low.

Making comparisons of project performance using the level of subsidy as an indicator is often a difficult and flawed process. The figures quoted in this report are based purely on the value of the materials given to the householders by the project. They do not include transport, mobilisation or organisational support costs.

The project initially worked with members of the community who were enthusiastic and willing to try the new approach to sanitation. When they saw the “power” of the human waste as a fertilizer they quickly made the economic linkage to increased crop production and the economic benefits that this would bring. Word quickly spread within the project area; one of the early innovators was so proud of his latrine and told so many people about it, that he was given the nickname “Mr Skyloo”.

After eighteen months, any resistance and doubt has disappeared. Communities have gained first hand experience of emptying human manure from the latrine pits, and know from this experience that the pit contents are neither obnoxious or unpleasant to handle. Any initial resistance has changed to unreserved enthusiasm.

#### *Community experimentation generates demand*

The level of enthusiasm for eco-sanitation has been surprising. Some households have even dug out their old traditional latrine pits and spread the contents on to their land prior to planting their annual crop of maize. One farmer who recognised the power of urine as a fertilizer at an early stage (completely unprompted by the project), adopted the practice of urinating into a container and tipping it into small holes dug near the roots of his maize. He then compared the growth of this crop with one fertilized by an artificial fertilizer and proudly announced that the yield of the urine fertilized crop was just as good. Farmers such as this have become wonderful advocates for eco-sanitation, which has now become self promoting within the area.

#### *Increased demand leads to decreased subsidies*

As a result of self-promotion of eco-sanitation at Embangweni, demand grew to such an extent that the project lacked the capacity to meet it. One of the positive effects was that it enabled the project to charge increased amounts of money for the concrete latrine slab (in

effect reducing the subsidy). At the beginning of the project the subsidy was a relatively low \$2.10 per slab; increased demand has made it possible to reduce the subsidy so that it now stands at \$1.40.

#### *Why is eco-sanitation proving to be so popular?*

This is the question that both CCAP3 and WaterAid are continually asking themselves. In addition, it is asking the related questions, “Why is demand so high?” and “What added dimension is eco-sanitation giving toward the search for that ‘holy grail’ - a truly sustainable sanitation project?”

One of the biggest factors as to why eco-sanitation is proving to be so popular is without a doubt, the ever decreasing fertility of the soil in Malawi. Soil fertility in Malawi is 60% of what it was ten years ago. People in rural communities are expert farmers and are well aware of this problem. They complain that all their crops now need fertilizer if they are to produce a worthwhile yield. When walking through fields in the maize growing season, it does not take long for even an untrained eye to tell the difference between the pale, thin, yellow leaves of an unfertilized maize crop and the tall, green heavy plants produced when fertilizer is added. The cost of fertilizer has rocketed and last season was around \$14 for a 50 kg bag. This may not seem too high, but in a country where 60% of the population live on less than a dollar a day, it is a huge proportion of the household budget. Any system which reduces this burden, and is free and within their control has got to be regarded as valuable. 80% of Malawians are subsistence farmers and if this project continues to show the promise of these early stages, the impact of ecological sanitation on rural livelihoods will be considerable.

No doubt if the fertility of the soil was naturally better, or if artificial fertilizer was cheaper, the demand for eco-sanitation would not be as great.

Another driving force behind demand could be the desire to own fruit trees. The income generating possibilities of selling the fruit is often quoted as the main motivation behind choosing the Arborloo, but it is also thought that owning a fruit tree may be a kind of status symbol. One householder described owning a fruit tree as ‘completing the house’.

#### *Children’s latrines and improved health*

The demand has also had some interesting knock on effects which maximise the health benefits of a latrine building programme. At one point the project ran a ‘two for the price of one’ offer and gave a free children’s latrine slab (60cms diameter dome slab) for every full

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<sup>3</sup> CCAP have been running a shallow well water supply project in the area for over eight years and have developed an extensive network of community mechanics. The problem they are now facing with the network is that of developing a better incentive structure for the mechanics so as to keep them interested. Experience has taught CCAP that to rely on ‘community spirit’ and ‘volunteerism’ for longer term sustainability is unreliable and unrealistic. It is with this experience in mind that the latrine building project has been designed.



size adult slab (80cms diameter dome slab) purchased. The take up of the offer was good and an evaluation on the use of children's latrines highlighted three interesting issues:

- Not only women, but men too were telling their children to use the latrine. Whilst the men may have been more interested in the fertilizer than the hygiene aspects of latrine use, the end result is the same, a huge reduction in children's faeces around the compound.
- The women said that at night using their own latrine was a frightening experience as snakes and insects could hide in the dark recesses of the superstructure. The children's latrine has no superstructure as privacy during defecation is not an issue for children, and there is nowhere for the snakes and insects to hide. The women can use this latrine with greater confidence at night, when the dark maintains their privacy.
- The women were grateful that they no longer had to suffer the drudgery of picking up their children's faeces to place into the latrine. As hand washing is not the easiest of processes for the average rural poor household, the elimination of the need to handle children's faeces, must have a beneficial effect on the health of the whole family.

These factors have the combined effect of reducing the amount of faeces, and therefore levels of pathogens, in the area around the house. This has a positive impact on the levels of oral-faecal transmitted diarrhoea diseases within the family.

#### *Gender roles and eco sanitation*

Eco-sanitation has had an interesting effect on the gender roles associated with latrine construction. During the baseline survey the men and women were asked separately why they did not have a latrine? The men tended to give technical reasons such as lack of wood or tools or the tendency of the sandy soil to cause pit collapse. The women were more direct and thought it was more to do with the laziness and drunkenness of their husbands. The project has now found out that it has always been the men's role to dig the 3 metre deep latrine pit and with the husbands refusing to do this, the women and the family have - in effect, been denied access to any form of sanitation. With eco-sanitation latrines, it is only necessary to dig a 1.2 meter latrine pit and the women in Embangweni have recognised that this is not a difficult task. Many of them have now dug their own pits, built their own latrines and provided safe sanitation for their family for the first time. In some cases there has also been an interesting knock on effect in that when the men have seen the 'power' of the faeces as a fertilizer they have been convinced of the need for a latrine and have 'reclaimed' their role as latrine builder.

#### *Development of a sustainable delivery system*

This may seem to be an unimportant subject when trying to develop a sustainable sanitation system, but WaterAid in Malawi believe that it is in fact crucial if latrine construction is to continue after external funding has been withdrawn. The problem the project is trying to overcome is the same as the one faced by all rural sanitation programmes in developing countries; when the supply of free cement ends, the production

of latrines also ends. Programmes may provide sustainable latrines, but they are not in fact providing a sustainable latrine building programme.

From the outset, a major consideration in the design of the Embangweni programme has been the question, “But what will happen when funding ends?” Although still in the embryo stage of its development, the project has identified a number of obstacles to achieving a sustainable latrine building programme. The following is a list of the obstacles together with steps taken by the project to try and overcome them.

#### *Subsidy dependence and policy*

The policy at Embangweni has been that the householder should always make a financial contribution towards the cost of a latrine slab, even though in some cases this may be relatively small. The programme feels that only rarely would a bought slab result in an incomplete or unused latrine, and that the more the slab is perceived to have a high value, the more likely it is to be looked after and utilised.

Rightly or wrongly, the project tends not to take into account the materials provided by householders when discussing the financial aspects of latrine construction. This would include the bricks, grass, bamboo, and labour the family provide for latrine construction. Its exclusion is intentional as all the raw materials, apart from the latrine slab, are effectively free to the householder – including the value of the labour. The inclusion of labour costs into the calculations tends to lead to confusion and misleading assumptions. The economist’s view of the value of labour has therefore prevailed; that is, the value of a person’s time is equivalent to the amount of money that the person could have earned if they were not employed in latrine construction. In the case of the Embangweni project this “opportunity cost” is effectively zero as very few income generating activities are available.

There are good arguments on both sides of the debate regarding costing in a person’s time. In the projects experience, taking a zero opportunity cost route has the advantage of focusing the discussion tightly around the financial inputs into the project. The financial contribution towards latrine construction has been found to matter most to the householder. This was summed up by one community member who said, “If I have MK100 in my pocket, I have 100 ways of spending it”.

The project has designed a mechanism which allows the subsidy to be adjusted without the end user being aware of the change. The price of the slab has been MK260 to the customer for over a year, the masons who built the slabs initially received cement at a subsidised rate of MK125 per bag (a subsidy of MK600 per bag of cement or MK150 per slab). This made it financially worthwhile for the masons to promote latrine production in order to maximise their profits. It was a good deal for them and linked effort to income. After nine months, demand for the latrines had increased and the project could lower the subsidy by increasing the cost of the cement to the masons to MK250. The price to the final consumer remained the same and the drop in the masons unit profit was off-set by the

increase in turnover. The next stage in the process is to encourage an inflational increase of the slab price the final consumer has to pay, possibly to MK280, and to increase the price the masons pay for cement to MK350 per bag (one bag currently costs MK750). Over time it should be possible to reduce the subsidy even further, but this will always depend on demand, which in turn depends on the perceived value of the faeces as a fertilizer.

#### *Project transport dependence*

One of the most significant hidden dependencies in sanitation programmes is that of transport costs. This can be an expensive budget item, particularly if inefficient systems are used, such as delivering one or two bags of cement in large pick-ups to remote rural villages. Communities and masons become used to having cement delivered to them and when this stops (because the project ends), they are reluctant and unused to sourcing their own supplies. This project, partly through necessity and partly through design, has never delivered cement to communities and instead has developed a system whereby the masons come and collect it and sign for their supplies from a central CCAP store. To date, project areas have not been too far away from the CCAP store, but even so this has meant that masons (or their brothers) have been making 14 km round trips on their own bicycles to collect half a bag of cement (enough for two slabs). The initial concern was that this would prevent latrines being built as the incentives were not great enough to warrant such effort, however this has not proved to be the case and latrine building does not seem to have been impeded.

#### *Lack of access to skills and advice*

One of the first people to build a latrine with materials supplied by the project was Mrs Sankhepo Mvula, a woman relatively well off in rural Malawian terms, who paid MK150 for a slab produced as part of the mason training process.

On a visit to her house it was found that she had paid the following prices to somebody to have her latrine built:

Item	Cost (K)	Percentage of total
Labour for digging pit (3m)	300	25%
Walls and roof	300	25%
Latrine Slab	150	13%
Half bag of cement for floor	350	29%
Window blocks (decorative)	90	8%
Total	MK1,190	

MK1,190 is a significant amount of money for a person to pay for a latrine, particularly when her source of income is subsistence agriculture, and the harvest that year was poor.

When Mrs Mvula was asked why she had not built a latrine before, she replied that she had always wanted one but didn't know where to buy a latrine slab.

This prompted the question, how many more Mrs Mvula's are there in Embangweni? How many more are there in Malawi? Are people willing to build their own latrines without subsidy and simply lack access to a supplier of good quality materials and the necessary advice?

In designing the project it was thought to be important to train and use only masons from the communities who would remain and be available to give advice after the project had ended. Mrs Sankhepo Mvula actually bought her slab from Mrs Phili, somebody who has developed into one of the best small scale private sector builders on the project. It is the role of Mrs Phili and masons like her, not only to advise on latrine building and supply the concrete slabs, but also to promote latrine building in the area where they live. The reward she gets for doing this is the profit she makes from selling latrine slabs and other associated materials.

The interesting question from a sustainability aspect is whether the masons can sell slabs at a high enough price to make it worth their while to continue to produce and promote latrines after the project has ended. This is very much linked to gradually reducing subsidy levels and increasing prices during the project implementation period.

Brief overview of the project from a social marketing perspective

An analysis of the current project position with regard to the 4 P's of social marketing (product, price, promotion and place) provides a useful insight into where the project is now and where it needs to go in order to achieve a better chance of becoming a sustainable sanitation programme.

### **Product**

Eco sanitation latrines seem to be the right product at the right time. The demand for these latrines can be said to be fuelled by:

- the declining fertility of land
- the increased cost of artificial fertilizer, and related poverty
- the high number of subsistence farmers in the project area.

With regard to the latrine design, there are different superstructure arrangements for the Fossa Alterna and Arborloo, most of which are due to innovations by the community, but the Skyloo is causing problems with regard to cost and the volume of the vaults. There is scope for further development to make it more affordable.

## **Price**

WaterAid in Malawi regard subsidy as a promotional tool, and not a crutch. As a promotional tool it has to ensure that the rate at which latrines are built remains acceptably high whilst at the same time ensuring that the level of subsidy is not so high that the product is devalued. Achieving the right balance is difficult and should be regarded as more of an art than a science. Perhaps the most important consideration with regard to subsidies should be the understanding that the process of setting them is dynamic and project managers should be constantly striving to reduce the subsidy to zero. Whilst it has to be accepted that this will not always be possible, it should not detract from the aim. At Embangweni the rate at which it has been possible to reduce the subsidy to a relatively low level is surprising, and this has to be attributed to the high demand for eco-sanitation and the resulting fertilizer.

The actual cost of a slab (and therefore the latrine) to a householder at the moment is MK260, plus between MK50 and MK 100 for transport, depending on the location of their house. A slab is currently subsidized by the method described section 5.1 at MK125 per slab. The true ex-factory cost of a slab should therefore be MK385, if the masons were to maintain their current profit margins.

At the moment the price of MK260 does not seem to be affecting demand and the price of MK385 is thought to be achievable with time. The subject of slab price elasticity is often pondered over. Interestingly, the masons are very non committal about this, as they know that if they gave any indication that people would be willing to pay more, the project would reduce the level of subsidy by charging the masons more for the cement. Silence is a wise option.

One disadvantage of a system where a householder has to make a financial contribution is that the poorest members of the community may be inadvertently excluded and fail to gain access to the benefits improved sanitation can bring. If the poor are being excluded, one possible solution would be to target additional subsidy at the most vulnerable households, i.e. widows and the sick, with the help of the medical staff at the CCAP mission hospital.

There are areas for potential improvement and experimentation which could have an impact on mason profit margins. The first of these is to diversify the range of products offered and for example, produce different diameter slabs giving the customer more choice. The second is to reduce the cost of the slab by improving production techniques, this is thought to be possible by using re-useable fibreglass moulds.

## **Promotion**

Like all well targeted interventions, eco-sanitation has been found to be self promoting and word has spread quickly throughout Embangweni about the 'fertilizer latrines'. CCAP is being pressurised by community leaders and other project staff members to start in other areas.

In the early stages of its introduction there was a lot of scepticism about eco-sanitation and the claims made regarding the quality of the resulting fertilizer. With CCAP's in-depth knowledge of the area and the trust that the people had in them, a few enthusiastic innovators were found who were willing to try out the new latrines. This was helped by the fact that the concept was not entirely new. These innovators soon discovered the fertilizer production quality of the latrines and talked to other members of the community enthusiastically about their findings. From these early innovators came more people willing to try the new latrines and from this the demand began to grow.

One of the most exciting aspects about a visit to Embangweni in the wet season is to be shown around some of the communities experimental plots. There is a large, but often a little confused, combination of maize crops growing with or without ash, manure, urine, and/or artificial fertilizer. To add to the confusion different varieties of maize are used, making comparison impossible. The quality of the experimentation is immaterial; what is interesting to see is the number of farmers actually experimenting on their own initiative and the enthusiasm and pride with which they explain their findings. The ownership and development of eco-sanitation in areas such as Epwangini in Embangweni has left CCAP and WaterAid and become driven by the communities themselves. This leads to excellent internal promotion and allows for natural organic growth between communities.

There are naturally still doubters, but it has been found that once they have seen how well a Papaw sapling grows in an Arborloo latrine pit, they are soon converted and become advocates for eco-sanitation themselves. One such household visited by the WaterAid Country Representative had a four month old Papaw tree that was over six feet tall and already beginning to produce small fruits. The rate of grow was spectacular.

With such good internal promotion and a product that speaks for itself, the need for more structured advertising campaigns with radio jingles and posters has not been necessary.

### **Place**

'Place' in this context refers to the products availability in the places where the consumers live. It does not refer to Embangweni or Mzimba.

Two systems are currently used to get the slabs to the customer, both with inherent weaknesses. The first is centralised slab production in a small workshop which results in high quality slabs, but high slab transport costs with a limited range. The second method is the roving mason who travels with cement and produces slabs at the household. This tends to result in poorer quality slabs, but lower transportation cost and larger ranges. Although the range of the second approach is larger, it is limited by the distance the masons are willing to transport the cement.

What has been found to work in Embangweni is to be flexible and not to dictate to masons how they should operate. However, if the project is to scale up, solutions need to be found for

- increasing the range of the centralised production workshop
- improving the quality of slab production of roving masons
- shortening the distances masons have to travel to collect cement.

The project is in the process of providing bicycle-trailers to some of the masons operating from a central workshop, monitoring the effect this has on their working range.

## Conclusion

Ecological sanitation latrines and their ability to produce much needed fertilizer has added a new dimension to the process of developing a sustainable latrine building programme. Rather than viewing excreta as a waste product, the communities in Embangweni now very firmly link it to fertilizer and income generation. This has added a much needed, direct and easily recognised benefit to building and using a latrine, and has allowed the social marketing of latrines, using small scale private sector organisations as providers and promoters, to flourish. Although improved health was the primary objective for WaterAid and CCAP when initiating the project, health improvement has been at best a secondary objective for the users.

Shortening the distances masons have to travel to collect cement is a more difficult problem to solve and is linked to the whole process of 'scaling up'. The method currently under discussion is by using schools as distribution, promotion and educational centres. The aim is to develop the schools so that they will become cement stores and distribution centres. They will sell the cement at subsidised prices to the masons and make a small amount of profit on the sale. They will be responsible for stock keeping, transport and re-ordering cement. The expectation is that by using the schools in this way the distance the masons will have to travel to collect cement will reduce and their effective range will increase. It is thought that this system will have advantages:

- Providing separate girls, boys and teachers eco-sanitation latrines at the schools which currently face sanitation problems.
- Developing an educational programme within the schools around the eco sanitation latrines and the effect of fertilizer on plant growth. As most of the children at the schools are likely to become subsistence farmers, these will be lessons which they are likely to remember and apply in later life.
- As part of the educational process it is thought that the children will become advocates for the process and apply pressure on their parents to build and use an eco-sanitation latrine. In other projects, this has been shown to be a powerful promotion tool.

- The schools will become the focus for mason training and monitoring. Parents who have decided to build a latrine will be able to visit the school and gain advice from a specified teacher on the advantages, disadvantage and use of each latrine. As the masons buy their cement from the school, parents can also be put in contact with a mason who works in their area and find out where to purchase a slab.

Any organisation wanting to develop latrine building programmes in countries where soil fertility is decreasing and fertilizer prices are increasing, should seriously consider the wealth of benefits offered by ecological sanitation. They should not let preconceived, and probably untested, ideas and obstacles to handling faeces deter them.



## 2. Tanzania- Private Sector Participation (PSP) in Peri-Urban and Rural Sanitation: A Case Study of "SanPlat Promotion

Alfred J. SHAYO<sup>4</sup> and Esnati J. CHAGGU<sup>5</sup>

### Introduction

Tanzania is one of the many countries worldwide where people live and raise their children in environments heavily polluted by human excreta resulting from inadequate sanitation facilities and use, leading to high rates of disease, malnutrition and death (Kalbermatten et al. 1980, Esrey et al. 1998). In urban areas of Tanzania, where the population is growing exponentially, the provision of infrastructure is increasing arithmetically (Chaggu and John 2002). If this gap is not bridged, excreta will continue to end up in the wrong place, contributing to serious health hazards. Official data indicate that 98% and 86% total urban and rural population respectively has excreta disposal facilities (WHO/AFRO, 2000, TWSSFS, 2003), but these figures are questionable from a sustainability and hygiene perspective. According to Lettinga et al. (2001) criteria for sustainable sanitation include (i) little if any dilution of high strength domestic (and industrial) residues with clean water; (ii) maximum recovery and reuse of treated water and by-products; (iii) application of efficient, robust and reliable waste water collection and transport systems, and (iv) treatment technologies which require few resources and which have a long life time. Many existing latrines in Tanzania are not durable or hygienic enough to be termed sustainable. In high water table areas, pit walls often collapse during the rainy season. Floor slabs may be reinforced with natural timber, which, over time, react with gases produced in the pit and contribute to slab failure. Floor slabs usually lack a smooth finish and so are difficult to clean and unhygienic. Figure 1a shows an example of the worst kind of disrepair of a latrine which is difficult for children or elderly people to use, frightening at night, dangerous in the rainy season and a source of killer diseases like cholera, dysentery and diarrhoea. Although many residents (>90%) use pit latrines, there is a poor record keeping (Chaggu et al., 2002) and figures vary depending on the source. For example, the Demographic Health Survey (DHS) (1996) showed that sanitation coverage figures for 1996 were 92.6% and 82.3% for urban and rural areas respectively, at variance with the 97% and 86% for 1990 or the 98% and 86% respectively for 2000, mentioned by WHO/AFRO (2000). There is no updated data from DHS. Better collection and use of data is necessary.

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*Figure 1a. Traditional pit latrine in Magugu Babati District Arusha (now Manyara) region. (Photo by EEPCO 2002)*



*Figure 1b. Same latrine improved by installation of SanPlat Slab (Photo by EEPCO 2002)*

Private sector participation (PSP) can play a very important role in closing the ever-increasing sanitation gap. PSP will assist in drawing in financial and human resources to reach people in need. Decentralised sanitation options are cheaper than highly technical sewerage treatments. High density living in urban areas necessitates timely and adequate planning for sanitation to minimise the risk of epidemics (Kironde, 2000). Tanzania has no adequate sanitation policy to guide activities in this sector, although a policy is under development. Sanitation is also fragmented between different sectors of different ministries. This causes conflicting accountability areas and ideas when implementing sanitation concepts and options through PSP.

In the 1970s, the Tanzanian Ministry of Health (MoH) put a major effort into improving sanitation through a campaign in which each household was required to have a latrine. The campaign did not achieve much. Most people constructed latrines so that they could show them to health officers/sanitary inspectors. However, using them was another matter. The latrines were not designed or constructed to hygienic standards and created hygiene problems rather than sanitary solutions. Part of the blame should go to the authorities for inadequate technical assistance to communities. There is no “best” technical solution for all situations and hence, technical solutions must be adapted to the local environment, financial resources, skills and the traditional “latrine behaviour” of the user (Winblad and Kilama, 1985).

To improve sanitation in Tanzania, EEPCO, a Tanzanian NGO, has taken the initiative of devising appropriate measures and technology, that will be acceptable to the people, cost effective and have higher degree of environmental control. This pertains particularly to

decentralized sanitation systems as many poor people have no adequate sanitation<sup>6</sup>. The **SanPlat technology** (Box 1) and the **SanPlat Promotion Approach** (Box 2) were chosen by EEPCO to contribute to an improvement in sanitation in Tanzania. UNICEF also supported this project.

#### **Box 1. SanPlat Overview**

SanPlat – or sanitation platform - is an improved latrine slab designed by Bjorn Brandberg. Moulds are used to give correct dimension and distinct shapes. Fine concrete is used to produce a long lasting smooth slab easy to clean. The smooth finish also appeals to the eye. The SanPlat is an economic solution because of the low production costs (one 50kgs bag of cement can produce 10 slabs), it is hygienic (washable floor with tight lid to keep flies and obnoxious smell away), it can easily moved to other places (Figure 1b) and it is safe for children to use (Figure 1a) The SanPlat is a good solution when combined with a sub-structure suitable for local conditions.

#### **Box 2. Requirements for an Effective SanPlat Promotion Approach**

- Advocacy for decision-makers is necessary to build political will
- Social mobilization of government and non-governmental institutions and influential personalities as partners are very important in promoting hygienic sanitation
- SanPlat benefits need to be promoted at household level

### Capacity Building of Private Sector involved in slab production

Tanzanian small and medium enterprises (SMEs), including private sector artisans involved in the production of latrine slabs, needed capacity building. Training workshops were organised (Box 3) for SanPlat latrine slab production and installation. The first training workshop was held in Kisarawe District (Coast Region) in 1995. It was agreed in the workshop that the SanPlat technology would be promoted in the participants' respective areas. SanPlat moulds were distributed to local artisans who had been trained, so that they could start producing slabs for sale. By 2002, the SanPlat Promotion Project had conducted fifteen workshops and trained 418 participants (75% of them from small-scale enterprises) on SanPlat technology in UNICEF-supported areas (Table 1). The project approach and results have drawn a lot of attention from Tanzanian government line ministries, international organizations, individuals and other stakeholders. The Project ended in 1999. From 2000 the MoH has taken over promotion activity replicating EEPCO's approach in other areas of the country and involving other Tanzanian NGOs<sup>7</sup>. No special

<sup>6</sup> About 70% of the population in Dar es Salaam (DSM) live in unplanned area, Mato *et al.*, 1997

<sup>7</sup>These include Red Cross in refugee camps and currently CHAMAVITA (Chama cha Maendeleo Vijijini Tanga) in Lushoto district Tanga Region, AMREF (African Medical Research Foundation) in its Mkuranga Water, Sanitation & Hygiene Project in Mkuranga district coast region and Ingenieria sin Fronteras in Karatu Arusha region.

skills are required, and any layman can learn to make excellent SanPlat within a few days of practice.

The long-term objective of the SanPlat promotion is to become self-supporting and to let the private operators gradually take over. After the training workshops (Table 1) plastic moulds and promotion materials (posters, fliers, T shirts, flags and stickers) were distributed to artisans, Health Workers (HWs) and Community Development Officers (CDOs). Artisans have the responsibility of producing, selling and installing SanPlat slabs in latrines and training other people in these skills. HWs and CDOs at ward and village levels assume responsibility for advocacy, social mobilization and promoting SanPlats at country level. HWs are in charge of latrine building and improvement programmes, or support these programmes by giving health talks, inspecting household latrines and advising households on latrine improvement. The number of SanPlat slabs sellers has increased. In Dar es Salaam 22 (81%) out of 27 SanPlat producers surveyed, were new producers who learnt the technology and skills from other artisans between 1997 and 2003. In Kisarawe district new producers make up 36 (46%) of 78 surveyed. Recorded sale of SanPlat slabs in Kisarawe by SMEs revealed that sales have reached 23% of households in target areas (Table 2). Record keeping is necessary for accurate assessment.

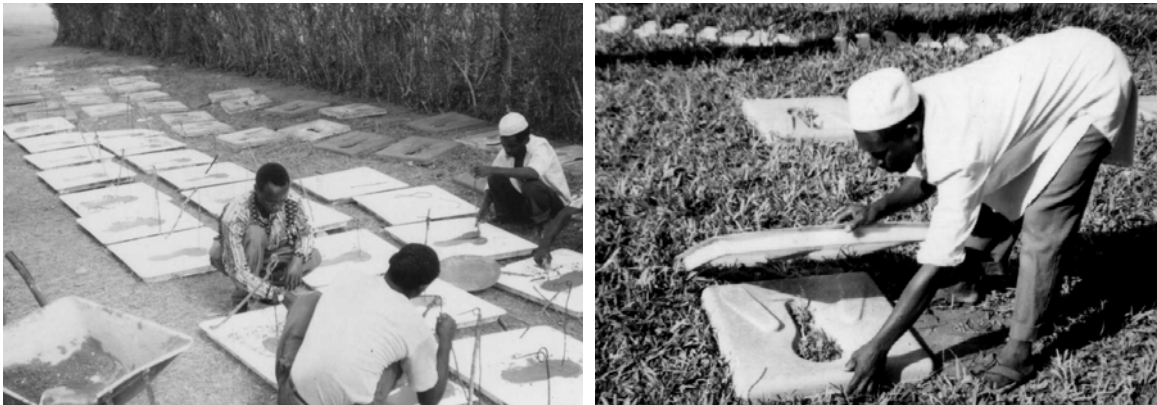
### **Box 3. SanPlat Promotion Project**

The SanPlat system makes toilet slabs affordable. They are easy to construct, flexible and can be adapted according to environmental and geographical circumstances. The SanPlat technology is a practical solution, maximising people's capabilities and combining local materials and traditional skills with innovative approaches and new materials, stimulating the people involved (Brandberg, 1997). EEPCO started the SanPlat Promotion project in Tanzania in 1995, in collaboration with UNICEF, aiming at contributing to a solution of sanitation problems in peri-urban and rural areas. Project activities included training extension workers and private artisans on sanitation, health and hygiene through participatory approaches including the Participatory Hygiene and Sanitation Transformation (PHAST). Practical training was given on sanitary latrine construction with SanPlat slabs, which improve traditional latrines. Production centres were established at ward and village levels. However, the SanPlat does not prevent the possibility of groundwater pollution, which is especially a problem in high water table areas, and does not address latrine pit wall stability. Further exploration is needed to improve the existing design by considering ecological sanitation where all human waste products are collected, preventing infiltration into the soil and groundwater pollution. EEPCO has introduced integrated some improvements, including low cost pit lining options suited to the environmental, soil and economic conditions of the area.

**Table 1. SanPlat Promotion Workshops In Tanzania**

Place <sup>8</sup>	Date	No. Of Participants					
		Health workers, Community Development Officers		Businessmen (small contractors and brick markers)		Artisans	
		Men	Women	Men	Women	Men	Women
Kisarawe District Coast region.	13 – 22 Nov 1995	2	6	0	0	20	2
Kisarawe District coast region	6 – 15 - May 1996	2	5	0	0	18	2
Chakechake Pemba	25 June - 4 July 1996	3	0	0	0	10	5
Rufiji District coast region	19 –28 Aug 1996	4	3	2	0	11	0
Mtwara	20 – 26 Nov 1996	5	6	3	0	9	0
Mwanza	15 – 21 Dec 1997	5	5	0	0	19	1
Mufindi Iringa	1 – 7 Dec 1997	2	5	0	0	23	0
Ilala District Dar Es Salaam	1997	2	4	0	0	18	6
Unguja - Zanzibar	22 <sup>nd</sup> to 24 <sup>th</sup> June 98	4	6	10	0	10	0
Masasi District Mtwara Region	13 – 15 July 1998	0	3	0	0	21	6
Ifakara District Morogoro region	10 – 13 <sup>th</sup> Aug 1998	1	3	0	0	23	3
Ileje District Mbeya Region	2 <sup>nd</sup> - 5 <sup>th</sup> Sept 1998	3	5	1	0	14	7
Vingunguti Ilala Dar Es Salaam with WHO	February 1999	0	1	0	0	13	2
Mzenga Ward Kisarawe district Coast region – 3 trainings in 3 villages with CARE Imara	12 <sup>th</sup> to 16 <sup>th</sup> Sept 2000	2	13	2	0	40	0
Babati District Manyara region MoH/WHO	3 <sup>rd</sup> to 12 <sup>th</sup> January, 2002	1	1	0	0	12	0
Total	15 workshops	36	66	18	0	261	34
% Men, Women		35.3	64.7	100.0	0.0	88.5	11.5
(%) Persons who were workshop members in SanPlat production		25		4		71	

<sup>8</sup> All of the places in this table are in UNICEF-supported areas, except the final three.



*Figure 2. SanPlat slabs making exercise during Sanitation Promotion Training – Rufiji District*  
(Photos by EEPCO 1996)

### Replicability of Initial and Adjusted SanPlat Promotion Project Approach

Initially, some SanPlat slabs produced in training workshops were provided free of charge for demonstration purposes to primary schools, health centres and a few poorer households selected by the workshop participants. These households contributed with materials and labour for the new latrine in which the SanPlat would be installed. In most cases, a traditional latrine can be built by the householders using local freely available materials at little cost, if labour and time are not costed.

As a second step the project introduced a symbolic price for the SanPlat slab, which therefore became a more prestigious product. Increasing the price eventually creates a market for non-subsidised sanitation products. However, given the poverty of households needing sanitation improvements and the unavailability of moulds, the Local Government Authorities (LGAs) provided replacement moulds free-of-charge to the first and new producers, through a subsidy from UNICEF and MoH. LGAs monitor the effective use of moulds by artisans and are also involved in advocacy (to motivate decision makers), promotion (to reach clients/households), and networking (to get everybody involved). Since 2000 the Ministry of Health (MoH) has been promoting SanPlat in areas not covered by EEPCO/UNICEF initiative. The MoH distributes the SanPlat moulds free of charge. Local manufacture of moulds has been planned by EEPCO, and when this has been achieved, subsidies on the moulds can be withdrawn. The private sector will sell moulds at a market price to an increasing number of SanPlat makers on a competitive basis.

### Commercial Production and Sale of SanPlat Slabs in rural areas

In principle, SanPlat slabs should be made available to everybody at a commercial price, covering all production costs, overheads and a reasonable profit margin so that the producer becomes a good partner in promotion (EEPCO and Brandberg 1995). However,

in Tanzania it has not work out as anticipated and unless the economic capacity of the people improves, the price of the SanPlat slab will continue to be a problem.

Cost estimate sessions were included in the workshops to enable participants to estimate the cost of producing and installing SanPlat slabs. The production cost, including labour, of a SanPlat slab is around Tanzanian Shillings 2,500/= (equivalent to US\$2.5 at 2003 exchange rates). This is affordable by some urban dwellers but may be too high a price in rural and urban poor settings.

Many rural households understand the potential of the SanPlat slab but they complain about the price. SanPlat prices vary with the income level of the area in question. Where income level is high, demand is high, and the price shoots up as producers increase their profit margins. Where income level is low the demand is low, so the producers reduce the price and gain a small profit. In low-income level areas people believe that a price of US\$ 2.5/slab is not expensive, but due to their poor economic situation, they could not afford that at one time. Many indicated that they could pay that sum after the harvest period when they have sold their produce, and many get the slabs on credit from the producers. In such circumstances, the EEPSCO team brings slab producers and their clients together to discuss the matter together and come up with an agreed compromise, such as households contributing labour and materials to produce the slabs and paying a lower price (Box 4).

**Box 4. Ten cell initiative for improved sanitation**

This initiative first started in three villages in Mzenga ward in Kisarawe district in 2001, because buying slabs for cash was difficult for most of households. Some ten-cell leaders organised their 10 households to contribute materials, labour and a little cash to pay the production centre enough to produce 10 SanPlat slabs for households. This initiative has been successful in Mzenga (see reported sale in table 2), and has been adopted by the wards Manerumango and Msanga in Kisarawe district. Groups of ten people from different cells and even from neighbouring villages have been requesting the same service from production centres. This option is more feasible in remote areas and may not be applicable in Kisarawe District town headquarter. A few people still buy slabs for cash.

The 2003 survey conducted in Kisarawe District (Table 2) indicates a good performance by CBO groups producing and selling SanPlat slabs in rural areas (Boxes 5 and 6). The reported sale of 1,710 SanPlat slabs among a total number of 7,388 households (23%) in four wards of Kisarawe may not seem very high, but taking into account the recent establishment of production centres, the poverty of the areas, and community attitudes and behavioural change, the sale is promising.

**Table 2. Survey on Production and sale of SanPlat Slabs in Kisarawe District, and Kinondoni and Ilala Municipal Districts (Dar es Salaam)**

SanPlat Production center	Year of Establishment	No of masons involved in SanPlat production	No of masons trained by EEPCO	No of Masons trained by their fellow masons	Other Selling Point(s) If any.	No of SanPlat slabs sold	Price per slab US\$
<b>Kisarawe District Pwani Region</b>							
<b>Ward: Kisarawe Type: Mixed (Peri-Urban &amp; Rural) Population: 11,844 No of hh: 2,760</b>							
Kisarawe	1995	8	4	4	Kibaha	206	3.2
Vijana Building	1995	4	2	2		150	3.6
Alex Nyalusi	1998	10	6	4	Pugu	250	3.2
Total		22	12	10	-	606	
% hh with SanPlat						22%	
<b>Ward: Msanga Type: Mixed (Peri-Urban &amp; Rural) Population: 5,234 No of hh: 1,231</b>							
Msanga	1995	10	5	5	Pugu	165	2.7
Vigama Village	1999	16	1	15	-	143	3.2
Total		26	6	20	-	306	
% hh with SanPlat						25%	
<b>Ward: Manerumango Type: Mixed (Peri-Urban &amp; Rural) Population: 8,904 No of hh: 2,135</b>							
Maneromango village	1995	2	2	-	-	130	2.3
Kimani Village	2002	1	1	-	-	10	2.3
Total		3	3	-	-	140	
% hh with SanPlat						6.56	
<b>Ward: Mzenga Type: Rural Population: 5,059 No of hh: 1,262</b>							
Mzenga Village	2001	12	10	2	Mzenga B	280	2.3
Vilabwa Village	2000	6	5	1	-	206	2.3
Mitengwe Village	2000	9	6	3	-	170	2.3
Total		27	21	6		656	
% hh with SanPlat						51%	
<b>Total Kisarawe District</b>		<b>78</b>	<b>42</b>	<b>36</b>		<b>1710</b>	
% hh with SanPlat						23%	



3 <sup>9</sup> wards in Kinondoni District - Dar Es Salaam <b>Type: Mixed Population: 113,641 No of hh: 25,774</b> (assumed that the project target lives in informal settlements= 35%, i.e. some 39,774 people or 9,021 households)							
Mbezi Africana	2002	2	0	2	-	40	5.45
Mwananyamala	1999	4	1	3	-	No data	5.3
Sinza Kijiweni	2001	2	0	2	-	No data	5.45
Total		8	1	7	-	40	
5 <sup>10</sup> wards in Ilala District - Dar Es Salaam <b>Type: Mixed Population: 257,860 No of hh: 54,899</b> (assumed that lives in informal settlements = 35%, i.e. some 90,251 people or 19,214 households)							
Pugu Kigogo	2003	2	1	1	-	50	4.1
Chanika Msumbiji	2002	3	0	3	Chanika Msumbiji	75	5.1
Tabata Barracuda	2003	3	0	3	-	10	5.45
Ukonga	1998	4	1	3	Majumbasita	130	5.45
Pugu	2000	2	1	1	-	No record	5.45
Vingunguti Chadema	2000	2	1	1	Buguruni Rozana	145	4.55
Yombo	2000	3	0	3	Shaurimoyo	104	5.3
Total		19	4	15		474	
<b>Total DSM<sup>11</sup></b>		<b>27</b>	<b>5</b>	<b>22</b>		<b>514</b>	

#### **Box 5. Formation of SanPlat-producing CBOs in rural areas**

Artisans trained in Kisarawe on SanPlat got themselves organized, formed CBOs in their respective villages and established a SanPlat production centre. The CBOs are composed of 5-12 artisans. Due to the nature of the work, no restrictions are set for gender participation, but women who are interested in masonry works were encouraged to join. The organisational structure includes a Chairperson, Secretary, Treasurer and members. The village governments recognize the CBOs as village working groups, so that legal articles like constitution, registration certificates etc. are not important for their existence. To start running the centres, each CBO was granted 10 SanPlat moulds, and a minimum of 10 slabs made during the workshops, depending on the size of the group. Normally 10 households contributed materials, labour and around 0.25 US\$ per household to pay the masons.

<sup>9</sup> Sinza, Mbezi and Mwananyamala wards in Kinondoni District

<sup>10</sup> Pugu, Chanika, Segerea, Ukonga and Vingunguti wards in Ilala District

<sup>11</sup> % of hh with SanPlat latrine in DSM is unrealistic (not included) since records are missing in some of production centres.

*Continued*

Members of the CBOs realised the importance of joint effort in producing and selling SanPlat slabs. Granting them materials to run the centres was an incentive. The advantages include; (i) CBOs plan together to reach more people in rural areas e.g. through the ten cell initiative, (ii) price controls on slabs make them affordable for the majority of the poor, (iii) quality control of the slabs, (iv) known points in villages where SanPlat slabs can be found, (v) good record keeping, (vi) proper use and control of moulds for high production, and (vii) proper management of the donated materials. However, CBOs lack capital to run the centres, and fully depend on the donated materials.

### Commercial Production and Sale of SanPlat Slabs in peri-urban Areas

Commercial production and sale of SanPlat slabs in districts towns and in peri-urban areas of major towns have proved to be more successful than in rural areas; one reason may be that the production and selling points continue to increase in these areas. Promotional slogans have been developed (Box 6).

#### **Box 6. Selling Arguments**

As well as health arguments, SanPlat production centres have been using emotional messages to market the SanPlat. The strong selling argument is “modern”, with a slogan “a modern person has a latrine with a SanPlat”.

The local identifier of SanPlat, is a hare, because the shape of the drop hole and footplates resembles a hare. A common slogan is therefore “Hare! It is clever to have it” (in Swahili “Sungura! Ujanja ni kuwa nayo”) is common in SanPlat promotion in Tanzania.

The 2003 survey (Table 2) conducted in Ilala and Kinondoni Districts of Dar es Salaam (DSM) shows a significant increase in the number of block sellers who are also producing SanPlat slabs. In rural areas, producers of slabs are also the sellers. In urban areas, while producers do also sell, there are often middlemen who buy from the producers and sell to the households. This increases the cost of the slab from US\$ 2.5/slab to US\$ 5.45/slab. It is difficult to know who are the “good quality” slab producers. A survey evaluated the results of SanPlat promotion training conducted in DSM, in which 80% of participants were from the small-scale private sector (masons, artisans, small contractors and brick makers). Five of the 24 artisans in Dar es Salaam who were trained in SanPlat production in 1997 by EEPSCO are now block makers in various peri-urban parts of the city. The others could not be traced but they may have left the job or work in non-surveyed parts of the city.

Unfortunately, a crackdown on street vendors by the DSM City Council (DCC) in early 1998 affected most of the block makers whose businesses were located close to roads, including successful and popular SanPlat production and selling points. As a result, only three points remain active in DSM, and these are far from the roads and the sales of slabs

are rather slow. Record keeping is generally a problem: the spread of production and selling points are not recorded as this remains a free market open to everyone. Although it is difficult to locate those who were trained by EEPCO in 1997, it is easy to locate SanPlat slabs displayed for sale at block and building decoration selling points scattered through peri-urban areas of the city (Figure 3).



Figure 3. Left: SanPlat slab and lids displayed for sell in a point also selling building decorations and blocks in Pugu Kigogo Dar es Salaam. Right: SanPlat center in Mitengwe Village Kisarawe District. Photos by EEPCO 2003

## Conclusions and recommendations

Based on the overview of this work, a number of conclusions and recommendations are made. Clearly more work needs to be done in involving the private and informal sector, as it has an ever increasing business in SanPlats. Other conclusions are:

- SanPlat slabs with other latrine improvements are very suitable for the Tanzanian environment. They provide jobs and income in the small-scale private sector and create social/economic relations for marketing the slabs.
- Hygiene improves if traditional latrine slabs are replaced with SanPlat slabs.
- Acceptability, affordability and political determination are crucial in promoting SanPlat.
- The involvement of the small-scale private sector in sanitation promotion is important, as these small business are very useful in information gathering, and in using and disseminating sustainable designs.
- SanPlat promotion in rural areas is best done after harvest as people have time to listen and money to buy slabs.
- Collective efforts at Ten Cell level to improve the latrine conditions by buying and installing SanPlat slabs have been successful in some areas and need follow-up. They are also very important in replicating knowledge and skills in slab production and sale
- Emotional messages are effective in both rural and urban communities SanPlat marketing.
- Better data needs to be collected about sanitation and private sector participation.
- There is no sanitation policy in the country at present, but one is under development.
- Sanitation is fragmented in different ministerial sectors, resulting in conflicting ideas and difficulties with accountability for the small-scale private sector implementing sanitation concepts and options.

- Building a latrine as an outcome of health campaign and using it are two entirely different issues in some areas of the country.

In terms of recommendations the following is suggested:

- The small-scale private sector should be involved in sanitation programmes to improve efficiency, develop effective marketing and maximise the impact of the improved technologies.
- The performance of the small-scale private sector should be monitored, preferably by itself, either by the established CBOs or possibly by an association of small-scale industries, if one exists.
- Quality control, price setting, the legal framework, regulation, micro-credit schemes etc, need to be discussed and followed-up between the local authorities and the small-scale private sector to support efficient and effective small-scale sanitation entrepreneurs.
- Public education in hygiene and sanitation for local people should continue. It creates awareness of SanPlat and hence, a possible increased market of slabs and more jobs for small-scale private sector.
- In rural areas, it might be good to design the latrines in the same way as the local houses are constructed so that self-help construction and maintenance can be used.
- The issue of subsidies needs a thorough discussion; experience in rural sanitation in Asia indicates several negative effects of subsidies on slowing the progress in improving coverage of hygienic sanitation (Kar, 2003).
- Funding agencies should assist by offering technical input and soft loans.
- Local authorities should be overseers of sanitation activities in their localities and assist communities to construct adequate excreta disposal facilities, co-ordinating efforts with knowledgeable NGOs.
- Local authorities and small-scale private sector should be encouraged to keep good records of men and women in various sectors who have been trained and monitor their performance for the sake of replicability, efficiency, durability, and sustainability. They should also keep records of constructors and households where SanPlats have been installed.

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### 3. Ghana- Financial and institutional challenges to make faecal sludge management an integrated part of the ecological sanitation approach

Anselme Vodounhessi

#### Introduction

There is nowadays a strong push for sanitation programmes in developing countries to solve the problems of the approximately 2.6 billion people without access to basic sanitation. The aim is to find more viable and sustainable solutions to sanitation in order to meet the Millennium Development Goal (MDG) Number 7, target number 10 (“Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation” (UNDP, 2005)). A new approach to sanitation is ecological sanitation (ecosan), which has been proven in many pilot projects to provide benefits such as: protect the environment, save water and money, provide barriers to water pollution and water-related diseases, and recycle water and nutrients for reuse in agriculture. Ecosan is a new paradigm in sanitation provision, which is not limited to a specific technology but encompasses all sanitation systems that lead to sustainable systems.

In West African cities today, the sanitation reality is that thousands of tons of faecal sludge from conventional on-site sanitation systems (mostly septic tanks, pit latrines; private and public toilets; wet or dry sanitation but without urine diversion) are disposed off untreated and indiscriminately into lanes, drainage ditches, inland waters, estuaries and the sea. Financial and institutional arrangements in most cities do not support faecal sludge management (FSM) programmes.

Many sanitation experts regard ecosan and FSM programmes as two separate entities. However, FSM should be considered as an integrated part of ecosan to solve sanitation problems in developing cities. Financial and institutional challenges can be overcome so that FSM can be part of an ecosan approach to deal with West African cities' sanitation problems in a sustainable manner.

#### *Drivers to consider FSM part of ecosan*

Justification for placing FSM under the ecosan umbrella is based on two premises: (i) More than 75% of houses in large cities and up to 100 % of houses in towns in sub-Saharan Africa are served by conventional on-site sanitation facilities (Strauss et al., 2004). These facilities produce thousand of tons of faecal sludge, which is very often indiscriminately dumped into the environment; (ii) Ecosan aims to close the loop of human waste of which faecal sludge is an important part. The divergence between the two concepts is that FSM focuses on the collection and treatment processes of a large amount of wet excreta, while ecosan focuses on the human excreta generation process (e.g. on producing dry excreta separated from urine) and on the reuse process.

If FSM could be operated in a manner that it is also sustainable (in all aspects) and especially if it enables and promotes reuse of human excreta, then it could be seen to be part of the holistic approach of ecosan. Hence, it should be possible to “close the loop” of human waste even with conventional on-site sanitation systems, which produce the faecal sludge, rather than attempting to convert all toilets to the (possibly more ideal) “ecosan compatible” toilet types (for example urine-diversion dehydrating toilets).

## Ecosan as Integrated and Sustainable FSM

### *What is ecosan?*

Ecological sanitation (ecosan) is based on the idea that urine, faeces and water are resources in an ecological loop. It is an approach that seeks to protect public health, prevent pollution and at the same time return valuable nutrients and humus to the soil. This recycling of nutrients helps to ensure food security (WASTE, 2005). Many consider ecosan simply as dry sanitation or urine diversion toilets, because the waste from them is easy to handle and safe for the reuse without high-tech treatment. However Schmitt states (Schmitt, 2003): “The term Ecological Sanitation stands for ecologically and economically sustainable sanitation systems. It does not refer to a specific technology. We use it rather to describe a whole range of technologies and institutional arrangements, which address both the issue of water scarcity and better sanitation.”

### *What is FSM?*

Faecal sludge management is the management of sludge to avoid a crisis, such as that caused by indiscriminate dumping, overflow of septic tanks or community toilets, unhygienic use of FS in agriculture, etc. A proper FM management system includes adequate de-sludging of sanitation facilities, safe handling and transport of sludge, treatment of sludge, and safe disposal or reuse, but where reuse is not necessarily the main focus.

*The convergence...*

Based on concepts of integrated solid waste management (ISWM) in (Klundert and Anschütz, 2001), a new approach has been developed for FSM in which integration and sustainability are key elements.

### INTEGRATED SUSTAINABLE FAECAL SLUDGE MANAGEMENT AS ECOSAN

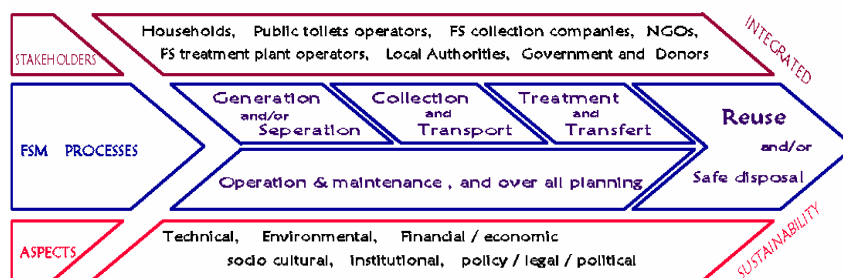


Figure 1. The ISFSM approach developed based on ISWM concepts in (Klundert and Anschütz, 2001)

In integrated-FSM all stakeholder needs, perceptions and capabilities for FSM processes are taken into account, as well as the interaction and relationship with others services such as solid waste association for co-composting, and farmers' consideration for the treated FS reuse in agriculture.

In sustainable FSM, all aspects of sustainability are assured, especially financial and institutional sustainability where there is a full cost recovery irrespective of donor support, and environmental sustainability where there is no longer a sludge crisis. When combined, these approaches can form Integrated and Sustainable Faecal Sludge Management (ISFSM) and can jointly become a part of ecological (and economical) sanitation Just a part, because ecosan also covers wastewater and solid waste management.

#### *The Kumasi case: Kumasi city*

Kumasi is the second largest city in Ghana, in West Africa's Gulf of Guinea. Ghana, with an area of 238,540 km<sup>2</sup>, is subdivided in ten administrative regions. Its capital city, Accra, is located in the Greater Accra region in the southern part of the country. Kumasi is the capital city of Ashanti region. Located 300 km Northwest of Accra, it covers 150 km<sup>2</sup> and has about 1.2 million inhabitants ((GLSS4, 2000)).

Living conditions in many parts of Kumasi are very crowded. The average size of a household is 4.6 persons. About 95 % of households live in apartment buildings, and 90 % of households live in a single room., The average number of people in an apartment building is about 50. Over 55 percent of households in Kumasi live in buildings with more than ten households, and more than one quarter of the households in Kumasi live in buildings with more than 60 people (Wiftintn et al., 1992).

Urban and peri-urban agriculture in Kumasi has an important socio-economic impact. It contributes to food security and increases the income of the urban poor. However, a recent study in Kumasi found that urban and peri-urban agricultural soils are greatly depleted of



organic matter and nutrients, especially in nitrogen and phosphorus (N&P) (IWMI and SANDEC, 2002). vegetables are cultivated intensively on approximately 120 hectares of land in urban and peri-urban Kumasi (Moser, 2004).

The daily generation of solid waste in Kumasi is estimated at 1000 metric tons, about 70% of which is collected. The bulk of the solid waste generated in the metropolis is collected by the private sector based on a mixture of contract and franchise arrangements. The main collection methods employed are House-to-house and Communal Container Collection systems (Mensah, 2005). The case study's findings will tell more about the faecal sludge management.

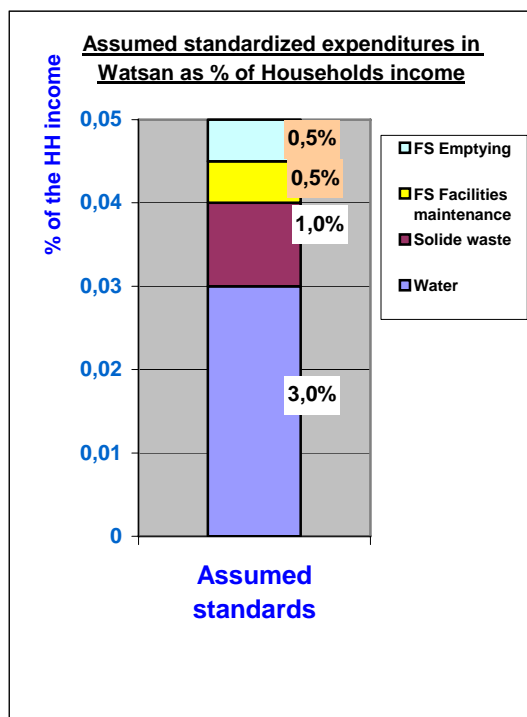
### The case study approach and methodology

This case study:

- Describes the existing situation in Faecal Sludge (FS) management along all its management processes (from the production to the reuse or safe disposal) based on the amount of FS handled at each step. As outcomes, the environmental FS load of the city is derived from the FS flow, and the case study examines the FS collection services coverage and all the proactive stakeholders in FSM in Kumasi.

- The related methodology is based on literature review (Kumasi Waste Management Department -WMD- reports and the faecal sludge treatment plant (FSTP) operator's worksheets. Key informants interviews (WMD Director and officers) and direct observation and discussion with some actors in FSM (collections companies managers and temporary manholes<sup>12</sup> managers) were also necessary to crosscheck and validate data.

- Analyses existing financial and institutional arrangements by determining the actual money flow for the overall system, based on direct stakeholders' financial and institutional situation. The study tries to evaluate the capabilities of stakeholders



<sup>12</sup> These service providers are the intermediary between bucket latrine owners and FS collection companies. They build manholes in which they store the FS collected from the households using bucket latrines. These manholes are emptied by the FS collection companies.

(mainly households, collection companies, and authorities) and their potential to improve the financial and institutional situation.

- Evaluates the current expenditure of households on sanitation services and compares this to their income. The main assumption made in the study is that households can spend 0.5% of their income on the FS emptying service. This assumption is based on a breakdown of the WHO standard that households can spend 5% of their income on water and sanitation services. (The remaining 4.5% can be spent on other watsan services.)
  - Household interview surveys were carried out 20 households randomly selected in different income areas (5 in high income areas, 5 in medium income areas, 10 in low income areas) to discover levels of household satisfaction with sanitation services and their opinion about the cost of the emptying services.
  - Structured interviews were carried out within FS collection companies, to evaluate their operational and financial performance and their internal and external institutional environments. Five companies were selected for interview, one of which is public. Data on the amount of sludge discharged by all the companies operating in the city was obtained from the treatment plant.
  - Open discussions were held with the directly involved authorities – the Waste Management Department (WMD) responsible for sanitation services, and the Environmental Protection Agency (EPA), the regulatory body. These looked at current institutional arrangements and institutional structure. Discussions helped to identify the actual financial and institutional problems that hamper FSM in the city.

The attitudes of farmers and households are critical to create a better financial and institutional situation in which FSM could become part of an ecosan approach in Kumasi. Households must pay what they are able to for services, while farmers must have incentives for co-composting and compost reuse to achieve integrated FSM and environmental sustainability. The potential revenues from households (based on an assumed 0.5% of income and the city's emptying service coverage) and from farmers (based on data from Kumasi farmers' WTP study done by IWMI<sup>13</sup>) have been estimated to determine how reliable is the CTP(Capacity to Pay) -approach to close FS loop in Kumasi without Government or donor subsidy. Due to the limited size of the sample, statistical data on the population income levels has been derived by working with the Kumasi Statistical Service Officers to update the 1996 data to 2004.

#### Case study findings: Current situation in FSM

The city's population of 2004 has been estimated at 1,482,480 inhabitants (KMA, 2003) of whom 38% use public toilets, 30% use a household water closet connected to a septic tank, 8% use an unhygienic bucket latrine, 8% use KVIP<sup>14</sup> and 2% use traditional pit

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<sup>13</sup> International Water Management Institute (office of West Africa based in Accra, Ghana)

<sup>14</sup> Kumasi Ventilated Improved Pits: improved pit latrines introduced 1989.

latrines (Mensah, 2005). The population relying on the city's five small scale sewerage systems (Asafo, KNUST, Ahinsan, KATH and Chirapatre Housing Estates) make up 10%, of the population. The bush provides for the remaining 4% of the population.

**Table 1. Faecal Sludge flow estimate for Kumasi city.**

City Population 2004			<b>1 482 480</b>				
Septic tank			1 l/ca/day				
Heavy sludge			0,2 l/ca/day				
Toilets facilities	Coverage	Population	FS production (that can be collected)		FS collection	FS Treatment	FS Reuse
			m3/d	m3/month			
Public toilet	38%	563 342	113	3 380	On average 1255 trips per month are collected from the city  i.e. ( in m3/month)	Dompoase solid waste landfill site including FS treatment ponds system of 9 ponds.  Currently receiving all the collected FS from the city. There is no longer illegal dumping	No reuse at the moment
WCs	30%	444 744	445	13 342			
Bucket	8%	118 598	24	712			
KVIP	8%	118 598	24	712			
Pit latrine	2%	29 650	6	178			
Total for FS	86%	1 274 933	611	18 323	6 275		
			<b>34%</b> <i>of the FS produced is collected</i>				
WCs sewer	10%	148 248	148	4 447	Connected to 5 small scale sewerage systems which are Asafo, KNUST, Ahinsan, KATH and Chirapatre Housing Estates.		
Bush	4%	59 299	12	356			
Total for FS	100%	1 482 480	771	23 127			

Based on an estimated FS production of 1l/ca/day for septic tank and 0,2l/ca/day for heavy sludge (Heinss et al., 1998), the total FS production of the city has been estimated at 23,127 m<sup>3</sup> per month of which 18,323 m<sup>3</sup> is in toilets that can be emptied. The remaining 4,447 and 356 m<sup>3</sup>, go respectively into the sewerage system and into the bush.

FS collection from households and utilities is carried out by 22 collection companies of which five are public. All of the companies use pumping tankers of a capacity of 5 to 8 m<sup>3</sup> (mostly 5 m<sup>3</sup>). They provide a mechanical emptying service for any type of toilet facility except bucket latrines and traditional pits latrines. The Waste Management Department is one of the five public companies providing an emptying service and is the only company providing a manual emptying service to traditional pits owners (Figure 2).



*Figure 2. Manual emptying service provision by KMA/WMD in a house at Zongo, Kumasi (Photos: Anselme Vodounhessi)*

Another type of direct (but informal<sup>15</sup>) stakeholder are Manhole Managers, who provide an emptying service for bucket latrines via conservancy workers<sup>16</sup>. FS collected from households (Figure 3) is stored in a manhole and emptied by collection companies at the same price as for household service.



*Figure 3. Bucket latrines at Adoum sudurb. (Photo: Anselme Vodounhessi)*

One pleasantly surprising fact is that all the collection companies discharge the FS they collect at the treatment plant, and there is no longer any illegal FS dumping in the city. This has been successful through the strictness of the District Assembly rules and community participation in denouncing defaulters. FS is deposited at Dompoase, a sanitary landfill facility with a 15 year lifespan, which takes care of solid waste in landfill and FS through treatment. A 9-stabilisation pond FS treatment plant became operational in January 2004. The Buobai pond system which had been operating for two years (2001-2003), was abandoned because the sedimentation ponds were full and there is at present no means of emptying them. The community around the plant was also unhappy about the effluent discharged into the neighbouring river.

On average 1255 trips of faecal sludge are discharged monthly at Dompoase FSTP, which amount to 6,275 m<sup>3</sup>. This represents just over one third (34%) of the collectable FS of 18, 323 m<sup>3</sup> monthly in various emptyable toilets. The environmental faecal sludge load of Kumasi is all of the sludge that is not collected and dealt with – i.e. the FS stored

<sup>15</sup> The District Assembly does not allow bucket latrines emptying service provision, despite that it is vital for buckets latrine owners. It is a way to discourage the use this particular type of latrines.

<sup>16</sup> Bucket latrine conveyers working by night.

underground due to the high full frequency of toilets pits, and the FS put directly onto the soil. From the FS flow shown in Figure 4

Figure 4, the total environment FS load of the city, has been estimated at about 12,400 m<sup>3</sup> per month (12,048 m<sup>3</sup> in pit latrines + 356 m<sup>3</sup> put directly onto the ground), which is about 54% of the total FS produced in the city.

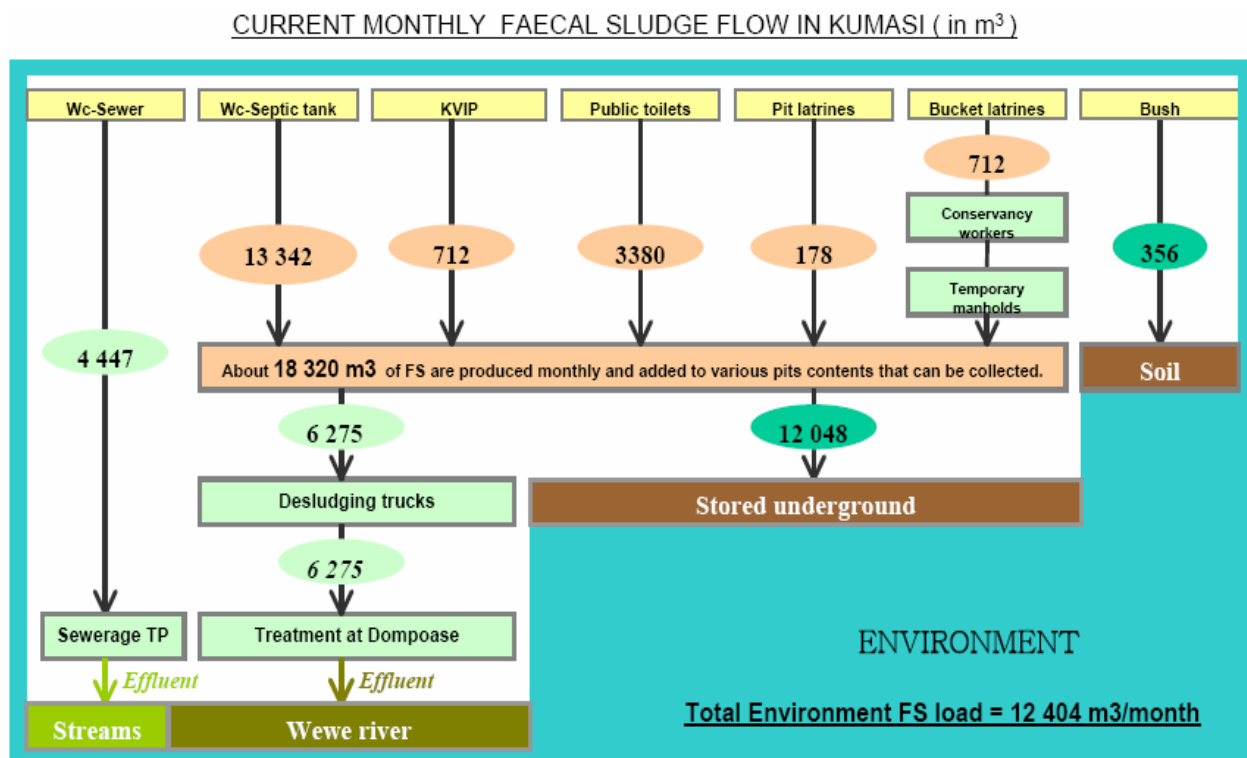


Figure 4. Monthly Faecal Sludge flow in Kumasi

It has been estimated that it takes an average of 4.2 years for each toilet pit in Kumasi to fill, dependent on pit volume and the number of people using it. This varies between 10 years or more in high income areas to 3 months in low income areas.

The 6,275 m<sup>3</sup> of FS discharged monthly at Dompoase is treated in the pond system in combination with the leakage from landfilled solid waste. Treatment is through a series of 5 anaerobic ponds, 1 facultative pond and 2 maturation ponds. Unfortunately the quality of the effluent mixed with the underground drainage from the solid waste landfill site and ejected into the Wewe River, is not desirable. The mixed effluent (figure 5) is black in colour and foamy, showing that environmental protection is still questionable.

There is currently no treated FS reuse in agriculture, but there is potential for reuse. All of the compost users and 83% of non-compost users perceived municipal co-compost as positive or 'good' material for soil amelioration and crop growth, and 70% of them are willing to pay for it (Cofie, 2003). Farmers who did not express willingness to pay argued e.g. that they first have to test the product to know its effectiveness in terms of yield and returns.



*Figure 5. Foamy effluent from Dompouse Treatment Plant discharged into the Wewe River (photo: Anselme Vodounhessi)*

## Existing institutional arrangements

In Ghana, waste management services are in the hands of District Assemblies<sup>17</sup>. According to (Mensah, 2005), one of the major functions of the Kumasi Metropolitan Assembly (KMA) is the provision of environmental sanitation services including the collection and disposal of both solid and liquid wastes. The institutions/stakeholders directly involved in FSM the city are:

At national level:

- The Government of Ghana (GoG), whose main role is the budget provision for KMA activities
- Donors, mainly the World Bank, which provides financial support for any initiative;
- The Environmental Protection Agency (EPA), the regulatory body.

At local level:

- Local authorities, i.e. the Kumasi Metropolitan Assembly (KMA) and its decentralised service provider, the Waste Management Department (WMD);
- Direct providers, mostly private partners such as FS collection companies, the contractor at the Dompouse treatment plant, and public toilet managers.
- FS service beneficiaries, mainly households.

### *Private sector participation in the city's sanitation services*

The institutional arrangement in FSM in Kumasi is characterised by private sector involvement at all level of the service. KMA is the owner of the sanitation services provision

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<sup>17</sup> The domination and power of the District Assembly depends on the settlements population. The assembly is a Metropolitan Assembly when the settlement has more than 250,000 inhabitants, Municipal Assembly when it is more than 100,000 inhabitants, and simply District Assembly when has less than 100,000 inhabitants. Kumasi District Assembly is a Metropolitan Assembly, i.e. The Kumasi Metropolitan Assembly (KMA).

and has mandated the WMD to be responsible for the service provision. The overall organization of the service as shown in Figure, can be described as follows:

- WMD provides financial assistance (50% subsidy) to the poor to access household facilities, under UESP-II<sup>18</sup>, and also constructs new and replacement public toilets in areas such as markets and commercial locations where the full cost can be recovered. The public toilets services provision are in the hands of sub-metro councils, under Management contract for public built facilities, and “build operate and transfer” (BOT) contract for privately built ones.
- At the FS collection level, there is liberalisation of service provision and 17 private companies are currently competing. Of the five public companies - the Police, Army, Prisons, TELECOM and KMA/WMD - only KMA/WMD provides a household service in competition with private companies. Private companies need a licence from KMA to operate and they pay a dumping fee for each discharge at the treatment plant, but the public companies do not. Only TELECOM pays a dumping fee.
- At the FS treatment level, the sanitary landfill facility at Dompase, built under UESP-I, has been put under Management Contract under UESP-II. A single private contractor has been operating both the solid waste landfill and FS treatment ponds system since January 2004. Technical monitoring of the contract is by WMD and financial monitoring is by KMA.

#### *Decentralisation not working effectively*

The KMA initiative to creating a decentralised office (WMD) for sanitation services and to involve the private sector at many levels is held up as good example in West Africa. However, the decentralisation is not effective and more needs to be done to improve stakeholder autonomy in playing their roles.

The WMD has limited autonomy in the execution of its activities, especially those related to the financial issues. It has no decision making power over investments, nor in the financial management of contracts. The role of the department is limited to facilitating and coordinating services. Its internal organisation is not results oriented since there is no clear strategy for staff incentives and no effective internal accountability. It is difficult to make the department accountable for results because there are no performance targets, due to the lack of resources to meet them. The department is thus working to targets it has set itself.

The multiple role of KMA – Owner, Provider, Regulator and Supporter of the services- do not allow the regulatory body to fully play its role. EPA is an autonomous regulatory body operating under the mandate of Act 490 of 1994 and legislative instrument of 1999, to ensure sound environmental management by regulating environmental activity. But despite its credibility, capability, transparency, accountability and power for enforcement and sanctions, the EPA can only work on collaborative basis with KMA because of the context. It has actually little power as regards local authorities. It is limited to advice rather than enforcement, because there are not enough resources for the authorities to do things right.

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<sup>18</sup> Urban Environmental Sanitation Programme - phase 2: A World Bank financial support programme.

Most of the private collection companies, perform well, despite the low educational level of their managers (ranging from primary to secondary school, with no background in sanitation). They demonstrate:

- Good operation performance: 100% demand satisfaction; quick response for the service provision; 0.07 to 0.2 staff per monthly population served<sup>19</sup>; no illegal dumping;
- Good internal organisation: efficient billing and collection system (beneficiaries pay before the service is provided); good staff motivation (financial rewards); 100% customers complains coverage; 100% of their revenue comes from customers.

They thus maintain a good competitive environment, a key factor in good service provision. However they are not free to set their own tariffs, as these are set by KMA. However, their external environment is favourable since they benefit from the authority's capacity building programme and the resulting good perception that the community holds for their activities.

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<sup>19</sup> A "*number of staff per population served*" is an operational efficiency indicator of water utility provided by Tynan and Kingdom (2002). It refers to the lowest cost use of labor and is normalized by the author in the case of water utilities.



**Table 2. Overall FSM money flow estimation based on 2005 data of FS discharge at Dompoase FSTP (used for Figure 7)**

REVENUE FROM COLLECTION COMPANIES													
Dumping fee at the FSTP=	20 000 cedis			Currency rate of 1 US\$ =						9 000 cedis		FSTP cost =	\$10 000
MONTHS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	AVERAGE	
TOTAL MONTHLY INCOME (US\$)	3 027	2 656	2 767	2 498	2 649	2 722	2 836	3 044	2 702	2 967	2 820	\$2 790	
MONTHLY INCOME PAID (US\$)	2 844	2 491	2 633	2 276	2 460	2 469	2 576	2 760	2 491	2 747	2 587	\$2 576	
MONTHLY INCOME PAID as % OF THE COST	28%	25%	26%	23%	25%	25%	26%	28%	25%	27%	26%	26%	
PART OF THE MONTHLY PAID FROM HH (US\$)	2831	2473	2587	2258	2429	2460	2560	2749	2478	2747	2560	\$2 557	
PART PAID FROM UTILITIES (US\$)	13	18	47	18	31	9	16	11	13	0	27	\$18	
MONTHLY INCOME UMPAID (US\$)	182	164	133	222	189	253	260	284	211	220	233	\$214	
MONTHLY REVENUE FROM HOUSEHOLDS IN THE SYSTEM													
Mean collection fee =	400 000 cedis			Currency rate of 1 US\$ =						9 000 cedis			
MONTHS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	AVERAGE	
TOTAL MONTHLY REVENUE FROM HH (US\$)	57 511	50 756	52 800	46 356	49 022	50 400	52 044	56 889	50 356	56 133	52 133	\$52 218	
MONTHLY GOVERNEMENT SUBSIDY													
Current monthly FS treatment cost =	\$10 000												
MONTHS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	AVERAGE	
MONTHLY SUSIDY (US\$)	7 156	7 509	7 367	7 724	7 540	7 531	7 424	7 240	7 509	7 253	7 413	\$7 424	
TOTAL MONTHLY REVENUE FROM HH (US\$)	72%	75%	74%	77%	75%	75%	74%	72%	75%	73%	74%	74%	

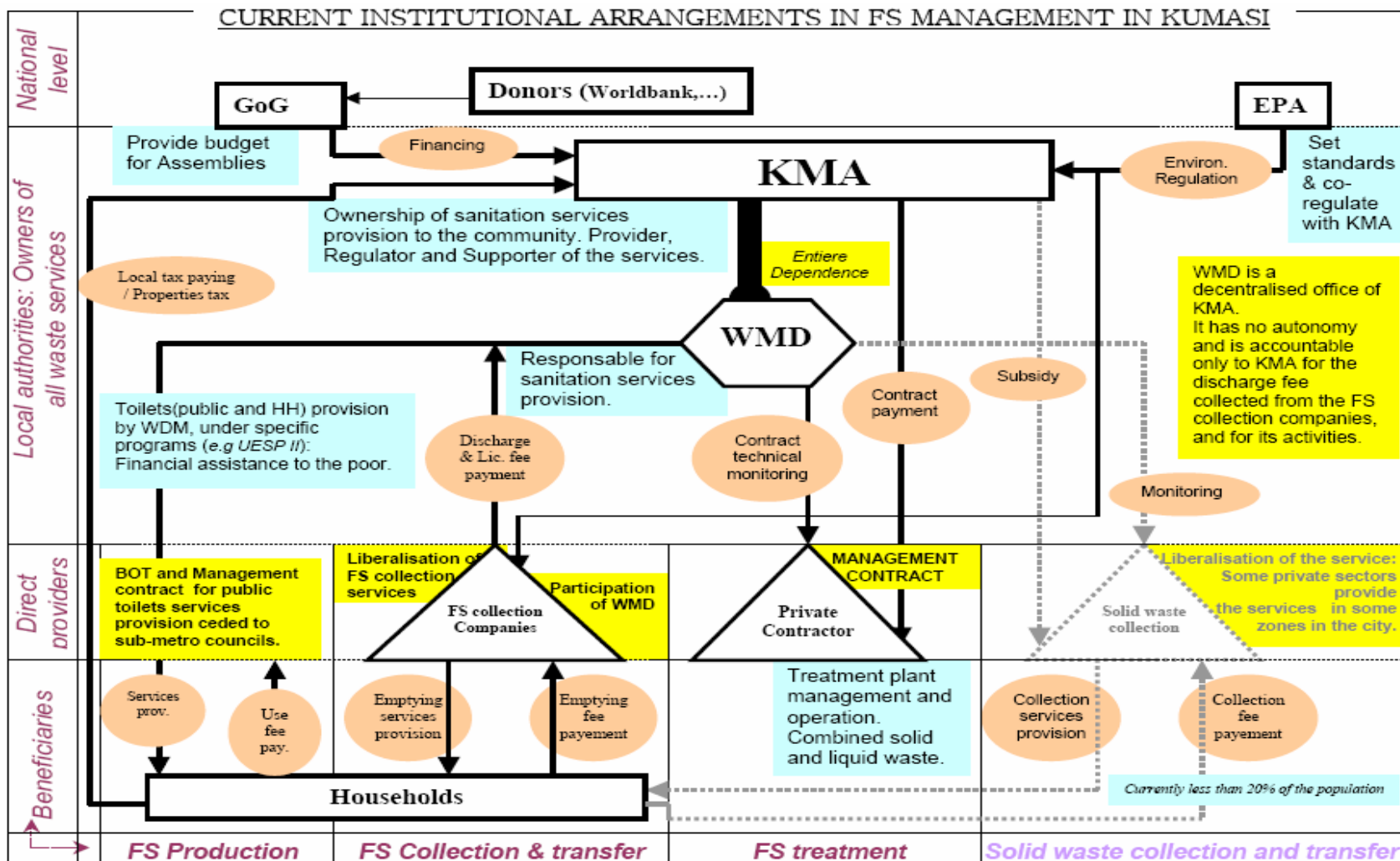


Figure 6. Current institutional arrangement in Faecal Sludge Management in Kumasi, Ghana

## Existing financial arrangements and stakeholders' capability

The direct actors involved in the overall financial management of Faecal Sludge in the city are: households (HH), collection companies and local authorities (through Government subsidy). As shown in figure 7, the central point of the financial chain is the FSTP (faecal sludge treatment plant). The collection companies are doing good business: the net profit margin of the four private companies studied, ranges from 11% to 28% (Table 3). The tariff for the service provision to households ranges from 300,000 to 600,000 cedis<sup>20</sup>. With the average tariff of 400,000 cedis (used by most companies), it has been estimated that US\$ 52,218 is paid by households of which 95% (US\$ 52,218) is retained by collection companies and 5% (US\$ 2,576) go to the FSTP as discharge fee, which is the only revenue of the FSTP. The cost of the overall FSTP management is estimated at US\$ 10,000, and thus cost recovery is 26%, requiring 74% to be covered by Government.

**Table 3. Financial statement of the five collection companies interviewed**

<i>I. Income statement</i>						
COMPANIES NAME	BABDAKO	AFRANIE	ALBERT J.	KMA/WMD	PLANET G	BILAN
<i>Daily statement per trip ( in cs)</i>						
Emptying tariff (+)	400 000	400 000	350 000	3 /600 000 <sup>1</sup>	400 000	
Fuel (-)	100 000	80 000	100 000		75 000	
Shop money <sup>2</sup> (-)	100 000	90 000	70 000	100 000	150 000	
Oil (-)	20 000	20 000	10 000		10 000	
Discharge fe (-)	20 000	20 000	20 000		20 000	
<u>Daily net Revenu per trip</u>	<u>160 000</u>	<u>190 000</u>	<u>150 000</u>		<u>145 000</u>	
<i>Monthly NOPAT ( in '000 cs)</i>						
Av number of trip / month	369	165	29	24	59	
Turnover	147 418	65 855	10 023	9 636	23 491	
Monthly net renevu	58 967	31 281	4 295	8 833	8 515	
Remaining Staff cost	11 000	6 800	2 600		1 000	
Maintenance cost	5 000	2 000	500		500	
<b>Profit before tax</b>	42 967	22 481	1 195		7 015	
Tax	3 223	1 686	90		526	
<u>Monthly Net Operation Profit After Tax</u>	<u>39 745</u>	<u>20 795</u>	<u>1 106</u>		<u>6 489</u>	
<b>Net profit margin</b>	<b>27%</b>	<b>32%</b>	<b>11%</b>		<b>28%</b>	
Use of the profit	<i>New invest.</i>	<i>Invest. in other act.</i>	<i>Take care of owner' family</i>		<i>Storage</i>	
Impact on the profit accepted	< 5%	< 5%	< 5%		< 5%	

<sup>20</sup> Local currency, which rate is currently about 9,000 cedis for 1 US\$.

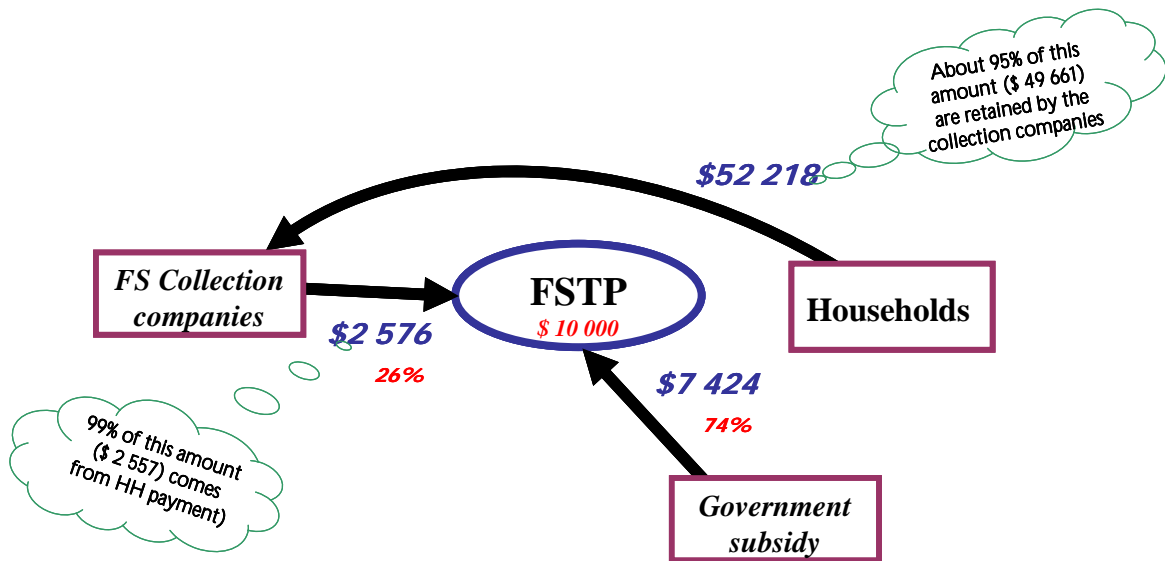


Figure 6. Current money flow in the overall Faecal Sludge Management in Kumasi.

Households are the main source of revenue of the system since they are the only direct beneficiaries. From the households interview survey, the Figure 7 shows the average monthly income per income area, of which the capacity to pay (CTP) for the emptying service (based on the assumed 0.5%) is estimated in Figure 8 and compared with the actual expenditures in emptying services. It can be seen that low income areas are currently paying 3.5 times their CTP, while high income areas are paying three times less.

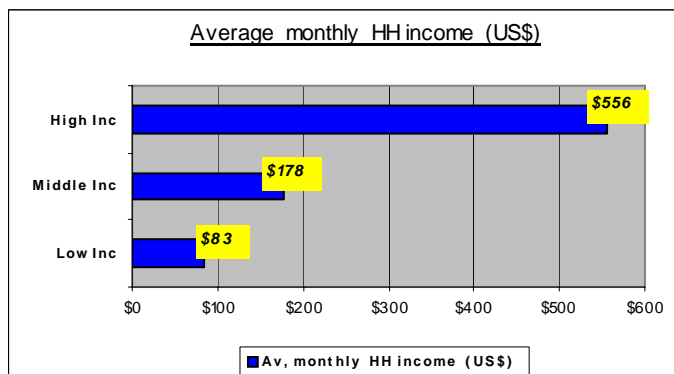


Figure 7. Average monthly HH income per area in Kumasi.

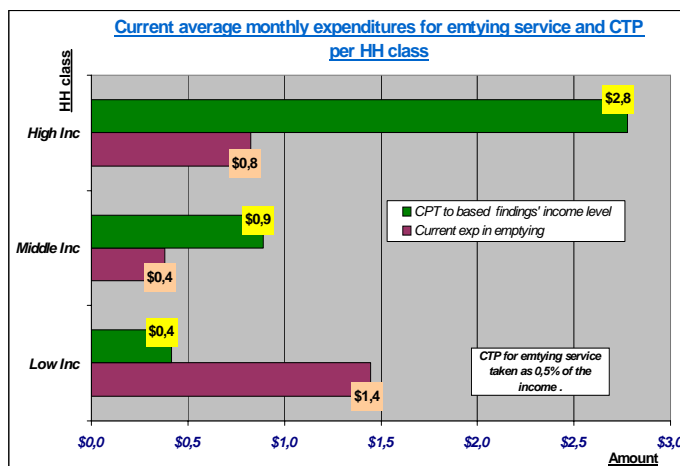


Figure 8. HH expenditures in emptying services and CTP

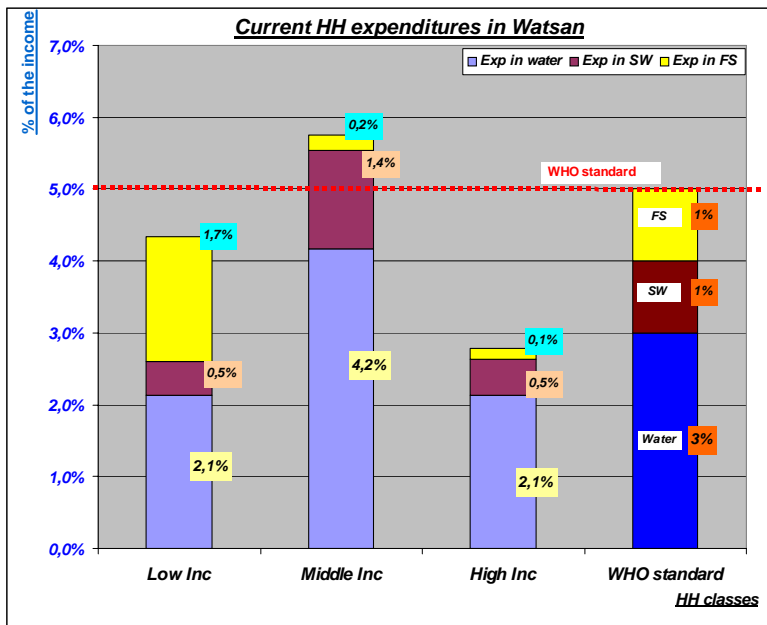


Figure 10. HH expenditures in watsan

The overall expenditure of the households in water and sanitation (watsan) according to the survey is presented in comparison to WHO standards of 5% of the HH income. The figure shows that middle income areas pay more than the standards, while the high income areas are still far away. Despite this fact, no household is willing to pay more what they are currently paying to benefit from service: only 5% of households (all in low income areas) think that their expenditure in the emptying service is low.

But based on the households capability estimated in Figure 8, more money can be expected from households to cover the overall cost of the system, if a good strategy is found to collect this money effectively. The target of environmental sustainability will be assured if FS treatment ends by producing biosolids for reuse in agriculture as it would do in an ecosan approach.

Institutional and financial problems that prevent FSM from becoming ecosan

The institutional and financial problems that hamper Faecal Sludge Management, and prevent it from becoming part of an ecosan approach in Kumasi, can be summarised in 10 points:

1. Government and donor orientation instead of household orientation
2. Political interference in management leading to ineffective decentralisation of WMD
3. Accumulation of roles by the District Assembly: KMA is owner, provider, regulator, financial manager and decision maker for sanitation services
4. Low autonomy of WMD the organisation responsible for service provision

5. No powerful regulatory body: action is collaboration-oriented, which makes effective regulation difficult
6. Low cost recovery for the treatment system (FSTP)
7. Political reluctance to charge the right cost for FS services
8. No trigger for waste reuse in agriculture
9. Farmers are not among direct stakeholders
10. No information system for better FSM planning: the FSM-IS is limited to counting truck trips at the FSTP, and there is no information collected about where the waste comes from (type of toilets facilities, areas, etc...).

### A way forward

To make FSM operate in line with ecosan principles in Kumasi, more need to be done as regards to the financial and institutional situation. Starting from the FSTP, the current system needs to be extended to introduce facilities for biosolid production to transform FS into compost ready to be used in agriculture. The existing combined site Dompouse site for faecal sludge and solid waste, offers a good opportunity for integrated-FSM in the city. A composting plant of both FS and SW can be effective, based on the current co-composting pilot plant managed conjointly by SANDEC<sup>21</sup> and IWMI at Buobai, the former FS discharge site for Kumasi. Obviously, the FSTP cost will increase, but farmers will be an extra source of revenue, even if the sums they pay do not cover the extra costs of compost production.

#### *Effective decentralization; clearer roles*

A SWOT analysis carried out in 2004 (Drechsel et al., 2004) shows good potential for WMD to run waste management services: its strengths were its potential knowledge and its database on waste management. However, lack of autonomy hampers effective accountability, through lack of clear WMD performance targets. The department needs to be assigned full responsibility, and clear roles need to be assigned to every stakeholder. The role of KMA must be limited to protecting the community interest and facilitating activities without interfering in WMD activities.

The EPA must fully and independently play its regulatory role without interference from other stakeholders, especially with regard to environment protection issues.

A stakeholder platform composed of EPA, KMA, community members, collection companies and WMD must be established to deal with tariff regulation and to set performance targets for WMD, leading to better participation in FSM for the city and greater transparency.

WMD roles must be more oriented to contract monitoring (technical and financial), FS information Management for better planning, and building new facilities to increase access to sanitation. The department must be given full autonomy, especially financial autonomy

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<sup>21</sup> SANitation for DEveloping Countries: Research Organisation based in Switzerland.

for better internal organisation and management. Clear performances targets must be set to hold the department accountable for results.

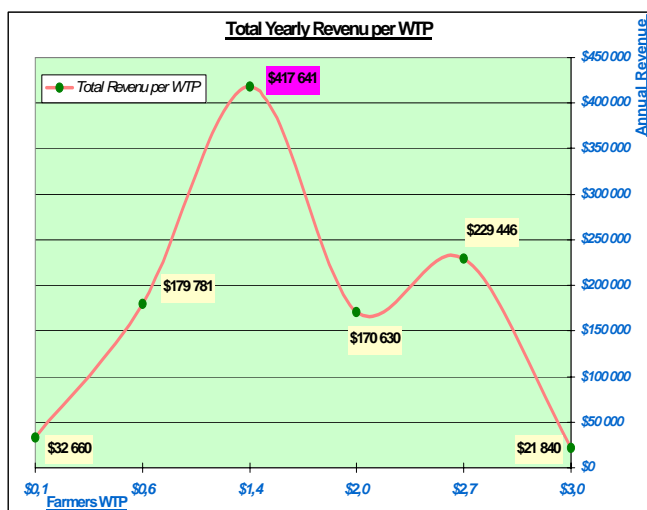
*Farmers' orientation as the way to an Integrated-FSM*

Institutionally, farmers need to be associated as direct stakeholders along with the Ministry Of Food and Agriculture (MOFA) and Research Institutes like IMWI and SANDEC. There is already a huge use of poultry manure by farmers in Kumasi, which means that it will not be easy to convert them to using biosolids from faecal sludge, especially since poultry manure is free and has a rapid (but not sustainable) effect. However a previous study carried out by IWMI, showed some potential for FS compost use in agriculture. The results of previous study on Kumasi' farmers willingness to pay (WTP) for FS compost is presented in Table 4.

**Table 4. Farmers Willing To Pay for compost. Source: (Cofie, 2003)**

Potential Clients	Estimated number of farming households and around the city (total)	Average farm size per farmer (ha)	Number of farmers willing to pay (extrapolated from sample size)	Average WTP (US\$)	Qty/ year in 50kg bags per farming household	Tota theoretical demand of compost in tons per year
Vegetable (urban)	200	0,1	126	0,1	214	1348,2
Vegetable (peri-urban)	280	0,8	260	3	28	364
Staple crops (urban)	115	0,2	67	2	5	16,75
Staple crops (peri-urban)	15000	0,8	5550	2,7	14	3885
Urban backyards	85000	0,04	71000	1,4	3	10650
Urban ornamentals	50	0,04	40	0,6	33	66
<b>Total</b>	<b>100645</b>		<b>77043</b>	<b>9,8</b>	<b>297</b>	<b>16329,95</b>

From this study, we estimate in Figure 11, the highest revenue that could come from farmers and the corresponding demand for compost.



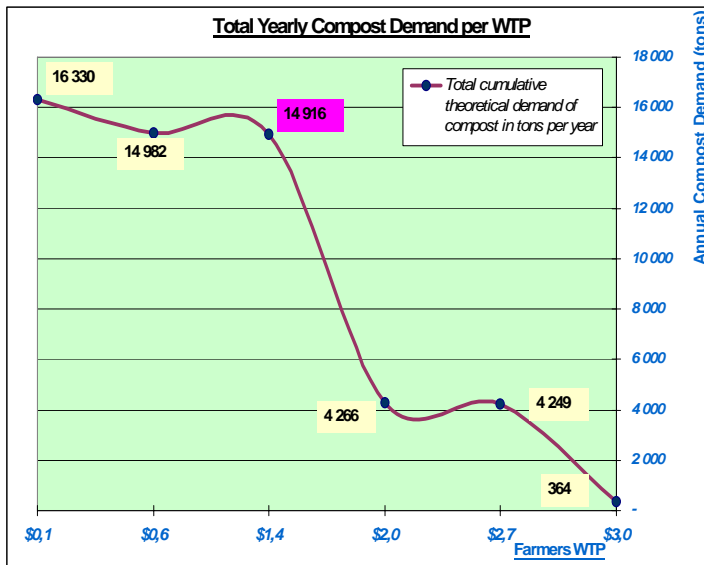


Figure 11. Yearly revenue from farmers and compost demand as function

At a WTP of US\$1.4, a maximum revenue of US\$ 417,641 can be expected from farmers corresponding to an annual demand for 14,916 tons of compost. Transport costs for delivering compost to farmers and extra capital and running costs at the treatment plant must be evaluated and balanced with this revenue. However, expecting the farmers to achieve full cost recovery is not reasonable, since FS reuse in agriculture provides indirect benefits such as food security, agricultural soil recovery and land saving by avoiding the need for so much landfill. The main point is that associating farmers as potential stakeholders in FSM and winning them over to view this as a positive service, will not be a heavy cost to the system but will rather build a reliable source of revenue.

#### *Household orientation is the way to sustainable-FSM*

Households are currently the only beneficiaries of the sanitation services. Unfortunately they do not consider the services as important as electricity or water services. A strategy needs to be developed to make them pay what they are able, rather than what they are willing to pay. Due to different income levels in the population, different tariffs must be set with cross-subsidies, using capacity to pay (CTP) to define the appropriate tariff for each income area.



**Table 5. Population, households, homes and income 2004 estimates for Kumasi city. Actualised from 1996 statistical data. Initial data from (GoG/MoLGRD, 1996)**

Areas (Suburbs) covered	CLASS	1996					2004				
		Population	Number of HH	Number of Houses	Av. monthly head of HH income (c. 000's)	Av. monthly HH income (c. 000's)	Population estimated	Number of HH	Number of Houses	Av. monthly head of HH income (c. 000's)	Av. monthly HH income (c. 000's)
Central Market CBD)	M	11,328	2,266	378	225	330	25,890	5,178	863	1,634	2,397
Adum (CBD)	M	13,675	2,735	456	250	325	31,254	6,251	1,042	1,816	2,361
Bompata (CBD)	M	9,685	1,937	323	195	240	22,135	4,427	738	1,416	1,743
Cultural Centre, Doctors' Flats, Zoo (CBD)	H	3,425	856	856	155	290	7,828	1,957	1,957	1,126	2,107
4 Battalion, Kmfo Anokye Hospital	M	17,500	3,500	583	183	258	39,996	7,999	1,333	1,329	1,874
Kwadaso Estates	H	7,950	1,988	1,988	305	450	18,170	4,542	4,542	2,215	3,269
Bantama	M	45,168	9,034	1,506	235	300	103,231	20,646	3,441	1,707	2,179
Ashanti New Town	M	36,491	7,298	1,216	85	180	83,400	16,680	2,780	617	1,308
Akwatia Line	L	25,779	4,297	358	155	220	58,918	9,820	818	1,126	1,598
New Amakom, Asokwa	H	19,131	4,783	4,783	305	510	43,724	10,931	10,931	2,215	3,705
Ridge, Danyame	H	11,342	2,836	2,836	413	568	25,922	6,481	6,481	3,000	4,126
Angola	L	61,248	10,208	851	355	490	139,982	23,330	1,944	2,579	3,559
Asawasi, Aboabo	L	33,919	5,653	471	75	190	77,522	12,920	1,077	545	1,380
Dichemso, Krolofrom	M	94,248	18,850	3,142	115	210	215,404	43,081	7,180	835	1,525
Bomso, Sisanso	L	5,829	972	81	300	392	13,322	2,220	185	2,179	2,847
Ayigya West	L	6,478	1,080	90	260	345	14,805	2,468	206	1,889	2,506
Old Ayigya	L	17,010	2,835	236	242	325	38,876	6,479	540	1,758	2,361
Akrom	L	26,572	4,429	369	85	210	60,730	10,122	843	617	1,525
Asokore Mampong	L	9,008	1,501	125	155	210	20,588	3,431	286	1,126	1,525
Moshie Zongo, Sepe	L	16,700	2,783	232	59	125	38,168	6,361	530	429	908
Buokrom Estates	M	9,056	1,811	302	158	258	20,697	4,139	690	1,148	1,874
Ahinsan Estate	M	5,821	1,164	194	180	285	13,304	2,661	443	1,308	2,070
Adiebeba	H	10,449	2,612	2,612	65	220	23,881	5,970	5,970	472	1,598
Chirapatre, Chirapatre Estates	M	6,560	1,312	219	110	165	14,993	2,999	500	799	1,199
Nhyiaso, Ahodwo	H	8,526	2,132	2,132	300	465	19,486	4,872	4,872	2,179	3,378
Fankyenebra Santasi	M	8,680	1,736	289	275	530	19,838	3,968	661	1,998	3,850
Kwadaso	M	10,508	2,102	350	265	310	24,016	4,803	801	1,925	2,252
Kwadaso extension, Asuoyebo, Brigade, f	M	7,863	1,573	262	185	350	17,971	3,594	599	1,344	2,542
Suame, Abrepo, Anumanye, Maakro	L	25,034	4,172	348	195	280	57,215	9,536	795	1,416	2,034
Old Tafo	L	64,225	10,704	892	255	290	146,786	24,464	2,039	1,852	2,107
UST	H	7,428	1,857	1,857	231	282	16,977	4,244	4,244	1,678	2,048
Boadi	L	5,960	993	83	105	310	13,622	2,270	189	763	2,252
Kentinkrono, Nsenie, Oduom	L	3,200	533	44	145	260	7,314	1,219	102	1,053	1,889
Asuoyebo SSSNIT Flats	H	2,850	713	713	388	538	6,514	1,628	1,628	2,818	3,908
total		648,646					1,482,480				
Ridge, Danyame					413					3000	
Income Coefficient							7.263922518				

A quick estimate of the potential revenue from households has been made, in order to ascertain the potential of a capacity to pay (CPT) approach for cost recovery,. The estimate was detailed enough to include all the city suburbs, the updated number of households in each suburb and their income levels. The statistical data presented in Table 5 is updated from 1996 data found in (GoG/MoLGRD, 1996).

By dividing the updated data into quintiles, and then into income classes the total potential revenue from the households has been estimated at US\$ 321,175 based on the assumed CPTs for a service with 100% coverage. With the actual collection service coverage of 34%, the potential revenue from households is US\$ 109,200.

This would raise US\$ 49,539 for capital expenditure and profit for the FSTP in the current situation. This is a huge amount, about 5 times more than the current running costs (500% cost recovery).

In practice, the issue is how to convert this nice theoretical approach into a practical fee to be paid after the latrine emptying service has been completed. Income is strongly dependent on the frequency with which pits fill up and need emptying and the volume of the toilet pit. There is also a question about the effectiveness of the collection of the theoretical CTP, mainly in poor areas, where households earn and expend their money on daily basis. CTP is calculated monthly but poor households will not be able to pay a huge emptying fee derived from this monthly CTP. It raises the question of whether a micro-finance system is needed to spread the cost of the emptying service.

The final and main issue is how to collect the extra money (the difference between CTP and current expenditure) in a system where households do not benefit directly from the FSTP services. Will collection companies accept to reverse a big part of the money collected from HH at the discharge site? Like would like the new financial flow showed in Figure, how can households pay the two-parts money? The issue here is that households are paying less than their CTP for the sanitation service. And this current payment is done via the collection companies.

In the case where households are paying their CTP, the difference of money (extra money) needs to go to Faecal Sludge Treatment Plant (FSTP) for its cost recovery. Unfortunately, households do not benefit directly from the FSTP services. So it will be difficult to pay this important extra money at the FSTP.

The derived questions are:

- If households accept to all the CTP to the collection companies, will these latter accept to pay back (reverse) the extra money to the FSTP?
- If not, how to practically make households pay the two-part money (one to the collection company and the other to the FSTP) shown in figure 13?

A lot of questions still need to be answered to make implementation of this new CTP-approach effective. But when these questions find answers, the city's waste management could be done without any external financial support. Instead external financial aid could be used for public awareness and capacity building.

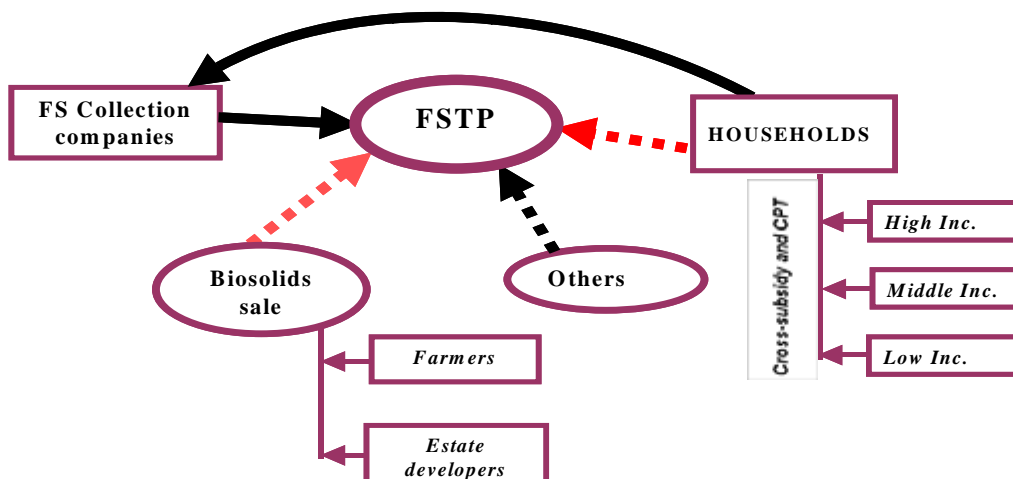


Figure 12. New money flow could point the way to better financial sustainability for FSM in Kumasi

### Conclusion

The approach developed in the study must be used as a new tool by decision makers to deal with sanitation issues if sustainability is their target. Any new system must not only focus on technologies but also on stakeholder capacity to manage it and to pay for the services. We can no longer fall in into the trap of choosing a high-tech system which performs well at the beginning, but becomes a financially heavy burden some years later and has to be got rid of.

The CPT approach used to address faecal sludge management financial issues, must be taken as a model, with institutional arrangements for its effective implementation, and strong incentives or other motivation for stakeholders to play their financial roles. The final point of the treated FS reuse in agriculture is an essential element for decision making in waste management in West Africa, where food security need to be assured through agricultural soil recovery.

In the case of Kumasi, where an orientation towards farmers and households could contribute towards sustainable FSM, a lot of questions need to be answered before this approach can be effective implemented. These questions will quickly find their answers if there is a strong political will to give waste management services equal status with water and electricity services.

This new approach could be the beginning of a long struggle for sustainable waste management in the developing world.

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## 4. Study on the use of human excreta in Bangladesh

Avizit Reaz Quazi

### Introduction

Bangladesh has made significant gains in latrine coverage over the last 15 years<sup>22</sup> but has not paid sufficient attention to the management of environmental sanitation – including the treatment and reuse of human excreta, solid waste and wastewater.

Bangladesh produces 17 million metric tons of human faeces and 57 million metric tons of urine each year.<sup>23</sup> The major portion of these excreta is deposited into water bodies and open places, so polluting water sources, groundwater and the general environment. As a result, a large number of people in Bangladesh suffer sanitation-related and water-borne diseases and other health problems caused by poor sanitation practices. The Progotir Pathay Report for 2003 indicates that 25% children of the age below five suffer from diarrhoea<sup>24</sup> and while an earlier report<sup>25</sup> shows that in 1996 about 110,000 children died of diseases caused by poor sanitation and contaminated water use.

The proper management and reuse of human excreta (human faeces and urine) would not only improve environmental conditions

#### Benefits of reusing excreta

##### *Fertilizer potential of a family of 5 adults*

Excreta are valued because of their nutrient content and their potential to condition soil and build humus. Based on a daily excreta production of 110g/person a family of 5 adults theoretically produces enough excreta to provide adequate nitrogen and phosphorus to cultivate a rice plot ranging between 40X40 m and 40X50 m in size.

(Strauss, 2002, p-22)

##### *Use of excreta for aquaculture*

Fish cultured in excreta reuse systems are of high quality and are equal or even superior in taste and odour to fish cultivated in other ways. Fish cultured in ponds manured in this way produce a high-protein natural food which is much leaner - only 6% fat compared to fish raised on high-protein feed pellets (15% fat) and grain (20% fat).

(Peter Edwards, 1992, p-272)

##### *Potential of biogas from human waste in Bangladesh*

<i>Feed materials</i>	<i>Total population (x10<sup>7</sup> nos)</i>	<i>Waste disposal rate (kg/head/day)</i>	<i>Gas production rate (m<sup>3</sup>/kg)</i>	<i>Amount of Gas (x10<sup>6</sup>, m<sup>3</sup>/day)</i>
<i>Human excreta</i>	11.50	0.40	0.07	3.22
<i>Cattle dung</i>	2.42	11.50	0.03	8.35
<i>Poultry manure</i>	13.79	0.18	0.06	1.49

*Source: MH Rahman, MA Mottalin and MH Bhuiyan, "A study on Biogas technology in Bangladesh, 22 WEDC Conference, 1996, New Delhi, p-340*

<sup>22</sup> In 1990 coverage was 21%, in 1995 it was 48% and in 2003 it was 53.2. (UNICEF & BBS, "Progotir Pathay 2003," December 2004, Dhaka, see p-21.) In 2005 latrine coverage is 67% (Speech of Chief guest, Mr. Abdul Mannan, Minister, Ministry of Local Government, Rural development and Cooperatives, Government of Bangladesh; International Symposium on Environmental Sustainability, BUET, 7 February 2006.)

<sup>23</sup> The Bangladesh Observer 15.05.04

<sup>24</sup> UNICEF & BBS, "Progotir Pathay 2003," December 2004, Dhaka

<sup>25</sup> UNICEF & BBS, "Progotir Pathay 2000," December 2000, Dhaka

in human settlements, but also promote economic and social well-being and the health of the population.

Human excreta can be safely used for generating energy and as fertilizer for agriculture and aquaculture. Safe reuse would make a significant contribution to preventing environmental degradation, eradicating poverty and developing rural areas of Bangladesh.

There is a lack of access to conventional fuels (gas, oil and coal) in rural areas of Bangladesh. In Bangladesh as a whole, 40 million tons a year of biomass, about 62% of the total national energy requirement is used as a source of energy each year, particularly, firewood, agricultural residues, leaves, cattle dung, straw and rice husks.<sup>26</sup>

In rural areas, 83% of households depend on biomass fuel for cooking.<sup>27</sup> To avoid spending half their household income on fuel, women spend long periods in gathering low grade biomass fuels from agricultural and animal residues.

The use of biomass as fuel causes environmental degradation to an alarming degree. For example, the quality of the soil is severely affected by a decrease in microbial population and fertility. For a productive harvest, soil must contain at least 3% organic compounds, but this has been reduced to less than 1% due to the extraction of low grade biomass. To improve the efficiency of agricultural production, farmers are using increased doses of chemical fertilizer. This situation is not sustainable. Cutting trees to meet fuel requirements leads to further environmental degradation and forest areas have been reduced to less than 9% of land area in Bangladesh. The use of lower grade biomass fuel by the rural poor also exposes women to smoke that can cause acute respiratory infections, chronic obstructive lung diseases, lung cancer, and eye problems, as well as causing them to have low birth weight babies.<sup>28</sup> Given this background, the use of human and animal excreta could be an alternative source of energy and fertilizer and would greatly contribute to solving these problems.

Use of human excreta using safe environmental sanitation approaches would not only improve the health of the people, but also bring greater access to safe drinking water and sanitation, alleviate poverty, improve the rural economy, relieve women from physical labour and safeguard the environment.

It is imperative to follow scientific procedures as human excreta contain pathogens such as bacteria, viruses, protozoa, and the helminths, which may cause serious health problems if the excreta are not properly treated.

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<sup>26</sup> Kazi Aktarujjaman, "The Urgency of Application of Biogas Technology: Bangladesh Perspective," Bangladesh Renewable Energy Newsletter, vol.1 No-2. Bols 2 & 3 July 200 December, 2002

<sup>27</sup> Wahidul K Biswas, 'Bangladesh's Energy sector: The past, present, and future of renewable energy technologies, p-2

<sup>28</sup> ibid

### **Health Risk related to reuse of Human excreta:**

#### *Agriculture:*

The main health risks for workers who use excreta related waste for fertilization or irrigation are faecal-oral infections and soil-transmitted helminths. Where workers come into contact with contaminated surface water, schistosomiasis could also be a problem. Consumers of crops are at risk of faecal-oral infections and ingested soil-transmitted helminths. (Eric Rottier & Margaret Ince, 2003 p-85)

The health risks of using untreated excreta-related wastes for fertilizer can be reduced by minimising the contact between crops and pollution as much as possible (e.g. through subsurface irrigation). Excreta-related waste should only be applied before the crops are planted or up to one month before the crops are harvested.

#### *Aquaculture:*

Non-bacterial faecal-oral infections, bacterial faecal-oral infections, water-based helminths, and excreta-related insect vectors categories need to be considered as potential sources of infection in excreta-fed aquaculture systems. Intestinal bacteria and viruses of warm-blooded animals do not cause diseases in fish but they may be passively transferred to humans by fish raised in excreta-fed systems. Water-based helminths parasitic to humans may be transmitted by fish acting as intermediate hosts, for worms such as liver flukes. Schistosomiasis, a disease caused by the water-based helminth *Schistosoma* has a snail intermediate host, and may also be spread through excreta-fed ponds. There does not appear to be much risk of insect vectors breeding in well-managed excreta-fed ponds. (Peter Edwards, 1992, p-268)

Avoiding the use of fresh excreta for aquaculture, eating well-cooked fish, snail control, and depuration (by keeping fish in clean water for a period prior to harvest) reduces these health risks.

#### *Biogas:*

Handling excreta and regularly removing sludge from a biogas plant could be a health risk. The sludge could be heavily contaminated with pathogens and should be handled and disposed with the same care as fresh excreta. (Eric Rottier & Margaret Ince, 2003 p-86)

## Literature Review

To gain an understanding about the practices related to reuse of human excreta in Bangladesh, a study was carried out between February and August 2005. Before empirical observation began, a literature review found only scanty documentation about the reuse of human excreta in Bangladesh. The few available documents are mainly about biogas plant development during specific agency projects.



### *Current practices*

A survey in the late 1980s reported on unintentional excreta reuse in Bangladesh. Latrines in ditches behind houses remained almost dry in the summer but filled with flood water during the monsoon. Fish that entered the ditches with the floodwater benefited from the eutrophic water and night soil from the latrines. Fish were harvested towards the end of the monsoon season when the water level had dropped. Consumers were generally reluctant to accept fish harvested in ditches, but were unaware of the origin of such fish when the product was bought in the market.<sup>29</sup> In the last few years, national newspapers in Bangladesh have reported on intentional fish farming, using sewage water, including large-scale fish cultivation in the lagoon of the sewage treatment plant in Dhaka.<sup>30</sup> A recent city survey on wastewater irrigation also reported on this practice.<sup>31</sup>

### *Religious issues*

Some literature has highlighted difficulties related to the reuse of excreta in Muslim society. They argued that the Islamic culture professes the avoidance of all contact with human excreta which, along with semen, corpses and other specified substances, are regarded as spiritual pollutants. Quranic edict and Islamic custom demands that Muslims minimise contact with these substances<sup>32</sup>. It was also reported that people of Bangladesh, who are predominately Muslims, are reluctant to accept fish harvested from ditches fertilized with excreta. However, it was also quoted that the reuse of treated sewage effluent seems to be perfectly legitimate from the Islamic points of view. The Eminent Scholars of Saudi Arabia expressed unanimous approval of reuse of treated wastewater effluents for all purposes including religious washing.<sup>33</sup>

Reluctance on the part of the people of Bangladesh to reuse human excreta was also mentioned in a study in 2002. According to this document, people kept silent when the possibility of reuse of human excreta was discussed but evinced discomfort through their gestures. Many respondents strongly opposed the whole idea. Even those who had a two-pit latrine showed reservations and argued that they were not using two-pits latrine for composting but to increase the longevity of the latrine. Only a small number of respondents, and with some hesitation, said that human excreta can be used as manure if it can be assured that composting is complete.<sup>34</sup> However, this hesitation is not universal. An earlier study provides a different picture, with the majority of respondents in favour of using human excreta as manure.<sup>35</sup>

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<sup>29</sup> Peter Edwards, "Reuse of Human Wastes in Aquaculture: A technical Report," UNDP-WB-ASP, USA, 1992, p-7

<sup>30</sup> Prothom Alo, 09.02.2002 & Editorial on 29.09.2003

<sup>31</sup> Dr Avizit Reaz Quazi, "Wastewater Irrigation in Dhaka," Unpublished, 2005

<sup>32</sup> Martin Strauss, opcit, p-11

<sup>33</sup> Peter Edwards, opcit, p-274

<sup>34</sup> Quazi Avizit reaz, "Impediments Towards sanitary Latrine Coverage: The case of Rural Bangladesh, NGO Forum for DWSS, Dhaka, 2003

<sup>35</sup> DPHE-UNICEF and VHSS, "Women in the context of Sanitation, Water Supply and Hygiene: A village based study," Dhaka (unpublished), 1995, p-60

The practice of reusing human excreta for agriculture has not been found in the literature although use of wastewater for irrigation is clearly mentioned.

#### *Wastewater in agriculture*

Recent city surveys<sup>36</sup> in Rajshahi and Dhaka revealed the use of drainage water in peri-urban areas for irrigation. The survey indicated that approximately 145 and 550 hectares of land are irrigated by untreated waste water in the peri-urban areas of Dhaka and Rajshahi respectively. The most common agricultural products grown on waste water are cauliflower, Lao (bottle gourd), sweet pumpkin, Pauishak (Indian spinach), Palongshak (spinach), Dantashak (amaranths) potato, tomato, pulse, oil seeds, wheat, paddy, and sugarcane. The survey also found that for several years diluted wastewater was used in nine lagoon/ponds in Pagla sewerage treatment plant (each pond 10002 ft) for aquaculture. Annual production was 562.5 tons of fish. But since early 2003, the Government of Bangladesh imposed a ban on aquaculture in such lagoons. Some aquaculture is still illegally practised there on a very limited scale. Production is now 18.75 tons per year, some 3% of the past production. The survey also revealed that customers are not generally comfortable with the idea of wastewater irrigated products. However, it was observed that they purchased these products from the market when they were not aware of the origin or the method of cultivation. The same survey also indicated that farmers practising wastewater irrigation consume their own products<sup>37</sup>. The use of wastewater is also supported by some NGOs, e.g. the NGO Prisam is involved in the cultivation of duckweed to feed fish.<sup>38</sup>

#### *Low cost technology*

Practices related to the reuse of human and animal excreta for biogas production in Bangladesh as a renewable energy source are reported in several documents available on the web pages of project initiatives taken by the Local Government Engineering Department (LGED) of the Bangladesh Council for Science and Industrial Research (BCSIR).<sup>39</sup>

The first biogas plant was built in 1972 by the Bangladesh Agriculture University (BAU). The first biogas plant based on night soil was constructed at Faridpur Muslim Mission in the early 1990s by LGED.

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<sup>36</sup> Dr Avizit Reaz Quazi, "Wastewater Irrigation in Rajshahi," Unpublished, 2005

<sup>37</sup> Dr Avizit Reaz Quazi, "Wastewater Irrigation in Rajshahi," Unpublished, 2005

<sup>38</sup> Paul Skillicorn, William Spira and William Journey, "Duckweed Aquaculture; A New Aquatic Farming System For Developing Countries," The World Bank Emena Technical Department, Agriculture Division , <http://www.p2pays.org/ref/09/08875.htm>

<sup>39</sup> Bio Energy Development, <http://www.lged.org/sre/bio-energy.htm> ; BCSIR, opcit also see, M. Halibut Rahman, Reuse of human and animal wastes in Bangladesh, 24<sup>th</sup> WEDC conference, Islamabad, 1998

Since the mid 1990s, initiatives have been undertaken by various organisations particularly by LGED and BCSIR which, are reported to have installed more than 20,000 biogas plants in the country. Most biogas plants use cow dung, with only a few using human excreta.

It is noteworthy that LGED has successfully constructed human excreta based biogas plants in number of religious institutions that involved Madrasash, Islamic missions, orphanages and mosques. One of the aims was to test whether reusing human excreta in the Islamic culture is feasible.

The literature review also indicated that a considerable percentage of biogas plants are not functioning due to design, construction and maintenance problems.<sup>40</sup>

Objectives of this study

Based on the literature review, a field study was undertaken with the purpose of:

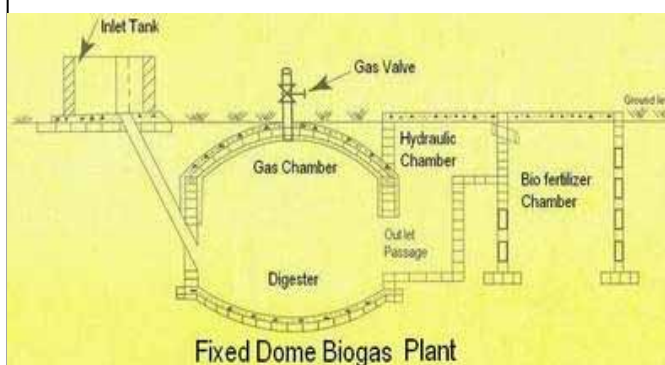
- understanding more about the reuse of human excreta and other organic waste in Bangladesh
- determining ways, processes and objectives for the reuse of human excreta in rural Bangladesh
- assessing the extent to which reusing human excreta meets the requirements for environmental sanitation.

#### Basic design of the biogas technology promoted by Government agencies

The first biogas plants introduced in Bangladesh were the floating dome Indian type plants. Later these were replaced by fixed dome Chinese-type plants. Currently, the majority of plants are fixed dome household based biogas plant.

Current fixed biogas plants have an underground cylindrical shaped biogas digester constructed with brick walls and concrete. The inlet connections/digester tanks vary with the nature of the raw materials. The digester is also connected to an outlet tank, which includes a hydraulic chamber, and a bio-fertilizer pit. The size of the plant depends on the availability of raw materials and the demand for gas. It maintains constant volume, with changing pressure. When the rate of gas production is higher than that of consumption pressure inside the digester rises and expels some digester contents into the outlet compartment. When consumption is higher than production, pressure inside the digester falls and expelled material in the outlet compartment runs back to the digester.

Biogas technology employs anaerobic digestion, based on the natural breakdown of organic materials under bacteriological attack in the absence of oxygen, producing a combustible gas mixture with up to 70% methane.



BCSIR Design

Source: BCSIR, *Biogas technology (Brochure in Bangla), Biogas Pilot Plant-2<sup>nd</sup> phase, Dhaka*

<sup>40</sup> M. H. Rahman, M. A Mottalib & M. H. Bhuiyan, "A Study on Biogas Technology in Bangladesh," 22 WEDC Conference, New Delhi, 1996, p-340.

## Methodology of collecting data at field level

Structured interviews were conducted by telephone with (i) the 14 NGO Forum Regional Managers who cover almost the entire country, (ii) staff members of national and international agencies engaged in water and sanitation activities, and (iii) consultants directly involved in water and sanitation program.

These interviews did not provide adequate information about the use of 'saturated' latrine pits and human waste for agriculture.<sup>41</sup> However, the study included a few group discussions with local NGOs who are partners of the NGO Forum. They provided information about the reuse of human excreta in agriculture as well as the use of saturated pits to grow plants, and identified a few places where such practices take place.

Based on these interviews and group discussions, three study districts were chosen: Bagerhat, Rajshahi and Faridpur. In total, 18 individual examples where human excreta were reused were studied:

- 6 households where users grew plants on saturated latrine pits (Doiboyga Kathi, Joka, and Nurullahpur villages of Morrelganj Upazila sub-district and Paschim Khada village of Sharankholan Upazila in Bagerhat district)
- 4 households where compost containing human excreta was used in the production of vegetables, fruits, nuts and trees (Haldhibunia and Malgazi villages of Mongla Upazila in Bagerhat district and in Bil Mahmudpur village of Sadar Upazila in Faridpur district)
- 8 cases where biogas plants were used; (in Dhopagata village of Mohanpur Upazila and Rakkhitpara village of Baghmara Upazila in Rajshahi district)

The field study area was restricted by time and financial constraints. Empirical observations in the selected sample areas were carried out between February and August 2005. The basic observation techniques were in-depth interviews, key informant interviews, transact-walks and direct observation of the reuse system, ways and outcomes. Key research instruments were interviews, check lists, audio and visual documentation. Informants included users of human excreta, senior staff members of institutions working with water and sanitation, social elites, engineers who constructed systems and were responsible for its monitoring and maintenance, and caretakers.

## Field Findings

Out of 6 villages (in 4 Upazilas) 4 villages (Doibogya Kathi, Joka, and Nurullahpur under Doibogya Kathi union of Morrellganj Upazila and Paschim Khada village of Randha union of Sharankhola Upazila) use 'saturated pits' for the production of plants. Nine households in these villages have been using saturated pits for the production of plants in a planned way.

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<sup>41</sup> Saturated in this context means that the latrine is full and no longer used.

### Using latrine pits for plant production



In Paschim Khada, Sayeedur Rahman Akkon, a Muslim and a primary school teacher, constructed a pit latrine in mid 1980 which was saturated in early 1990. Mr Akkon covered the saturated pit with soil and kept it for a year. In 1992, he sowed two 'Molibansh' bamboo saplings which are thin and short. After a few years, a bamboo bush developed 10 to 15 feet high and about 2 inches in diameter. From this bush he collected at least one hundred bamboo poles, which he sold for taka 30 each. He had cultivated a similar bamboo on land without using any type of fertilizer and found that the bamboo grown on the latrine pit were thicker in size and that the bush grew better than the bamboo bush cultivated on plain land. He arrived at the conclusion that plants grown on saturated pits produce better results.

In the Joka village of Doibogya Kathi union of Morrellganj Upazila, Asken Sheikh, a Muslim and a shrimp cultivator, constructed a latrine in 1999 that was saturated and sealed with soil by 2003. He constructed another latrine in close proximity. After a year he sowed a coconut sapling on the saturated pit as he had heard that this would produce more coconuts than a coconut tree planted on plain land.



In the Joka village, Yunus Ali, a Muslim and a peasant who is also engaged in a small business with Golpata (a type of mangrove) and bamboo, constructed a latrine in 2000 which was saturated in 2003, sealed with soil and kept for six months. He sowed a betel leaf sapling in mid 2004 and in mid 2005 deposited mango seeds on the sealed pit. The betel leaf tree is growing and three mango saplings are visible on the saturated pit surface. He used this saturated pit for growing plants because he had heard that plants grown on such pits develop better. He also disposes of organic household waste into a hole for later use as fertilizer.



Also in Joka village, is Shujid Kumar Biwas, a Hindu who is an agricultural labourer. He works with betel nut trees, removing the bark to collect the juice. His family constructed a ring pit latrine in 1998 which was saturated in 2002 and sealed with soil. After a few months, he sowed a coconut sapling. Another pit latrine was saturated in 2000 and was sealed with soil.

After nearly a year, family members sowed betel nut sapling and a chambal tree sapling. These saplings have been growing for four years. He and his family did this because they had been told by his grand father, Mahendro Nath pal, that latrine pits are good for growing plants.



In Nurullahpur village, under Doibogya Kathi union of Morrellganj Upazila, Abdul Salam Sheikh, a Muslim and a peasant constructed a pit latrine in 2000, which was saturated in 2004. He sealed it with soil and, after four months, sowed roots of Mitya Alo or Gouz Alo, a very special kind vegetable where the bulky root grows in the soil, while thin, long creepers grow on top on which small roots appear. The life of these root plants is about three years. Roots in the soil and small roots on the creepers are cooked and eaten.

He planted this on the saturated pit as he had learned from a television programme, 'Mati O Manus', (land and human), that saturated pits are good for vegetable production. The root has grown for six months on the surface and became matured to produce small roots on its creepers. However, family members have expressed strong opposition to using plant products grown on the pit and warned him that they will not eat it. Mr Salam, had decided to sell the entire product at market where he expects that it will provide him with a profit of taka 500 each year.

In Doibogya Kathi village, Kalam Sheikh, a Muslim and an agriculture labourer sealed their pit latrine in 2003 after the pit became saturated. After a few months, he sowed bamboo saplings on the saturated pit. It has been growing for the last one and a half years. He did this because he heard that saturated pits are very effective for growing plants. His father's brother, Hatyem Sheikh, an agricultural labourer, had constructed a latrine in 1997 that was saturated in early 2000 and sealed with soil. After a few months a coconut sapling was placed there and has been growing for the last five years.



Four main reasons were given for using saturated pits.

1. Empirical experience—it was reported that the saturated pits are more efficient than chemical fertilizers as the latrine pit fertilizer lasts for a longer period of time, measured by the quality and quantity of crop.
2. Information from neighbours—they tell them that saturated pits produce healthier plants and a greater yield.
3. Television programmes—show the effectiveness of latrine pit fertilizer.
4. Indigenous knowledge—ancestors believed that latrine pits provide better fertilizer and this belief is transferred from one generation to the next.

Plants sown on saturated pits include coconut, betel nut, bamboo, mangos, chambal (tree) and mitha alo or guz alo vegetables.

As well as the use of saturated pits it was also found that human excreta is used as a fertilizer in two villages, Haldhi Bunia of Chila Union and Malgazi of Chandpai Union under Mongla Upazila.

#### **The use of human excreta in cultivation**

Mr. Mohammad Abu Siddique, a Muslim and a labourer from Mongla Harbour owns some land within his homestead which he uses for cultivating different vegetables (brinjal, green chillies, 'dantashak' (amaranths), lemon); fruits, (papaya, guava, banana, pomegranate, mango, jackfruit), 'safeda ('sapota), jam (a blackberry like fruit), nuts (dates, peanuts, coconuts, betel nuts), and trees (Kaorah and Shundari).

As fertilizer, he uses compost which contains 10% human waste, organic solid waste and poultry manure. He collects human faeces from his latrine that is used by his family member and mixes it with other organic waste to produce the compost. Initially, he dug a hole 2 feet deep, and 3 to 4 feet wide. After a year of use, he stop using the latrine for one to one and a half months. After this period he collects all the faecal material with the help of a sweeper and carries it to the hole dug for compost. He keeps the faecal material in this hole for a month and then adds other organic waste consisting of poultry manure, kitchen and garden waste and leaves. All this is mixed and kept in the hole for another one and a half months until it has decomposed. He covers the hole with wood, banana leaves and palm leaves. He estimates that each hole provides him with 40 to 50 kilograms of compost. After digging out the compost from the hole he mixes it into the soil then he plants vegetable seeds and fruit and tree saplings. In August 2005, he used compost for cultivating brinjal, green chillies and danta on three decimals of land (100 decimals = 1 acre) and to sow 20 saplings of guava. When handling compost, he uses plastic boots and gloves that he has from his job as a labourer in a harbour.

He learned about the benefits of such compost from the Agriculture Office at Mongla in 1987. Since 2003 he has been using compost to cultivate his land. Cultivation of these vegetables is at its peak between October and February, but the period is extended for three months for certain vegetables. He gets a satisfactory amount of produce from his field. It is noteworthy that in August, some plants - particularly brinjal - were not of the quality and size he usually obtains during the season, when one brinjal alone weighed 800 grammes. He earns between 10 and 12 thousand taka in one year by selling vegetables cultivated on his land. Brinjal alone has brought him a profit of 4,500 taka. He sowed 32 guava saplings, of which 12 trees produced 200 kilograms of guava, which he and his family ate or he offered to neighbours and visitors. His 16 coconut trees provide him with an income of nearly 10,000 taka a year. His 13 papaya trees give around 20 kg's of fruit which he sells. He observed that banana and papaya production was significantly reduced in the year when floods caused water logging for a long period of time. He believes that using compost in his agricultural production provides 60% higher profits than products grown on chemical fertilizers. He mentioned that his main occupation as a wage labourer at Mongla Harbour is becoming difficult as number of ships entering the harbour is falling and he gets only one duty shift a month which earns him only 450 taka. As a result, he is giving more time to agriculture.

Mr. Siddique indicated that in Satgaria, Malgazi and Haldibunia villages many households used organic compost from any source and almost 100 households used human waste. About a year ago a 'miking' campaign (spreading information by mobile speakers) informed people that using human faeces in food production is hazardous for health, and this resulted in the use of human waste in cultivation being reduced.

### The use of human excreta in cultivation (cont)

The use of human excreta and other organic compost is also practised in Malgazi of Chaddpai union, where three more cases were observed. Kuldeep Mondol and Biprotip Mondol are both Hindu and Maneendra Halder is a Christian. All three produce compost by using a hole to which human excreta is transferred from latrines. Excreta are kept for three months and other organic waste such as poultry manure, cow dung, household and kitchen waste and leaves are added. After decomposition the compost is used on the fields for production of vegetables, fruits, nuts and trees. Amongst the vegetables were found particularly, barbati (a kind of beans), tomato, potatoes, cauliflower, cabbage, 'puin-sak'-green leaves, ladies finger, lou-bottle-gourd. All of farmers are of the opinion that the compost is capable of producing a greater output than the chemical fertilizer and that the products appear healthier and better looking. The experience of Kuldeep Mondol is noteworthy. He said: "Gato bachhar Kritim Shar babohar korey jay fashal payeshilam, A bachhar tar thake adhik fashal payechi jaiboshar babohar kore, A bacchar barboty along Danta hoyeche goto bochhar rer diguin", or "Last year I used chemical fertilizer but this year I got more yield by using compost. This year I have got double the quantity of beans and fibrous vegetables than last year."



Mr Abu Siddique



Mr Kuldeep Mondal



Mr Biprotip Mondol



Mr Maneendra Halder



Pit that is used by Siddique for decomposition



Pit that is used by Biprotip for decomposition



Pit that is used by Maneendra for decomposition

Human excreta and other organic compost are used to produce compost, as shown in the case studies outlined in the box.

The reuse of human excreta is not limited to agriculture but is also used for the production of alternative energy, in particular, biogas. Eight cases have been studied to provide some understanding about its use and purpose.

Biogas plants using human and animal excreta were found in projects undertaken by government institutions. Eight biogas plants were investigated in Mahmudpur village of Sadar Upazila in Faridpur district, Dhopagata village of Mohanpur Upazila and Rakkhitpara village of Baghmara Upazila in Rajshahi District. Two plants linked to community latrines use excreta for biogas production. The energy so generated is used for cooking in a single

household. One community latrine linked to a biogas plant is installed in an Islamic religious institution, where the energy is used to cook meals for orphans. The remaining five biogas plants are for individual households.

The study revealed that the cow dung is the main raw material in biogas plants. Although the 5 household-based biogas plants were each linked to the household latrine, human excreta contribute only 10% of the total raw material, while cow dung provides 90%. Use of cow dung increases as demand for biogas for cooking increases.

In contrast, the three community-based plants use only human excreta for the biogas production. Raw materials for these plants are supplied through an inlet pipe from community latrines to the digesters. An extra inlet tank for adding cow dung was constructed during the installation of the plant, but was later closed, as the plants are currently able to supply enough biogas for cooking without them.

The use of biogas has the great advantage of significantly reducing the cost of household fuel. The fuel cost for households (using cow dung) has come down to less than half of their earlier costs, while households using human excreta are paying an insignificant amount for energy for cooking.

The biogas plant installed at the religious institution is providing enough energy to cook for a quarter of the residents, and so fuel costs have reduced by one fourth.



### Household based biogas plants: A few instances of reuse of human and animal excreta

Gulam Mustafa is a resident of Dhopagata village, Baghshimail union of Mohanpur Upazila in Rajshahi district. He serves at the Agriculture Extension Directorate as a block supervisor, so he had some knowledge of biogas technology. However, it was his nephew, who was involved with a biogas pilot for Bangladesh Council for Science and Industrial Research (BCSIR) as deputy assistant engineer, who encouraged him to install a biogas plant instead of a septic tank for his building which was under construction. Subsequently, in 2003 he installed a household biogas plant for cooking purposes in front of his house, taking the advantage of BCSIR project. The total cost of the plant is 14,000 taka. However, he spent only taka 6,500 himself, with the other 7,500 taka provided under the BCSIR project. The plant occupies one decimal of land that has value of 4,000 taka. The design is similar to the biogas plant design promoted by BCSIR.

The digester is attached to his family latrine through an inlet pipe, taking the excreta of six people. Each week he adds two bags of cow dung (100kg) to the plant through the inlet tank. Cow dung makes up 90% of the raw materials and human excreta the other 10%. As the family does not have any cows they have to purchase cow dung at a cost of 15 taka for 100kg. Previously, the family used to spend 400 to 450 taka per month on kerosene for cooking. Since installing the biogas plant, the household spends only 60 to 80 taka a month only on kerosene.

Ms Jharna, who runs the house, says that she was not comfortable cooking with kerosene as the operation and maintenance of the kerosene oven is difficult. She enjoys cooking with biogas and finds it as good as natural gas. She says that the plant produces enough gas to cook three meals a day for her family of six adults. When guests visit she adds additional cow dung to the digester. To ensure cost effective use of fuel, they use pressure cookers.

They family is Muslim and well educated. Its members feel no hesitation in cooking with biogas produced by human and animal excreta. Before the plant started functioning, Ms. Jharna was not very comfortable with the idea of using biogas for cooking. However, after she began using it, gradually her perceptions started to change. She found no difference between natural gas and the gas from the plant, and there was no smell. Furthermore, the biogas stove was easier to use than the kerosene stove. However, the family expressed the view that an autopilot on the oven would help them to avoid releasing of biogas while lighting the oven. This may be considered as an indicator of their unconscious discomfort about the raw materials.

Other members of the family expressed similar views. They have not encountered any problems, except when waiting for engineers to repair minor problems with the stove. (They have not been given any training in maintenance.)

Observation showed that the plant area was mostly clean. However, the sludge tank was covered with a bamboo mat and sludge was disposed of in very unhygienic way in an open space next to the river. When this was brought to the attention of Mr Mustafa, he said that the problem would disappear as he planned to use this sludge as compost on agriculture land owned by his family. At present a small part of the sludge is used for roof gardening.

In Dhopagata village, this was the only Biogas plant using cow dung as well as human waste. However, in Rakkhithpara village, of Bagmara Upazila four similar plants were found. All four plants were also found to be disposing sludge in an unhygienic manner and polluting the surrounding environment, as the plants installed under the BCSIR project all have a similar design.

In Rakkithpara, of four households, only one is using a small portion of the sludge to fertilize Patol (a kind of vegetable). No tests were carried out on the quality of sludge, and health risks could not be assessed.

It is important to note that all the biogas users are resourceful. Each has a well-structured house made of bricks and concrete and household income ranges between US \$1300 to \$1400 annually. All the families are Muslim, and no complaints were made about the use of human and animal excreta. It is noteworthy that one of the users Abdul Waheed, is a religious teacher, who finds no reason not to use a biogas plant. He has constructed a community toilet for his poorer neighbours and their excreta is collected in the digester of his biogas plant. Like other users, his family also uses a pressure cooker. In both villages, reuse of excreta other than in a biogas plant, was not been observed.



A biogas plant (human and animal excreta based)



Disposal of sludge (unhygienic)



Use of biogas sludge in roof gardening

Observation shows that the residues of the biogas plants are generally managed in an unhygienic way, being disposed of in water bodies and open places. An exception is the religious institution. The Arambag Islamic Trust mixes residues with soil and organic solid wastes and, after 10 to 15 days, uses the resulting product as fertilizer for cultivation. A few users of household-based biogas plants use a small part of their residues on roof gardens and in other cultivation.

It was observed that the households using biogas energy are relatively well off in term of money. The construction of a biogas plant requires 12,000 to 14,000 taka and one decimal of land (100 decimal=1 acre) is needed for the installation of the plant. For this reason, household biogas plants are not feasible for the poor, because of high construction costs and the lack of adequate biodegradable material (human waste; cow dung; chicken manure). Biogas cannot therefore be the sole environmental sanitation solution contributing to poverty alleviation.

**Use of Community latrine for biogas production:**

Mr Abul Kalam, whose relative was involved with a biogas pilot project, constructed two community latrines for the nine neighbouring poorest families in 2004. The 31 members of these families used to practice open defecation on the bank of the river. Now the majority of the members use these toilets.

Mr Kalam also constructed a biogas plant based on BCSIR design there. The inlet tank to add cow dung is sealed off and human excreta is the only raw material used in this plant. Biogas produced from the plant is supplied to his house through 150 feet of gas pipe. His five member family uses a two-burner stove to cook three meals a day. The total cost of the plant was 15,000 taka (US\$250), half of which was contributed by the BCSIR project. The annual income of the family during the construction of the plant was approximately US\$ 1,400.

Now Mr Abul Kalam saves nearly 300-400 taka per month in what he saves on fuel. However, when guests visit or they need to cook extra items, they use their traditional oven, made of mud and fuelled by biomass. His family is using a pressure cooker and they are strictly maintaining this practice as it was. The family is very strict about always using a pressure cooker, and not a traditional uncovered pot.

This family has no problem in using the biogas plant but, like others, would prefer an auto-firing oven over the present one. Users have not received any training about taking care of the plant or using it in a hygienic manner.

During observation, it was found that the outlet pipe disposes of the sludge into the open in a very unhygienic manner and that the community latrines were not clean. The owner said that he uses 640 kg of sludge from the plant each year on their land to improve the soil. During this study, use of the sludge was observed on a betel leaf farm of 2 decimals of land. However, no testing was carried out to determine the quality of the sludge. In Dhopaghata, one other similar plant was observed and the conditions relating to sludge disposal were similar. In Rakkhitpara no biogas plant was found that uses only human excreta.



A community Biogas plant (human excreta based)



Disposal of Sludge (unhygienic mode)



Cultivation of betel leaf using sludge as fertilizer

### Muslim religious institution uses human excreta to generating biogas for cooking and agriculture

In the village of bil Mahmudpur of Aliabad Union in Faridpur Sadar Upazila, no reuse of human excreta was found except for a biogas plant constructed by Arambag Atim Khana, established under Arambag Islami Trusts in 1986, as a home for nearly 200 children, overwhelmingly orphans. Cooking for this large number of children is a difficult task. The institution spent 20,000 to 22,000 taka a month on fuel in the form of 'bushtech', a processed material made of wood dust.

In 1999, LGED encouraged the trust to construct a biogas plant for cooking, taking advantage of the huge amount of human excreta generated in the community latrines at the orphanage. LGED contributed part of the installation costs.

The plant has a 10-inch diameter fixed dome digester. It is connected with the two units of toilets including 6 urinals and 5 lavatories that are regularly used by nearly 200 people, most of them children. The design is nearly the same as that of BCSIR. The cow dung inlet tank is sealed as only human excreta are used in this plant. The biogas is used for cooking but it is not enough to meet the needs of entire orphanage population. However, the biogas is enough to cook for 20 to 25 people, which saves nearly 3,500 taka per month. The trust ensures that there is proper management of human excreta.

Neither users nor cooks had any complaint about using human excreta as source of energy for cooking. Asked whether they feel uncomfortable about having food cooked by the energy generated from human excreta, the children simply responded 'no'. The caretaker, Mr Tariquzzaman, and the cooks said that they had not experienced any operational difficulties and that no major repairs had been needed. It was observed that the plant area was very clean, that sludge disposal was done in a very hygienic manner and that the sludge point was covered. A female staff member is paid to collect sludge from the plant and dispose of it into a hole with other solid organic waste such as leaves and kitchen waste. After 10 to 15 days this compost along with TSP are used for cultivating groundnuts and vegetables in an area of 2.5 acre of land. Sludge is not used in aquaculture. No preventive measures are taken when handling sludge.



The biogas plant with inlets



The deserter of Biogas plant



Sealed inlet facilitiv to add cow duna



Oven flame fuelled by biogas



Covered disposal point of sludge



Cultivation of vegetable use compost of sludge as

On the other hand, the study also found that a biogas plant based on reuse of human excreta requires more excreta than one or two households generate. A good number of households have to be included to generate enough raw biodegradable material to enable the biogas plant to function properly and so meet the energy demands of a single household. It was observed that two community latrines had been built to collect the excreta of the poor families for the operation of one biogas plant; the biogas being used by

the household of the owner of the latrines and plant. In this manner, affluent households can support the sanitation coverage of the poorest.

The biogas plants studied are fixed dome designs, as promoted by government institutions, with variations only in the number of inlets for the supply of raw materials. No complaints were recorded about the design or functioning of the plant. However, owners expressed a preference for an auto-firing oven to avoid experiencing the release of biogas during lighting. This may be considered as an indicator of unconscious discomfort about the raw material. The use of a pressure cooker by almost all the users may have a similar implication, although this was not explicitly expressed. All the users appreciated that the gas fire made cooking easier.

The study found that the users of biogas plants were not given enough information about sanitation and hygiene related to their use. Those looking after the plant did not have the capacity to manage even small technical problems, which may result from lack of training.

## Conclusion

This study looked at six households growing plants on saturated latrine pits, four cases where compost including human excreta is used to produce vegetables, fruits, nuts and trees and eight biogas plants in nine villages under three districts.<sup>42</sup> The study has increased understanding about the way human waste is reused, the motivation for reuse and the outcomes.

Human excreta and compost containing human and animal excreta and other organic waste are used in cultivating various kinds of vegetables, fruits, nuts and trees. Overwhelmingly users expressed satisfaction with the use of excreta. Their experience was that products grown on saturated pits and organic compost are healthier, larger, better in quality and have a better look. Moreover, the produce provides financial benefits.

Reuse of human excreta has sometimes been encouraged by ancestors who transmitted this indigenous knowledge to the next generation. However, most of the present users learned of the benefits of human excreta as fertilizer from mass media, NGOs, government organization or neighbours. There was, however, little evidence of advice or training about the safe handling of human excreta, and the instances of using human waste for cultivation were all individual initiatives.

In the case of biogas plants, construction was supported by a project or governmental body. However, there was still no evidence of training in the safe handling of human excreta. This was evident in the way that sludge from biogas plants is disposed of in surface water and open spaces and in the unhygienic use of latrines.

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<sup>42</sup> Details of these place are given under Methodology

The reuse of human excreta is discouraged by Islam according to some literature. During the study, it was observed that a Madrassa (Islamic religious academic institution), a Madrassa teacher and Muslim families are, in fact, reusing human excreta. This observation is based on a limited study, and cannot be extrapolated to the entire country. It can be said, however, that the use of human excreta for cultivating agricultural products for human consumption is practiced, at least to some extent, by Muslims, Hindus and Christians.

Despite the limitations of this study, it can be concluded that the reuse of human and animal excreta and other organic waste is a reality in Bangladesh. However, the way it is used may be improper or even dangerous to the health and environment of poor communities. The issue of using human excreta safely should be addressed by the government, by non-governmental organisations (NGOs) and by international agencies.

### Recommendations

As this particular study was carried out in a very limited, and specifically selected, area of Bangladesh, it does not provide an overall understanding about the reuse of human excreta in the entire country. Assessing the magnitude of human excreta use across the entire country requires further extensive research. Such a study should also look at the range of purposes for which human excreta is used.

As the study revealed that safe and hygienic utilization of human excreta was usually not practised, serious health risks exist for the people managing the processes and for consumers of the agricultural produces. The same applies to the general environment which is likely to become heavily contaminated if improperly treated sludge from biogas plants is dumped in the open. It is recommended that government and support agencies consider activities to share information and build the capacity of users to dispose of such sludge in a safe and hygienic manner. It is furthermore recommended that a study is conducted to determine the extent of health risks to human beings from all aspects related to the reuse of human excreta.

It is also recommended that Government, NGOs and entrepreneurs who are engaged in sanitation, incorporate use of human excreta into their programmes and undertake initiatives and activities for its safe use.

Given the development situation in Bangladesh, it is likely that Government, NGOs and private institutions will be intensively involved in the use of human excreta. The government should adopt a policy for the use of human excreta, allocate budgets to develop affordable and appropriate technologies and provide subsidies so that the poorest families can become involved. NGOs can raise awareness about safe and effective use of excreta, provide training for users, caretakers, and private producers, conduct advocacy at national and local level, and carry out action research to ensure that technologies and

approaches are effective in the socio-economic and environmental context of Bangladesh. They can also monitor and facilitate field level operations.

When simple and affordable designs have been developed and communities are willing to become involved in the use of human excreta, the private sector can ensure the availability of hardware materials, provide technical building skills, and market and promote excreta use options in each locality.

**Acknowledgement:** We like to thank Dr Shah Jalal, Professor, Department of Anthropology, Jahangir Nagar University for editorial support. I also like to acknowledge, the support provided by Mr. Mizanur Rahman, and Mr Qamruzzaman of NGO Forum, Rifatul Islam of NGO Forum and Md. Motasheen Bilah of Mohanpur during the field survey. I also want to acknowledge the support I received from Quamrun Nahar of UNICEF, WS of Bangladesh. The initiative was supported by Jo Smet (IRC) with the assistance of Laurent Stravato (IRC).

## 5. Bangladesh- CBO management of slum neighbourhood sanitation services: the Aynal's Bastee Case, Dhaka, Bangladesh

Hasnat Khandaker and Gitali Badrunessa

### Introduction

Although the rate of population growth in Bangladesh declined from 2.5% in 1971 to 1.6% in 2001, the urban population has been rapidly growing.<sup>43</sup> The urban growth rate currently stands at 5%-6% per annum, and 28.5 million people, just over 20% of the total 136 million population, live in urban areas. Of these, 10.5 million live below the upper poverty line and 5.5 million live below the lower poverty line.<sup>44</sup> Most of the urban poor live in slums and squatter settlements, with the largest concentration in Dhaka, where there are more than 3000 settlements of between 10 and 2500 households.<sup>45</sup> About one third of these settlements are more than 15 years old.<sup>46</sup>

These slums are characterised by high levels of deprivation. Basic services, including water and sanitation, are absent or grossly inadequate. About only 3% of the urban poor in Dhaka city have legal tenure to the premises they occupy.<sup>47</sup> Legal status is important, because access to water and sewerage, as well as gas and electricity, is contingent upon one's legal tenure of a plot. Consequently, the urban poor living in what are known as "informal settlements" are excluded from public services. Most slum dwellers use unsanitary hanging latrines<sup>48</sup> or resort to open defecation in ditches and roadside drains that remain permanently clogged. Women wait for darkness to respond to nature's call while children defecate anywhere, creating a highly unsanitary and nauseating environment.

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<sup>43</sup> The World Bank: World Development Report 2004, Washington DC, 2004. This is supported by the Bangladesh Population Census 2001 published by the Bangladesh Bureau of Statistics (BBS), July 2003.

<sup>44</sup> The Bangladesh Bureau of Statistics (BBS) measures the incidence of poverty as the share of the population with monthly per capita consumption (including food and non-food goods) below a predefined poverty line. The same allowance for basic food items is assumed for both the upper and lower poverty lines. However, the lower line incorporates a minimal allowance for non-food goods, while the upper line makes a somewhat more generous additional allowance.

<sup>45</sup> Centre for Urban Studies (CUS), Dhaka, 1996

<sup>46</sup> CUS 1995 Ibid

<sup>47</sup> Government of Bangladesh (GOB) Planning Commission/ADB Study of Urban Poverty in Bangladesh, 1996

<sup>48</sup> A hanging latrine is made of two planks laid over a hole, usually behind the house, that is then used as a designated spot for open defecation. It is considered another form of open defecation

## Stakeholders – community residents and users

Aynal's Bastee is located in Ward No. 85 under Demra Thana (Police Station) of Dhaka City Corporation (DCC). The neighbourhood consists of 350 households, with a population of 2000 residents. It was established in 1989 on the DCC land.

Around 80% of the households in this slum are composed of migrants from various parts of the country who joined DCC as cleaners. About 30% of the migrants are women. Others took shelter here as they lost their houses and lands due to river erosion or from a hope of earning some money. Over time, many have become engaged as rickshaw pullers, garment workers or small vendors. Their overall economic status is very poor as the average monthly income of these individual income earners lies between 4000 to 5000 taka (US \$58-\$75).

Although the houses in the slum were built by the DCC, they are very small and densely placed and no provision was made for sanitation facilities. Dwellers used hanging latrines, the construction and installation of which cost them around Tk. 200 to 300 (US \$3-\$4.35). However, women in particular did not feel comfortable as other residents could watch them while defecating. They had virtually no access to many essential services including safe water and hygienic latrines and suffered continuously from waterborne diseases. For most residents this had become a recurrent phenomenon.

### **Dhaka Water Supply and Sewerage Authority**

Dhaka Water Supply and Sewerage Authority (DWASA) is the statutory body responsible for water supply, water borne sewerage and sub-surface drainage in Dhaka city. During the course of the programme, DWASA officials have shown their commitment to meeting the needs of the Bastee's poor residents. DWASA policy on connections was recently changed in favour of the temporary settlers.

### **Dhaka City Corporation**

Dhaka City Corporation (DCC) is responsible for solid waste management and implementation of on-site sanitation in Dhaka city.

### **WaterAid Bangladesh**

WaterAid is an independent British Charity that works in 15 developing countries to bring about lasting improvements to water, sanitation and hygiene, using local skills and appropriate technologies. WaterAid Bangladesh is one of its country programmes.

Through its urban partners, WaterAid Bangladesh has financially and technically supported the construction of three Sanitation Blocks, 37 Communal latrine, 10 twin pit latrine and 1,026 individual slab latrine in poor slums of both Dhaka and Chittagong City. WaterAid also networks with sector alliances and undertakes advocacy work to change government policy on sanitation services in the informal settlements.



### Population Services and Training Center (PSTC)

Population Services and Training Center (PSTC) is a Bangladeshi NGO focused on service delivery, education, community development and training. It works as a partner with larger external NGOs, including WaterAid.

### Stakeholder map for sanitation block installation and effective management

Figure 1 below illustrates the number and range of stakeholders with which a Sanitation Block Management Committee (SBMC) members in the Aynal's Bastee slum needed to interact to establish sanitation Blocks and manage them sustainably.

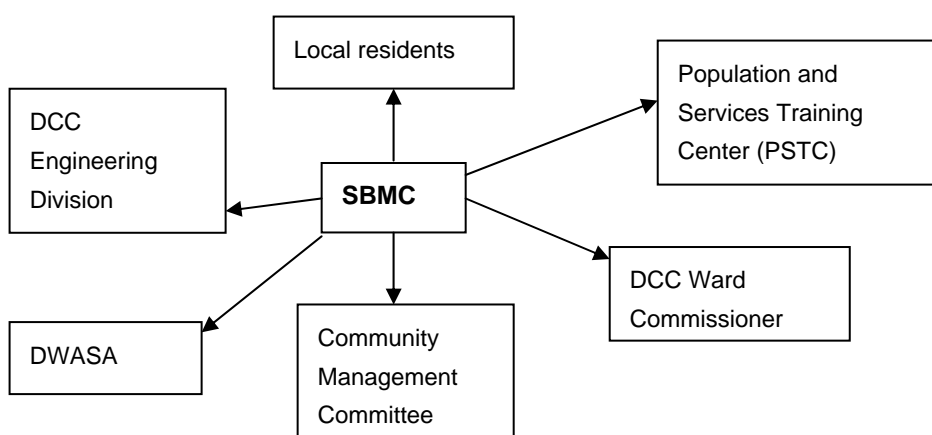


Figure 1. Stakeholder map for sanitation block installation and effective management

### Aynal's Bastee: The pre-intervention context

There were 20 to 25 hanging latrines in this slum which were poorly maintained. Some of them did not have any fence to shield the user from public view while others were weakly built. Some did not have any roof, while others were leaning over. Children found it very risky to use the latrines, and used to defecate in the open.

Women residents faced particular problems. They would not use the latrines as they could be seen by men living nearby. They also found the piling up of faeces in open places embarrassing.

Bamboo pillars often broke as the latrines got older. Sometimes the person using the latrine fell into the faeces. Older women and children were afraid of using the hanging latrines, especially at night, as some of them had also become victims of such accidents. Some defecated in polythene bags or household mud pots and then threw them away.

#### Box 1. Problems for Bastee

Major problems and their impacts:

- Continual bad smell
- Loss of prestige and dignity for women
- People walked barefoot and trod in faeces
- Men and women used to wait in one long queue to use latrines. Sometimes there were quarrels with men dominating the queue and pushing women to the back
- Spread of diseases linked to poor environmental sanitation, especially in children
- Overall polluted environment

With no sewerage system, flies, cats, dogs and chickens roamed freely over the piles of faeces. As a result, the slum represented a perpetual dirty and unhealthy environment.

The Project: PSTC intervention in Aynal's Bastee

#### *Approaching the community*

In 1998, Population Services and Training Center (PSTC) initiated its WatSan programme activities in Aynal's Bastee following a new community-based approach that encourages participation. PSTC field staff approached the people of the Bastee to build rapport, initiate dialogue and hold meetings focusing on water supply and sanitation (WSS). The entire process followed the PSTC 5R approach (**R**elations with the community, **R**oot level organisation development, **R**esource person development, **R**esource centre development and **R**ights based communication with official bodies and NGOs).

A cross section of Aynal's Bastee residents met together to assess and analyse the environmental situation and to prioritise issues. Sanitation was identified by residents as one of the top priority issues that needed to be addressed immediately.

#### *Raising community awareness*

Once sanitation had emerged as the top priority, PSTC facilitated this cross section of the community to hold meetings with a group of other interested residents in order to form a **Reflection Group**. This group of 20 residents was gender-balanced (11 female and 9 male) with each individual represented one household. Members of the reflection group are mostly adolescents and unemployed youth. Although they shoulder responsibility for some household activities, they did not have to give up income earning opportunities to engage in group activities.

PSTC provided hygiene training (a sort of Training of Trainers) to increase group members' knowledge and capacity. These trained people, known as **Resource Persons**, later volunteered to lead a good number of hygiene sessions which were held with (mostly female) parents and children in the neighbourhood. The overall objective was to raise the awareness of residents to issues related to water, sanitation and hygiene. Through dialogue and interviews, PSTC staff learnt that parents were concerned about their children's frequent diseases and sicknesses. They found the sessions quite helpful in raising awareness about how this problem could be tackled. Their concern motivated them to send their children to interactive hygiene sessions, which the children really enjoyed.

Through the hygiene sessions, most residents began to understand the primary causes of their ill health and its impact on overall livelihoods.<sup>49</sup> They realised how lack of sanitary latrines and an unhygienic environment directly affected their health. They began to realise

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<sup>49</sup> Female residents shared what they had learned about hygiene with male family members.

why women and children in the neighbourhood have long suffered from urinary tract infections, abdominal pain and infections.

This process started through facilitating residents to conduct a Mind Mapping exercise to list future dreams. They were then encouraged to discuss what could be done to reach them. Poor residents drew a family map of the slum and identified issues around each family and about four or five neighbouring families. They also identified overall issues in the slum.

The Reflection Group prioritised key issues that must be addressed to improve environmental sanitation in the area. Following this, they used a Problem Tree analysis to prioritise problems, and to discuss, analyse and identify the root cause(s) of each priority issue. Once these root causes were identified, they developed an action plan, clearly outlining urgent and medium term activities to address the issues. Responsible people were identified for each activity and approached.

Through these exercises, poor residents collectively explored a set of environmental sanitation issues and related sub-issues. They included lack of water, open/hanging latrines, unhygienic practices, careless dumping of solid wastes, and lack of outlets for waste water etc. all of which are responsible for degrading the environment of the slum. They also identified environmental sanitation as the top issue on the agenda to be addressed immediately.

#### *Community mobilisation and capacity building*

After sanitation emerged as the top priority, PSTC facilitated residents to hold meetings and to form a Community Management Committee (CMC) to lead the overall development of the neighbourhood, including water, sanitation and environmental hygiene.

In the case of Aynal's Bastee, the CMC comprises 11 residents, six male and five female, led by a Chairperson, Secretary and Treasurer. In this CMC, the Treasurer was female. CMC members acted as the overall guiding supervisors for the other committees that were formed to implement particular projects such as sanitation blocks and water-stands.

Two Sanitation Block Management Committees (SBMCs)<sup>50</sup> were formed to establish two sanitation blocks and manage day-to-day operations. Each SBMC was formed with nine local members democratically nominated by the neighbourhood residents, who maintained gender sensitivity by nominating five male and four female residents.

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<sup>50</sup> With the support of residents, Aynal's Bastee was physically split into two segments – Aynal's Lane and Shawkot's Lane – to make the project more effective. One Sanitation Block was established for residents of Aynal's Lane and the other for Shawkot's Lane

Members of CMC attended a couple of SBMC meetings and developed a structure for smooth functioning so that each SBMC is led by a Chairperson, Secretary and Treasurer with the rest as members. The SBMC of Aynal's Lane nominated a woman as treasurer.

Members of committees at different levels were provided with training in hygiene, leadership, health and organisation, so that they became aware of WSS activities and the potential role of people living in the area. They identified WSS issues, prioritised them, decided on what projects needed to be undertaken and designed them with an estimated budget. They also formed a purchase committee to procure materials for the project.

#### *Rooted advocacy*

In order to build sanitation blocks, members of the CMC and SBMCs lobbied officials with facilitating support from PSTC. They visited the local ward commissioner<sup>51</sup> and the engineering division of DCC, discussing issues with them and appealing for them to approve the allocation of two small pieces of land. Both the ward commissioner and the engineering division welcomed the initiative and assured them of their support. The ward commissioner approved their application for land.

#### *Technical aspects of the sanitation blocks*

According to the sanitation needs of the Aynal's Bastee and following their participatory and advocacy activities, CMC members decided to construct two sanitation blocks, one for each of two lanes in the slum. The first was constructed in Aynal's Lane in 2001 and the second in Shawkot's Lane in 2002. The cost of the first SB was just over Tk.200,000 (US \$ 2,900) and that of the second one was Tk.260, 000 (US \$ 3,750).

The physical size of each sanitation block is 31' x 17' (9.45mx5.18m). The walls are made of brick and the roof of tin. Transparent sheets are fitted into the roof so that users have adequate light. There are eight 4' x 3.5' (1.22mx1.07m) toilets in each block. Each block is split into two parts, containing four toilets including one for children. This means that two toilets in each block are allocated for the children.

Each part has one male urinal point and one 8' x 6' (2.44mx1.83m) bathing space (surrounded by a brick wall) for women. Men continue to bathe at existing open water-stands. There is one DWASA pipeline connected to each sanitation block. From this pipeline, four sub-lines connect to four water tap points inside each block. Another six water tap points in the slum are connected with the DWASA pipeline to provide drinking water. These were set up by the DCC.

#### Community management of the sanitation blocks

The CMC financed the sanitation blocks with a three year Interest Free WatSan Facility Loan from PSTC. After a sanitation block opens, the CMC repays the loan to PSTC in

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<sup>51</sup> Ward Commissioners are locally elected DCC Representatives for overall development in the wards.

monthly instalments. The monthly repayment instalment for Aynal's Lane was fixed at Tk.6,450 (US\$ 94) and that of Shawkot's was at Tk.7,200 (US\$ 105).

A total of 1800 people from 300 slum households (150 from Aynal's Lane and 150 from Shawkot's Lane) have been using these two sanitation blocks. Of these households, 43 and 48 in the respective lanes own their houses while the rest are in rented accommodation. Each home-owner pays Tk.150 (US\$ 2.20) per month toward repaying the WatSan loan to PSTC. All 300 households, including those who are renting, have been paying Tk.10 (US \$ 0.15) each month to maintain the sanitation blocks and to pay the caretakers' salary. To date, 82% of the loan for Aynal's Lane block and 32% of the loan for Shawkot's Lane have been repaid.

Each SBMC has appointed two caretakers for its sanitation block. All four caretakers are women residents of the slum. These caretakers regularly clean and properly maintain the sanitation blocks, which open at 5am and close at 12 o'clock midnight.



*Figure 2. One Sanitation Block in Aynal's Bastee*

Each caretaker is paid Tk.300 (US \$ 4.35) a month by the respective SBMC from the Tk. 10 per month collected from user households. With this money, the SBMC also buys cleaning agent, brushes, brooms, bleaching powder etc. Details of expenses and collections are recorded by SBMC and presented at monthly meetings called by the Secretary. A notice book, a pass book, a cash book, and a registrar book are kept to maintain these records.

If any family fails to pay monthly instalments, the Treasurer fills the gap from his/her own pocket, and settles personally with defaulting families. No serious conflict has so far arisen or been reported. Only two or three families sometimes default. Rules and regulations for dealing with conflict have not yet been drafted or adopted by the SBMC.

### *Support from PSTC*

PSTC field staff regularly visited the neighbourhood and sanitation blocks and continue to help build community capacity to manage the services. Meetings between field staff and SBMC members were held each month to review progress and discuss matters such as maintenance, cleaning the blocks, repayment instalments and conflict resolution. PSTC provided training courses for both CMC and SBMC members on hygiene and on how to manage and maintain sanitation blocks.

### *Impact of the SB project on the slum neighbourhood*

Today, all the residents of the Aynal's Bastee use sanitary latrines. Residents are more aware of their health status and practice hygiene behaviour. From SBMC reports and field staff observations, it is evident that residents wear sandals when going to the latrines and wash their hands with soap or ashes after using them. Latrines are maintained and used in a hygienic manner and children now use sanitary latrines. Where people, in particular newly arrived residents, are found not to be practising hygienic behaviour, efforts are made to address this problem.



*Figure 3. Poor women of the slum using the Sanitation Block*

It has been observed that residents suffer from diarrhoea and other water borne diseases less frequently. Residents do not report the need to visit the doctors quite as frequently. Less money is spent on treatment of diseases and sicknesses. Their working capability has also been enhanced. They feel that they are now living a better life.<sup>52</sup>

Another important outcome is that the poor residents are able to access the DCC officials and the ward commissioner directly and have developed working relationships with them. Moreover, both the DCC officials and the ward commissioner now know that a little support

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<sup>52</sup> Farouk A. Chowdhury, an Economic Evaluation of WaterAid Bangladesh's Water and Sanitation programme in specified areas of Bangladesh, December 2002, DFID Bangladesh.

from them can help poor and informal urban settlers to install and use hygienic latrines and sustain these by themselves. They are happy to see an initiative that promotes an improved standard of environmental sanitation.

## Lessons Learnt

### **Low-income urban residents are willing and able to pay for sanitary latrines**

The community based sanitation block project has demonstrated that even those on a very low income are willing to pay the capital and recurring costs of a hygienic sanitation service. This counters official claims that providing sanitation services to the urban poor requires subsidies.

### **Mediation is an effective strategy**

Without PSTC's advocacy and mediation, DCC officials and the ward commissioner would not have sanctioned the pieces of land in the slum for the establishment of sanitation blocks. The innovative role of NGOs has been one of the keys to success.

### **Co-operation of government functionaries and elected representatives is vital**

A project like this depends on the commitment of senior managers and local elected representatives in key sector agencies – in this case, DCC. This group of actors is very important for developing the project strategy and for its timely implementation.

### **Community ownership and management leads to sustainability**

Great attention and effort towards motivating this poor neighbourhood community, engaging them in participatory processes right from the beginning and building capacity in many areas has helped the community (via the CMC and SBMC) feel the ownership of what they were doing. Effective management of the sanitation blocks and effective cost recovery by the SBMC demonstrate that it is their project.

SBMCs meet regularly to discuss issues and resolve them in a democratic way. They collect monthly contributions from users, and are repaying the loan to PSTC through monthly instalments. They also discuss how to improve their management skills. They realise that although they have to make payments, once the capital loan is repaid, they will own the sanitation blocks and will not have to make loan repayments any longer. A monthly contribution will be required only to pay the caretakers' salary, for the purchase of cleaning materials and to cover the cost of minor repairs.

Residents and users have also enhanced their information, knowledge and skills base through participating in training provided by PSTC. They regularly contact the local government bodies and representatives at their own initiative and raise other issues such as sewerage with a view to gaining a greater understanding about potential solutions.

PSTC hopes gradually to transfer responsibilities to the SBMC and respective neighbourhood people. These responsibilities include approaching and negotiating with

DCC, the agency that helped neighbourhood people to establish their right to sanitation services.

Members of all 300 households in Aynal's Bastee have been using the two sanitation blocks for hygienic sanitation since they opened. There has been no evidence of anyone being left out or excluded.<sup>53</sup> Thus, it can be said that 100% of the residents of the slum are served by the project.

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<sup>53</sup> Farouk A. Chowdhury, an Economic Evaluation of WaterAid Bangladesh's Water and Sanitation programme in specified areas of Bangladesh, December 2002, DFID Bangladesh.



## 6. Philippines- Tingloy ecosan pilot project

Susanne Boom, Wetlands

### Introduction

The Center for Advanced Philippine Studies (CAPS) is facilitating an Integrated Sustainable Waste Management (ISWM) program in the Municipality of Tingloy Island, Batangas Province under the global Urban Waste Management Expertise Program (UWEP), coordinated and financed by WASTE (Advisors on Urban Environment and Development), a Dutch NGO. The latest extension of this program is called UWEP+. Initially, the Tingloy Ecosan Pilot Project started off as part of the UWEP+ program under a research stand entitled “Local research on the environmental aspect of good waste management practice in four municipalities in Southern countries”.<sup>54</sup> However, during the course of project development and implementation the Tingloy Ecosan Pilot Project got a status of its own and the main objectives became to introduce the ecological sanitation approach and technology (urine diverting toilets) in the ISWM project area in the Philippines and to demonstrate it can be an attractive alternative sanitation technology for the situation in Tingloy. Overall the project can be seen as an effort in advocacy for the ecological sanitation approach in the Philippines.

With a small budget, CAPS contracted the Philippine Center for Water and Sanitation – International Training Network Foundation (PCWS-ITNF) for a period of six months (July – December 2002) to run a pilot project. In fact, project activities and budget continued until the end of March 2003. Three development and implementing phases can be distinguished in the project, each with its own approach and outputs. In general, the project involved the following activities:

- Community organising
- Training
- Design development and improvement
- Construction
- Information and reference material development
- Assessment of water and sanitation situation
- Monitoring
- Extraction of lessons learned

The initial project team consisted of: Mining Manguiat (CAPS), Boji Gendrano (PCWS-ITNF) and Susanne Boom<sup>55</sup> (PCWS-ITNF). During the second phase of project implementation Apol Jimenez (PCWS-TNF) took over from Boji Gendrano.

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<sup>54</sup> This strand is known as the Carbon/Nitrogen pathway.

**Box 1. Ecological sanitation: composting, dehydration and urine diversion**

Ecological sanitation is all about sanitising human excreta (turning it into safe products) and then recycling them back into the environment and into productive systems. Sanitizing can be done in two ways: through composting or dehydration. By dehydration all water is removed from the excreta (diverting urine, using heat, ventilation and addition of dry material). Composting is a biological process in which organisms (bacteria, worms, fungi etc.) break down organic substances (human excreta plus bulking agents) to make humus. In both processes, pathogens are killed due to a combination of factors: increasing pH (adding sawdust, ashes), increasing oxygen (ventilation), decreasing moisture content (no water used for flushing, separation from urine), increase of temperature (heating of vaults) and increasing the retention time (using double-vault or buckets). Both composting and dehydration toilets are referred to as dry toilets as no water is used for flushing. The composted or dehydrated material acts as a soil conditioner, the diverted urine acts as nitrogen fertilizer (after proper storage and dilution).

## Phase 1

### *Approach and output*

During the first phase of the project (July – August 2002) the respective partner households and community representatives were insufficiently involved in the process of designing and constructing the toilets. Construction was not supervised carefully enough and was rushed. The construction method (ferrocement-technique) and materials used (moulds, ferrocement), were unknown in the project area. The outcome of this phase was that the three toilet facilities constructed could not be used as dry ecological sanitation (urine diverting) toilets; they showed several operation errors and were inconvenient to use. During this phase training was conducted and information material was developed.

The approach and output of this phase did not conform to the usual methods of working or to the approaches of either PCWS-ITNF or CAPS but was due to the sum of circumstances (miscommunication, poor understanding of ecological sanitation concept, inexperience in project management, time pressure, etc.).

### *Activities: initial site visit*

A mixed group of people, PCWS-ITNF and CAPS staff together with staff from the Environmental Engineering Department of the University of the Philippines, visited the project area on June 22 2002 to get familiar with the situation. The team met with the Rural Sanitary Inspectors (RSIs), Barangay Health Workers (BHW) and some of the Barangay Captains of the Tingloy community.

A sketch of the initial design of the ecosan technology was presented and the ecological approach to sanitation was explained. Community representatives were asked when and where the ecosan approach and technology (urine diverting toilets) could be tested. The

scheduled date for the start of the pilot project was agreed for July. The visit ended with a quick (transect) walk around the project area.

Based on the outcomes of this orientation meeting with representatives from the Tingloy community it was decided to implement three pilot ecological sanitation toilets; i.e. in one household in each of the three Poblacion barangays of the Tingloy municipality.

### *Community organising*

Community activities during this phase were carried out by Mining Manguiat, who organised teams consisting of Barangay Captains and Rural Sanitary Inspectors within Poblacion Barangays 13, 14 and 15. These teams visited several poor households with no sanitation facilities, asking them about their willingness to participate in the pilot.

The three partner families selected were all part of the lower (poor) class within the project area. Two households are located in rural upland forest areas (Barangay 13 and 14); the other in the urban centre (Barangay 15). The three households selected by the site selection team all participated on a voluntary basis and were willing to help construct the urine diversion toilet facility. The selection team briefly informed beneficiary households about the place of this project in the UWEP+ program, the type of toilet, the construction and necessary training activities.

The project team also raised awareness with partner households and community representatives about ecosan, and project activities.

#### **Box 2. Design of urine diversion toilet under Phase 1**

The design involved a cylindrical substructure with a height of 1 meter and a diameter of 1 meter, divided into two processing chambers of equal volume. Each chamber has an access door. The slab has two holes, one above each one of the chambers. On one of the holes a movable toilet bowl is placed. The other hole is covered with a lid. The bowl and lid can be shifted when the first chamber is full. The toilet bowl makes use of a urine diverter (a small hole plus separation device). Urine is transported to a covered bucket by a hose. The slab contains two holes for ventilation pipes, each connected to an individual processing chamber. The slab also has two small openings to access the chambers with a slim stick for stirring. The superstructure is directly connected to the slab, is also cylindrically shaped and is about 2 meters high. The toilet has a tin door and an outside step in front of the door.

### *Construction*

For the urine diverting toilets, a mould set was fabricated in the mainland by a hired foreman and supervised by engineer Boji Gendrano (PCWS-ITNF) and shipped to Tingloy Island. The ferrocement construction of the first urine diverting toilet unit in Barangay 14 started in the last week of July, the unit in Barangay 13 was finished in the first week of

August and the unit in Barangay 15 was completed in the second week of August. Construction activities were carried out by the hired foreman and partly supervised by PCWS-ITNF staff. Some people of the partner and surrounding households helped in the activities.

#### *Training conducted*

Training on ecological sanitation was conducted on August 24, 2002 after the construction of the initial three urine diverting toilet units was completed. The training team consisted of PCWS-ITNF staff.

The one-day training module provided simplified information in an interactive, visual art based way on the importance of sanitation, different technological options, the ecological sanitation approach, the operation and maintenance of urine diversion toilets and hygienic practices. The training was also an opportunity to consult the people on adjustments to be made in the design of the toilet facilities.

In total, 25 people attended the training day, excluding facilitators, 10 from Barangay 14 (including four users), nine from Barangay 13 (including two users) and five from Barangay 15 (including one user) plus one participant from Barangay Papaya (RSI).

Participants gave comments and made recommendations for design and construction of the toilet facilities, based on their observations during the transect walk, the experience of the users and what they learned about ecosan from the training.

#### **Box 3. Feedback of training participants on constructed toilets**

- The hole of the urine diverter needs to be adjusted (bigger, deeper and more to the centre)
- Women need to be consulted in making the design
- The hole in the toilet bowl for the faeces to drop in needs to be bigger and should be vertical
- Smoothen the toilet bowl (so it is easier to use, to clean, and it looks more inviting)
- Make the chambers/vaults easy to open
- The toilet should have overhead windows for ventilation, light and aesthetic reasons
- Everything (including the walls) should be easy to clean
- The superstructure needs widening
- The seat (toilet bowl) should be movable

CAPS commented that the training provided a lot of information already known to participants. People in Tingloy have a high level of sanitation and hygiene awareness, due to the work of the RSIs and BHW. The focus of the training should therefore have been more focused on the approach and technology of ecosan, and how it differs from the

'usual' and 'conventional' sanitation practices in the area. The training was felt too general and to some extent too simple.

#### *Monitoring, problems encountered and follow up*

The construction process was only partly overseen by PCWS-ITNF staff and monitored twice: one visit during the construction of the toilet units in Barangay 13 and 14, the other after construction of the three units was complete. During these visits Mining Manguiat and household members were asked about the process of the project. The main findings were:

- The respective household and community representatives were insufficiently involved in the process of designing and constructing the toilets
- Construction was not supervised carefully enough and had been rushed
- The toilets as constructed could not be used as dry ecological (urine diverting) toilets
- The toilets had several operation errors and were inconvenient to use

As a result, PCWS-ITNF decided to conduct in-depth consultations with the respective households to find out what needed to be done to improve the facilities and adjust them in such a way that they could be classified as dry ecological (urine diverting) toilets and be convenient to use.

#### **Box 4. Technical errors in design of urine diverting toilets under Phase 1**

- Half of processing chamber/vault was below ground level
- The bottom of the vault was not lined which can be problematic during rainy season
- The doors of the processing chamber/vault were cemented, and so not accessible for emptying and monitoring
- The toilet bowl was cemented to the slab and not movable as planned
- The hole in the toilet to drop the faeces into the pit was too small and a PVC pipe connected to the hole was positioned at an angle.
- The toilet bowl was not smooth and faeces could stick there, producing bad smells and attracting flies. Urine could be absorbed by the ferrocement and cause cracking
- The lid attached to the PVC pipe connecting the hole in the toilet bowl only opened using pressure (water, stick), and did not close completely, which could cause the spread of bad odour and flies.

#### *Information materials developed*

The information materials developed during this phase were mainly materials targeted for the training on ecological sanitation. Materials that were disseminated for use and reference after the training included:

- A colour poster with recommendations on how to use and maintain a urine diverting toilet

- A monitoring sheet on use and maintenance of urine diverting toilets (so the performance)

The poster was initially developed for partner families but copies were also given to Barangay Captains and RSIs. Copies of the monitoring sheets were also given to the RSIs. These materials were translated from the original versions found in two Spanish books (one for households, one for facilitators) developed for a programme on dry toilets in El Salvador.<sup>56</sup>

Because these materials were directly translated and not adapted to the Philippine context and local situation of Tingloy, they were actually not appropriate and even sent out some wrong messages. This was later explained to partner families by the project team and the materials were not further distributed.

## Phase 2

### *Approach and output*

During the second phase (September–October 2002) community representatives were informed about scheduled activities taking place and in-depth consultations were held with the respective partner households to find out what needed to be done to improve the facilities in such a way that they could be classified as dry ecosan (urine diverting) toilets. The Rural Sanitary Inspector (Auring Arrelano) working in the project area participated in the in-depth consultations. A new engineer (Apol Jimenez) was involved in the project and a new design was made. The outcome of this phase was that two of the existing toilet facilities were converted into pour flush toilets with a leaching pit (Barangay 13 and 15) and one partner family agreed on a new dry ecosan (urine diverting) toilet facility, according to the new design (Barangay 14). The old toilet facility was converted into a bathroom. Local labour and materials were used during (re)construction.

### *Activities: in-depth consultations with partner households*

A full week was spent in the project area (September 5 – 12) to conduct in-depth consultations with barangay officials and households on continuation of the project. The first meetings were with the Barangay Captain and Barangay Health Workers of respectively Barangay 13, 14 and 15. The team comprising the RSI (Auring Arellano), CAPS and PCWS-ITNF informed them about the current status of the project, the problems and the reasons for them, the options for continuing the project, and involvement of local masons/carpenters, using local materials. The prototype of the urine diverting toilet bowl was displayed.

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<sup>56</sup> The original is entitled '*La Letrina Abonera Seca, Manula de Educacion Sanitaria para la Persona Facilitadora/Visitadora Familiar*' published by UNICEF El Salvador, Agencia Sueca para el Desarrollo Internacional and Gobierno de El Salvador Ministerio de Salud Publica y Asistencia Social in October 1996

Household visits were made together with the RSI (who acted as translator and sanitation resource person) and respective BHW. The households were informed about the same things as the barangay officials and were consulted about which option they preferred for continuation of the project:

- Converting the current toilets into working dry ecosan facilities
- Construction a new dry ecosan toilet
- Pulling down the existing toilet
- Converting the existing toilet into a bathing facility

#### **Box 5. Prototype urine diverting toilet bowl**

To tackle the problems of the toilet bowls constructed under Phase 1 of the project (rough surface, too small holes for faeces and urine, hole placed under an angle) a prototype urine diverting toilet bowl made from fibreglass was introduced. This prototype and mould was developed by the Centro de Innovacion en Tecnologia Alternativa, in Mexico. Three copies of the bowl were made by a fibre glass workshop in Metro Manila (GRP Systems & Fabrications, Inc.) at a cost of PhP 1800 each. The prototype was well received by the people in the project area, the only concern they had was that it can be dangerous for children as the hole is quite big. This could be solved by covering it with a lid that has a smaller hole, made locally.

However, during the course of the project the prototype turned out to be inappropriate as it was designed for a community of 'wipers' while the people in the project area are 'washers' and the design did not accommodate that. Further, the cost of the prototype cannot compete with the cost of the conventional pour flush toilet bowl / squat-type pan (PhP 400–600). Also, it cannot be locally made, as there are no fibre glass workshops in the project area. A research trial to copy the prototype using cement was undertaken by PCWS-ITNF. Costs were low (PhP 300 per bowl) but the bowl turned out to be too heavy to handle and the surface could not be made smooth enough to be convenient.

The advice from WASTE (during Phase 3) was to eliminate the use of the prototype urine diverting toilet bowl in the project as it only limited the development of an appropriate and convenient design.

#### **Box 6. Barangay 13**

The toilet was not used at the time of visiting the partner family because of bad smell; the family blocked all holes in the structure and covered the bowl with a lid to fight the smell. The toilet was used once in a while, consuming a total of around two litres of water per person per time for cleaning and flushing. The family taps water from a nearby deep well. In principal the toilet will be used by three households (all relatives) with a total of 11 members, six adults and five children. The partner family said that they were still interested in the ecosan project and in understanding the ecosan approach. They preferred to build a new urine-diverting toilet and convert the existing structure into a bathing facility. The family preferred to use the prototype urine diverting toilet bowl as introduced by PCWS-ITNF in the project, making a trough for anal cleansing. The family agreed to contribute labour and preferred construction materials were discussed (hollow blocks, yero sheet).

The suggestion from WASTE during a follow up visit to this partner family as part of the WASTE/CAPS mission (Phase 3) was to include the option of converting the constructed toilet into a pour flush toilet (with squat-type pan) in the range of options on how to continue the project given to this partner family. This because under the given circumstances (household located in hinterlands with lots of space available, neighbours relatively far away and no open water sources present around) any form of sanitation could be classified as ecological sanitation as 'nature can easily take care of the human waste produced' by the family and it would not contaminate any water source.

After informing the partner family about this option they indeed decided that they preferred the squat-type pan pour flush toilet instead of a urine diverting toilet facility.

#### **Box 7. Barangay 14**

The family of ten members was using the toilet without water for flushing, using toilet paper for cleaning. They feel comfortable with using toilet paper instead of water for cleaning as they were used to that from when they used to defecate in the forest. The family encountered problems of bad smell that it is too hot and dark inside the toilet, faeces do not easily fall into the chamber and it is hard to sprinkle them with ashes. The family consists of 10 members.

The colour poster, provided during the training conducted under Phase 1 of the project, with recommendations on how to use a dry compost toilet was taped to the inside wall of the toilet, so family members could look at it while using the toilet.

The family expressed an interest in the ecosan project and a willingness to understand the ecosan approach. They preferred to build a new composting toilet and convert the existing structure into a bathing facility. The family preferred a structure made from hollow blocks and yero sheets. The separated urine should be leached into the ground. The family was eager for reconstruction to start but it was agreed that first a cost estimate needed to be made together with a design before construction could start. The family committed themselves to contributing through their labour.

#### **Box 8. Barangay 15**

This partner family was visited twice. During the first meeting only the woman and her small children were present, During the second meeting the mother in law of the women joined. The family consists of four adults and three children. The toilet was used but not often and water was used to flush the toilet (otherwise, they said, faeces did not go into the vault), around 1.5 litres per person each time (cleaning and flushing). Water comes from private faucet outside the house.

The toilet was dirty at time of visit (stripes of faeces where visible in toilet bowl). Problems that the family encountered were that it is too hot inside toilet (needs a window), difficult to clean (rough material) and faeces are not easily flushed. At the time of the visit, the bucket



of urine had not yet been emptied. The woman of the family (who attended half of the training) found the ecosan approach and operation and maintenance of ecosan toilets hard to understand, and she had not explained it to other household members.

Although this partner family was selected, the impression was that there was no interest in ecosan approach and household members were sceptical about the facility. The PCWS-ITNF/CAPS team in support of the RSI decided that this household should convert this facility into a pour flush toilet by changing the bowl for a squat-type pan (already provided by the Municipal Health Office of Tingloy) and adding a leaching pit (locally referred to as a septic tank). In this way the partner family at least has a working toilet facility that they can handle.

### *Design development*

Learning from the errors in the design under Phase 1 and based on the information gathered during the in-depth consultations with the partner families, PCWS-ITNF made a new design for the urine-diverting toilet. The prototype urine diversion toilet bowl from Mexico was used as basic element in the design development. Detailed drawings were made, together with cost estimates using various combinations of construction materials. The drawings were given to the some barangay officials of Barangay 14 and to the partner family for feedback.

In the new design, the substructure is fixed to two chambers (vaults), which could be used alternatively by shifting the toilet bowl. The slab contains a hole for a ventilation pipe in the middle, two holes for placing the toilet bowl and a basin with a drain over which people can wash themselves by squatting over it. The vaults each have an access door. Urine from the toilet bowl is drained to an evapo-transpiration bed and the water used for anal cleansing is drained into a soak bed in the ground. The substructure consisted of a roof, walls, door and a vent pipe with fly screen. Part of the space under the roof was left open for ventilation and light.

### **Box 9. Technically working but convenient?**

Improving the design for ecosan toilets in the project was a learning experience. Although the design developed and constructed under Phase 2 of the project implementation (in Barangay 14) was technically working and could be used and maintained according to the ecosan approach, it was not optimal in terms of convenience. The toilet bowl was used in combination with a basin on the floor to facilitate anal cleaning with water. This meant that users could sit first but then had to squat. Further, the design did not include a urinal so that men had to sit down to urinate. An added change in the operation of the toilet is to use buckets from palm leaves to collect the faeces. Therefore actually only one vault was needed, as there is space enough to store a full bucket next to the new one in the single chamber.

### *Reference material developed*

PCWS-ITNF developed a manual<sup>57</sup> (in Tagalog) during this phase on how to construct, use and maintain a compost toilet and how to construct a soakpit. This acts as reference material for partner families (mainly the one of Barangay 14), copies were also given to some of the barangay officials and to the two RSIs. The aim was to enhance and support the knowledge of people in operating and maintaining ecological sanitation facilities and to stimulate the families in constructing a soakpit for collection of draining water from washing.

#### **Box 10. Composting, dehydration and urine diversion cause confusion**

Throughout Phase 1 and 2 of the project the terms composting, dehydration and urine diversion were used interchangeably. The toilets were referred to as dry composting toilets, producing fertilizer but families were also told they were dehydration toilets, producing soil conditioner. The information material in Phase 1 (poster and training materials) were based on the concept of dehydration, the reference material in Phase 2 (manual) was based on the concept of composting. During Phase 3 the constructed toilets were referred to as dry ecosan urine diverting toilets. Getting familiar with the (meaning) of these different terms and its appropriate use, was part of the learning process for the project team.

### Phase 3

#### *Approach and output*

The third and final Phase (November 2002 – March 2003) of the project implementation started with a mission by the WASTE/CAPS team to the project area, partly joined by PCWS-ITNF staff, to analyse the water and sanitation situation within the project area and to monitor/evaluate the project. This mission showed that the initially selected partner families were strategically not well chosen: the focus should have been on families living in the urban centres (build-up areas) of the project area as it is here that existing toilet facilities (pour flush with a leaching pit) are the main cause of groundwater pollution. It also became evident that the new (Phase 2) design was still not sufficiently appropriate to the local situation. Another outcome was that the information and reference materials developed did not reflect enough on the situation and practices present in the project area. It was agreed that one dry ecosan (urine diversion) toilet unit would be designed and constructed (initially in Barangay 15) during this final phase. Further, it was agreed that after this phase, PCWS-ITNF would pull out as the implementing organisation and that ecological sanitation activities would fall directly under CAPS coordination and management as a UWEP+ (ISWM) activity.

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<sup>57</sup> The manual was a direct translation of parts of an existing reference: *'Sanitation without Water'* from Uno Winblad and Wen Kilama, 1985.

**Box 11. Selection of partner families**

The initial selection of partner families under Phase 1 of the project actually created a wrong 'image' of ecosan in Tingloy. Because these families can all be considered as part of the lowest-income households within the project area and two of them live in the upland forest areas. Ecosan is seen as a sanitation option / solution only for the 'poor' and for those living 'out there in the forest'. It is not seen as an attractive sanitation option for the range of families (low-income, middle class to rich) in the built up parts of the Tingloy Poblacion. Paradoxically, it is here that the ecosan approach can make a difference and should have its entry, given the current water and sanitation situation. If preferably middle class families from those built up areas had been selected as partners for the project, perhaps ecosan really would have taken off in Tingloy...

The selection of partner families was not based on real demand for (ecological) sanitation. Demand was assumed by Barangay officials and RSIs by tapping poor families without toilet facilities for the project. Only the partner family in Barangay 15 showed demand, as they have small children and live in the densely populated area of the Barangay, and there is pressure from the neighbours for them to build a toilet. The other partner families did not express a real need for sanitation. All the families had previously been provided with a pour flush squat-type pan and two bags of cement by the RHU but no toilets had been put in place. However, the partner family of Barangay 14 was interested in the ecosan approach as water for cleaning and flushing is not available close to the house.

*Follow up of ecosan activities by CAPS*

Given the situation during this phase, CAPS and PCWS-ITNF agreed that the process of finding interested families, willing to implement the improved design (Phase 3) to further pilot ecosan, should not be pressured and therefore should not be time bound. Further, that this would be handled by CAPS (Mining Manguiat), as an integrated part of their activities in Tingloy. Therefore it was decided that the involvement of PCWS in the project would stop at this point. CAPS might decide to approach PCWS again in the future, either when a partner family is identified in Tingloy or for other ecosan activities. CAPS wants to stay involved in ecosan activities in the long run, either in Tingloy or elsewhere.

**Conclusions and recommendations**

The project encountered problems during the development phases and appropriate solutions had to be found. When looking at the project cycle of the project it can be said that the focus has been on implementation. Preparatory steps of identification, preparation and approval did not receive enough attention. This resulted in e.g. improper costing of the project, not knowing the water and sanitation situation, improper site selection, inappropriate designs and reference materials. Operation, monitoring and evaluation activities were implicit rather than explicit. However, the working process and the outputs improved over time (i.e. increased participation, more appropriate designs, better

understanding of situation) due to efforts of the project team and CAPS and PCWS-ITNF as organisations.

Under the given circumstances this pilot project in short had the following strengths and weaknesses:

#### **Strengths**

- CAPS' long term and good relationship with the Tingloy community served the project
- Existence of support from Local Government Officials, Barangay Captains Rural Sanitary Inspectors and Barangay Health Workers
- As it was a pilot project, the design of the toilets could be adjusted over time

#### **Weaknesses**

- The pilot project was created by PCWS-ITNF and CAPS for technology demonstration and advocacy, not as a respond of sanitation demands within the Tingloy community
- Partner households were not given options for alternative sanitation technologies.
- Project coordination was sometimes difficult with two NGOs involved in different activities.

During the project preparation and implementation of Phase 1, the Tingloy community and stakeholders could be typified as 'beneficiaries' as they did not have a say in process of designing the ecosan (urine diverting) toilets and construction. During Phase 2 and 3, the project tried to involve them more and to increase participation. In Phase 3 stakeholders were explicitly defined and the users involved seen and approached as 'partners', in accord with the usual way of working and the ideology of both PCWS-ITNF and CAPS.

However, the people in Tingloy have always been supportive of the project staff and the involved partner families were accommodating. Especially during Phase 2 & 3, the project team tried to keep things as open as possible and people were encouraged to give feedback on the designs made and to express concerns and needs. This resulted, for example, in converting two of the three initial constructed toilets into pour flush toilets and one family being able to pull out of the project.

Initially the roles and activities of CAPS and PCWS-ITNF were carried out quite separately and followed each other. In the course of the project, staff worked more as a team. During Phase 3, tasks and responsibilities were more clearly defined. PCWS-ITNF responsibilities within the project team were that of technical designer and project coordinator/task manager and CAPS was responsible for community organising/development issues. CAPS also always has been very supportive to the PCWS-ITNF staff although it was sometimes hard to commit and allot time to the project due to heavy involvements in other activities in Tingloy. For both organisations the pilot project really has been a learning experience, especially on the content issues of ecosan.

## Achieving outputs of Phase 3

### **Ecosan meeting the needs of stakeholders and users**

On an overall scale it is doubted if ecosan is really meeting the needs of people in Tingloy. This should actually be investigated in more depth. Perhaps demand first needs to be created and awareness raised (about how pour flush toilets pollute ground water sources). Families without having a toilet are mainly interested in getting a pour flush toilet as that is what is common in Tingloy. There seem to be no incentives to look into alternatives. However, the design for a urine diversion toilet system as it is developed now seems appropriate for the situation and people in Tingloy as verified in stakeholder meetings. Ecosan could probably be stimulated if a partner family in Poblacion or another built-up area was willing to pilot the design.

### **Self-replicating effect of ecosan in Tingloy**

Project activities did not create a self-replicating effect of ecosan in Tingloy. The partner family in Barangay 14 lives too far out in the hinterlands to stimulate this effect, and ecosan most is probably now seen as a solution only for poor families. A start towards changing this perception would be to construct an improved design ecosan toilet in a more built-up part of Tingloy, preferably in the home of a middle-class family.

### **Social platform for the ecosan approach**

A social platform for the ecosan approach does exist, as the two RSIs, the Barangay Captains and some of the BHW are still interested in this issue. The question is how to keep this active and alive?

### **Opportunities for small entrepreneurs**

No real insight is gained in this. On Tingloy there are only carpenters working. Again, perhaps these opportunities become more visible when the first urine-diverting toilet is constructed according to the improved design.

## Lessons learned

### *Project preparation*

- Staff on the project needs to spend time on reading on the subject and share/discuss examples and cases from other countries and regions.
- At site there should be a clear picture of the water resources and sanitation situation in order to find the 'niche' for ecosan.
- The demand/incentive for ecosan needs to be investigated through an Initial Sanitation Assessment including the views of people from different sectors (health, users, agriculture, government etc.).
- Partner families should be selected on the basis of their demand for sanitation and should preferably be part of the 'middle class' to stimulate a self-replicating effect.

### *Project implementation*

- Allot time and effort for technical design development together with the partner family and community.
- Use local material and expertise so the design becomes the product of the community.
- As well as partner families, also involve people from the 'enabling environment' like Barangay Captain, Rural Sanitary Inspectors, health workers, mayors, etc.
- Organise training or a workshop on ecosan in an early stage of the project (after the partner families are on board) to inform a larger public.
- Assess the need for training on sanitation in general and ecological sanitation in particular before an actual training programme is designed.
- Be careful about using, mixing and confusing terms like composting, dehydration and urine diversion.
- Do not use direct translations of Information and reference materials from other countries, until they have been checked for appropriateness and adapted to the local situation.
- Be careful if using a prototype urine diverting toilet bowl from another country (different sizes, designed for 'wipers' in stead of 'washers') as this may limit the development of an appropriate and convenient local design.

### *Monitoring and evaluation*

- The outcome of the design process should be a pleasant and affordable toilet facility that sends a hygiene promotion message to other families and is easily replicable.
- Being an advocate for ecosan does not automatically make you suitable for implementation of activities.
- Do not scale up too fast: first create appropriate, 'sellable' toilet devices, eyes are watching you!

### *Recommendations*

The ecosan approach and urine diverting toilets as a technology option prevents pollution, fights infections, saves water, promotes zero waste management and encourages food production. However, if the facilities are not sufficiently operated, maintained and monitored these can increase health hazards for people and the environment, give ecosan and organisations involved in the project a bad reputation, and create a burden for the households involved.

To 'introduce' ecosan in the Philippines it is recommended to spend more time on project and (technology) design development for pilot projects. This case study, documenting the implementation process of the Tingloy Ecosan Pilot Project, should serve as a basis. The experience and lessons learned from this project should be taken into account.

It would be good to follow up this project by:

- writing project proposals
- starting new pilot projects

- developing case studies
- investing in design development and fabricating urine diversion devices
- developing appropriate information and reference materials on ecosan

In order to design better projects and implement projects in a better way, it is recommended to follow a methodology or approach such as the Strategic Sanitation Planning (SSP) or the Household Centered Environmental Sanitation Approach (HCES). Such approaches consist of logical steps, and may prevent the errors evident in this experience, due to lack of insight, improper costing of the project, improper site selection, and inappropriate design and reference materials.

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UNICEF (1996). *La Letrina Abonera Seca, Manula de Educacion Sanitaria para la Persona Facilitadora/Visitadora Familiar*. El Salvador, UNICEF El Salvador, Agencia Sueca para el Desarrollo Internacional and Gobierno de El Salvador Ministerio de Salud Publica y Asistencia Social

### Internet

Organisations	
<a href="http://www.undp.org/seed/water/">http://www.undp.org/seed/water/</a>	UNDP
<a href="http://www.sida.se">http://www.sida.se</a>	Sida
<a href="http://www.wkab.se/">http://www.wkab.se/</a>	SANRES China Conference, reports China, Mexico etc
<a href="http://www.laneta.apc.org/redseco/">http://www.laneta.apc.org/redseco/</a>	Latin American Network on ecological sanitation
<a href="http://www.laneta.apc.org/esac/drytoilet.htm">http://www.laneta.apc.org/esac/drytoilet.htm</a>	National NGO - ecological sanitation in Mexico
<a href="http://www.riles.org/photos.htm">http://www.riles.org/photos.htm</a>	Resource, Boston based NGO

	working in C America
<a href="http://user.tninet.se/~gyt516c/ECOSAN.html">http://user.tninet.se/~gyt516c/ECOSAN.html</a>	Ecological sanitation in Ethiopia, Swedish NGO
<a href="http://www.tema.liu.se/tema-v/">http://www.tema.liu.se/tema-v/</a>	Tema V - Sida course on ecological sanitation
<a href="http://www.gtz.de/ecosan/">http://www.gtz.de/ecosan/</a>	GTZ on ecosan
<a href="http://www.iees.ch/news.html">http://www.iees.ch/news.html</a>	International Ecological Engineering Society
<a href="http://www.ecological-engineering.com/">http://www.ecological-engineering.com/</a>	The closed loop approach to eliminate waste
<a href="http://www.cepp.cc/index.html">http://www.cepp.cc/index.html</a>	Center for Ecological Prevention Pollution
<a href="http://cityfarmer.org/comptoilet64.html">http://cityfarmer.org/comptoilet64.html</a>	City farmer, Int.NGO on urban agriculture
<a href="http://www.i-s-w.org/ecosanitation1.htm">http://www.i-s-w.org/ecosanitation1.htm</a>	International Secretariat for Water, Int. NGO
<a href="http://www.mvula.co.za/work.htm#Sanitation">http://www.mvula.co.za/work.htm#Sanitation</a>	Mvula Trust, South African NGO
<b>Ecological Sanitation publications/articles</b>	
<a href="http://www.ruaf.org/1-3/35-37.PDF">http://www.ruaf.org/1-3/35-37.PDF</a>	Article in Urban Agriculture Magazine on "Closing the Loop"
<a href="http://www.compostingtoilet.org/10articl/esac1.htm">http://www.compostingtoilet.org/10articl/esac1.htm</a>	Article about ecosan in Mexico
<a href="http://www.undp.org/seed/water/">http://www.undp.org/seed/water/</a>	UNDP papers on ecological sanitation
<a href="http://www.gwpforum.org/gwpef/wfmain.nsf/Publications">http://www.gwpforum.org/gwpef/wfmain.nsf/Publications</a>	Sida publication: Ecological Sanitation (E,F,S,C,Vie)
<a href="http://oneworld.org/cse/html/dte/gobertimes/may1999/gtimes.htm">http://oneworld.org/cse/html/dte/gobertimes/may1999/gtimes.htm</a>	Ecological Sanitation for children, CSE, India
<a href="http://www.i-s-w.org/ecosanitation1.htm">http://www.i-s-w.org/ecosanitation1.htm</a>	Case studies from Mexico and Zimbabwe.
<b>Composting Toilets</b>	
<a href="http://www.compostingtoilet.org/">http://www.compostingtoilet.org/</a>	
Products on the Market	
<a href="http://www.clivus.com/">http://www.clivus.com/</a>	
<a href="http://www.wost-man-ecology.se/index.html">http://www.wost-man-ecology.se/index.html</a>	
<a href="http://www.ecosan.nl">http://www.ecosan.nl</a> (The ecosan Market Place)	



## 7. Mexico - The worth of ecological sanitation: a project in the slum areas of Mexico City

Jacinto Buenfil

### Introduction

Tepoztlán is a microcosm of socio-economic and environmental conditions for much of Latin America, displaying enormous contrasts: natural beauty and overexploitation of resources, rapid population growth but lack of planning, large income-generating activities but little spent on conservation, luxurious weekend homes and indigenous villages that lack basic services.

Tepoztlán lies seventy kilometers south of Mexico City, within El Tepozteco National Park in a strategic water catchment area at the top of the Río Balsas watershed. The main water source is an aquifer supplying public and private wells. The aging, inefficient municipal water distribution network caters to the urban area, while the remaining population is provided for through tank trucks, private wells, springs, and rainwater harvesting – often at higher cost.

Due to soil conditions and topography, conventional centralised sanitation is unfeasible. Sanitation practices in the urban core include approximately 70% septic tanks with infiltration pits; the remaining 30% is comprised of latrines, open defecation and dry toilets. These proportions are inverted in peri-urban and rural settlements. Septic systems are constructed to avoid maintenance – often connected to fissures in the volcanic soil. Sludge is not regularly emptied, so the risk of groundwater contamination is high. Recent water quality tests indicate that faecal coliform and nitrate levels exceed national standards.

In 2002 and 2003, municipal, state, and federal funds were allocated to construct fully subsidised sewerage for the downtown area to serve approximately 4000 Person Equivalent (PE). To date, only a fraction of the planned 7 km collector pipe is completed and there is no consensus on the treatment technology. In the meantime, some untreated sewage is collected in tank trucks and discharged at the municipal garbage dump, while the rest flows into nearby ravines. This situation reflects not only lack of vision from authorities, but also inequities in infrastructure allotments that favour the rich at the expense of the poor.

Although legislation sets clear guidelines for regulating waterborne sanitation, effective enforcement is practically nonexistent. The conditions in Tepoztlán are a reflection of the national situation. Indeed, even though law requires municipalities to treat their wastewaters, treatment plants are rare, while those that exist are either non-functional or operate below design efficiency. Moreover, the status quo favours unsustainable solutions,

such as sewage without treatment, and does not consider decentralised, low-tech, — but more sustainable — sanitation options. Furthermore, national law establishes a three-year municipal term with no possibility of re-election, seriously inhibiting long-term vision and strategic planning to address chronic W&S needs, while reinforcing lack of continuity in development programs initiated by previous administrations.

The TepozEco Municipal Ecological Sanitation Pilot Project addresses critical interrelated problems common to many Latin American municipalities: low sanitation coverage; wastewater-induced pollution — which limits access to safe water, threatens public health, and endangers ecosystems — and mismanagement of natural resources, including non-renewable nutrients for agricultural production. The project's integrated closed-loop systems approach, which focuses on sustainable management of separate domestic residue flows (urine, faeces, greywater, organic and non-organic solid waste), radically reduces water consumption, while safely recycling valuable nutrients into the soil.

### Impact of the project

TepozEco is organised around complementary subprojects, managed by interdisciplinary teams drawn from three technical components: Water and Sanitation Services, Urban Agriculture and Composting, and Environmental Education and Training. While generating a working example of applied ecological sanitation (ecosan) in a specific community, the wider objective of the project is to change the focus of the municipal W&S sector, including its regulatory and institutional framework.

The periurban town of San Juan Tlacotenco, an indigenous, water-scarce community of approximately 2000 people, is proving to be an ideal context to demonstrate a cost-effective, holistic ecosan model. Building upon community expressed needs and initiative, the San Juan subproject has facilitated the installation of 30 household-centered ecosan systems. CEAMA, the State Water and Environment Commission, subsidised construction materials, while the community provided labour. Current plans to construct 100 additional systems by mid-2006 are a reflection of acceptance by both the community and CEAMA. The long-term goal is to develop the first regulated ecosan town in Mexico without expectations of sewerage.

A key element of sustainable sanitation is the use of sanitised products in agriculture, resulting in improved food security and quality of life. Project activities support a youth group (Impetu Joven) in establishing a community eco-station to provide maintenance for the household systems, including collection, processing and recycling of organic by-products at their composting centre and plant nursery. The eco-station micro-enterprise is ensuring the action's sustainability while providing employment opportunities to discourage migration of valuable community members.

In the wider context, TepozEco has facilitated greater consensus between key municipal, state, and national stakeholders regarding adequate W&S regulations, mechanisms

towards sustainable use of water resources, and appropriate technologies for treatment of wastewater. This has included three parallel lines of action: lobbying for constructed wetlands as a viable alternative for municipal wastewater treatment, a strategic assessment of W&S conditions in Tepoztlán, and establishing sanitation guidelines within local building regulations. The wetland is now the preferred solution among decision-makers; discussions for establishing a decentralised organisation for W&S management are in progress; and the new building code awaits approval by the City Council. Whereas a few years ago sanitation was hardly mentioned, today the need to view sanitation as a system accessible to all is slowly permeating different levels of government.

Applied research has focused on promoting public and domestic waterless urine harvesting – collection, transportation, storage and application. These activities have raised awareness regarding water conservation and the benefits of urine as a fertilizer. By “demystifying” urine, the project has helped to sensitise people towards ecosan in general. Another micro-enterprise, in its pilot phase, is dedicated to construction, rental and maintenance of public portable male/female, waterless urinals – a unique opportunity for collecting and recycling “liquid gold”. Volumes collected have grown rapidly (by 240% compared to last year).

The Demonstration Centre displays working ecosan systems; provides information, training and support to the general public; and develops new prototypes or upgrades existing technologies. So far, the project has held 12 workshops, advised 139 families, and designed 22 systems for institutions and private households.

### Types of stakeholders involved

TepozEco is involved with a wide range of stakeholders, from local to international level:

#### **Tepoztlán**

- Families, user groups and local organisations in San Juan Tlacotenco, as well as other neighbourhoods (colonias and barrios) of Tepoztlán. Close relationships with youth and women groups have been critical.
- Local Government, including the town representatives (ayudantías) and municipal council persons.
- Comisariado Ejidal (local farmland management authority).
- Tepoztlán Valle Sagrado AC, representative municipal civil society organisation (CSO) formed under the auspices of a national sustainable tourism initiative.
- Colegio de Arquitectos (Architects’ association).
- La Jugarreta, which works with local youth, and other local CSOs.
- El Taller Artes y Oficios AC, collaborated in a diploma course, various workshops and the design and production of training materials.
- Various schools, from preschool through to the CONALEP, technical college based in Tepoztlán.
- Consejo Empresarial (Chamber of Commerce).

### **Morelos State and Federal Government Agencies**

- CEAMA – Morelos State Commission for Water and Environment.
- CONANP – National Commission of Natural Protected Areas (Saras/TepozEco is the only NGO on the Morelos State Advisory Board).
- CIMMA – State Children’s Environmental Summit. Saras/TepozEco plays an active role in the organisation.
- SEMARNAT-INE – Environment and Natural Resource Ministry / National Institute of the Environment.
- INDESOL – Ministry of Social Development supports ecosan capacity building.
- Secretaría de Economía y Comercio – Ministry of Finance and Commerce.
- Ministry of Tourism (Agenda 21).

### **National NGOs**

- Fundación Comunidad AC – has funded ecosan capacity building.
- Centro Mexicano del Agua, Guadalajara.

### **International organisations**

- UNDP / BDP / EEG – United Nations Development Program / Bureau of Development Policy / Energy and Environment Group.
- SEI – Stockholm Environment Institute / Sida – Swedish International Development Cooperation Agency – global EcoSanRes (Ecological Sanitation Research) program.
- NCCR-N/S – National Center for Competency in Research – North/South (Switzerland).
- WASTE advisers on urban environment and development – The international ISSUE programme funded by Government of the Netherlands.

### **Private sector**

- VERNA Ekologi – Swedish partner in EcoSanRes Network.
- Comercializadora GERALI S.A. de C.V., and ADDICOM, Mexican and South African waterless urinal manufacturers and distributors, respectively.
- CITA – Centro de Innovación para la Tecnología Alternativa, produces cement and fiberglass urine diversion (UD) seats and urinals.
- Peter Osvik AS – Norwegian industrial and furniture designer collaborates to develop more attractive user-friendly ecotoilet fixtures.

### **Universities and research centres**

- Alliant International University, Mexico City – Sustainable water management training and diploma courses.
- UAEM – Universidad Autónoma del Estado de Morelos – Department of Agriculture and Microbiology Laboratory for analysis of compost, urine and water samples.
- SLU - Swedish University of Agricultural Sciences / Department of Biometry and Engineering.
- SANDEC/EAWAG - Water and Sanitation in Developing Countries, Switzerland.

- AC CENCA – Instituto de Desarrollo Urbano, Peru.
- EPESA – Costa Rica

### **Networks**

- LaRedSeco – Latin American Ecological Sanitation Network, coordinated by Sarar.
- Red AGUILA – Latin American Urban Agriculture Network.
- RECALL – Latin American Rainwater Harvesting Network.
- Red de Género y Medio Ambiente.
- FANCA – Freshwater Action Network of Central America.

### Involvement and role of stakeholders

Sarar/TepozEco maintains a close relationship with many key international organisations, several of which manage important ecological sanitation programmes funded by their own national governments. The nature of these partnerships includes programme and strategy development, information exchange, capacity building, networking and financial support.

TepozEco receives core funding from EcoSanRes/Sida (Sweden) and UNDP/BDP/EEG, as well as targeted financial support from NCCR-North/South (Switzerland) and WASTE (Netherlands). The project has received funding from Mexican institutions such as INDESOL (Institute of Social Development), CEAMA, and Fundación Comunidad AC. Local partners that have made significant cash and in-kind contributions include: the Municipal Government of Tepoztlán, the Comisariado Ejidal, El Taller Artes y Oficios AC, Tepoztlán Valle Sagrado AC, and members of the population in San Juan Tlacotenco.

Support from international donors has been used primarily for funding technical assistance (i.e. the TepozEco project team) and small infrastructure facilities for demonstration. The construction of household ecosan units has been financed by user families whenever possible, and in the low-income demonstration settlement of San Juan, with materials subsidised by CEAMA. Families have provided some local materials and covered all of the labour costs (about 30% of total). Local government authorities have played a critical role in organisation and follow-up.

System monitoring and support services are being provided by local groups: Impetu Joven in San Juan for domestic ecosan system maintenance and Oro Líquido (liquid gold) in Tepoztlán town for rental and maintenance services of public urinals. With support from the Secretaría de Economía y Comercio, TepozEco is providing guidance towards developing these initiatives into sustainable micro-enterprises.

The project coordinates closely with a range of local, state and federal organisations in implementation of integrated municipal ecological sanitation strategies. The following matrix illustrates how some of these organisations impact in the different components of the programme:

	Integrated W&S management	Urine harvesting	Solid waste management & composting	Urban agriculture	Wastewater treatment	Greywater management	Public education
Local government	X		X	X	X	X	X
TVS	X	X	X		X	X	X
Ejidatarios			X		X		
NGOs	X	X	X	X	X	X	X
Consejo Empresarial	X	X	X			X	
CEAMA	X		X		X		X
Ministry of Tourism	X		X				
Ministry of Environment	X		X		X		X
CNA	X				X		
IMTA		X			X		
GERALI		X					
SEDESOL	X						X
Commercial associations			X				
National universities			X	X	X	X	X

### Long term commitment and targets of the project

When choosing sanitation systems, authorities seldom have the proper tools or background to evaluate environmental, social, economic, and health factors. Instead, conventional sanitation options are viewed as recipes to be applied in all circumstances, for all people, without performing a weighed analysis of these and other key issues. TepozEco is developing tools to steer the decision-making process towards sustainability, based on a strategic, multi-stakeholder approach to municipal planning. They include:

- Participatory methods, based on PHAST/SARAR methodologies.
- Open Planning of Sanitation Systems, developed in collaboration with EcoSanRes.
- Matrices for comparison of different sanitation systems, which include economic, health, environmental, and cultural aspects.
- Strategic Environmental Assessment for W&S planning.

These tools have helped to facilitate a productive dialogue with both civil society and government, better understand each system's functions, and refine criteria for adequate sanitation.

Prevalent national political and structural conditions inhibit long-term municipal planning because every three years a new administration takes over – including W&S service providers who are usually appointed by the municipal president. This makes establishing a decentralised water utility with increased community participation crucial to foster the proper environment for sustainable use of water resources. TepozEco's work in this direction is well underway.

Probably the strongest barrier to W&S sustainability is general lack of awareness and information about medium and long-term effects of present trends. Through its environmental education component, TepozEco is reaching many layers of society to share information and promote behavioural change that will result in more coherent practices. Perhaps the greatest impact, so far, has been on key institutional stakeholders who have an increased awareness on these issues and are more committed to addressing them. Experience has shown that there is more resistance to change where waterborne sanitation systems are already in place, even when they are not sustainable. It is also clear that if people see well functioning examples of ecological systems and have economic incentives to install them, such resistance diminishes. An unexpected outcome has been that state – rather than local – authorities have provided greater economic support to pilot ecosan activities.

A key strategy of the project is to “put ourselves out of a job” by facilitating the creation of a decentralised W&S institution that can provide the appropriate framework of regulations, incentives and tariffs to promote sustainable practices, on the one hand, in partnership with small and medium sized enterprises to share in service provision, on the other.

The project has generated significant learning in a critical, emerging field and international agencies have responded accordingly. At this stage, funding for further R&D is crucial so that technology and capacity are transferred to local communities. The next phase will focus on institutionalising ecosan locally and disseminating information and capacity to interested partners in the rest of Latin America. EcoSanRes, the main international partner, has committed itself to at least two more years of funding, while the project generates additional support within federal housing, urban planning, sustainable agriculture, and poverty alleviation programs.

#### Originality and innovative ideas from the project

If governments of developing countries seriously expect to achieve the MDG sanitation target, they must realise that conventional waterborne systems are simply too expensive and unsustainable to cater to most of the population. With ecosan it is possible to reduce domestic water consumption by as much as half, recycle a significant amount of greywater,

increase soil fertility (through application of sanitised products as organic fertilizers), and close the loop to urban agriculture. Ecosan addresses water scarcity, improves health and food security, and diminishes reliance on non-renewable fertilizers, such as phosphates.

Through participatory and social marketing approaches and a range of products catering to distinct socio-cultural tastes and habits, TepozEco is demonstrating that ecosan solutions are suitable for different socio-economic population segments. Water borne double-flush urine diversion (UD) toilets, pioneered in Sweden, offer an alternative for those who have resistance to dry sanitation. Earth composting toilets, such as the fossa alterna and arborloo, are low-cost alternatives to – and major improvements on – pit latrines and open-air defecation. The UD dry toilet has been demonstrated as versatile and adaptable in many regions: East Asia, Latin America, Scandinavia, and Africa.

In partnership with local manufacturers and foreign product developers, TepozEco is researching and testing new technologies and products to make ecosan more available and acceptable. In conjunction with GERALI (Mexico) and Addicom (South Africa), an innovative, low-cost odour trap for urinals and UD seats is now being produced in Mexico. New models with this trap should significantly improve acceptability of and access to ecosan. In collaboration with international specialists, TepozEco is also breaking new ground in the development of greywater treatment systems that are easy to maintain, inexpensive and effective. Mulch beds show great promise for domestic treatment and reuse.

Consistent with the vision of ecosan as a complete system, ecotoilet models in San Juan include rainwater harvesting, an integrated washbasin, greywater treatment in mulch beds, and urine collection for later application in agriculture. Families also separate organic and inorganic residues and the composted organic fraction is incorporated into their fields. In the next phase, modular units will include options for bathing and washing facilities with proper greywater treatment, and more emphasis on integrating the module to the house.

Perhaps the most innovative aspect of the project is to involve different sectors of the population in efforts to ensure quality and sustainability, not simply the quantity of units built. The use of participatory techniques has been crucial to allow community participation, personal involvement in decision-making processes, appropriation of ecosan systems, and adequate operation and maintenance. Preliminary work involved a gender-oriented evaluation of sanitation facilities and practices, which sparked women's participation in the remainder of the process. During the early stages of the project, TepozEco also provided ecosan training to motivated youth, who now offer monitoring services, establishing a micro-enterprise, and enjoying improved status within the community. Local masons were trained during the construction of dry toilets, so they are now capable of replicating these systems.



## Costs involved

The Swedish EcoSanRes Project coordinated by the Stockholm Environment Institute (SEI) has provided core funds for the TepozEco Project. Since the programme is conceived mainly as technical support, most of these funds have been applied to salaries and fees, as well as administrative costs, for a multidisciplinary team of part-time and full-time ecosan experts and local counterpart staff (e.g. architect, biologists, agronomists, environmental and water management engineers and social scientist). Women have consistently made up more than 50% of the professional team.

Another major source of funding has been the United Nations Development Program (UNDP/BDP/EEG), primarily for research and international outreach. Recent research has focused on groundwater quality for strategic assessment of W&S; vulnerability and risk analysis as a baseline for sanitation regulations; and development of guidelines for urine application and faecal composting. Outreach activities consist of attending or hosting seminars, conferences and training relating to ecosan and appropriate technologies. Recently, team members gave presentations at the Third International Conference on Ecological Sanitation in Durban, South Africa. In September the project hosted an international Workshop on Urban Agriculture and Ecological Sanitation, with participants representing several Latin American countries (see WWF4 registration).

During 2004, the project received funding from the NCCR-NS/EAWAG (Switzerland) PAMS (Partnership Actions for Mitigating Syndromes of Global Change) initiative to develop a urine harvesting system. Approximately half of the budget was used to pay salaries and fees of product designers and social promoters, while the remaining half financed initial product development and the construction of 12 portable male/female urinals. Equipment, such as a pump and containers ranging from 20 to 1000 litres, was also purchased with these funds.

Currently, NCCR-NS/EAWAG is funding activities that will help ensure sustainability in the San Juan sub-project. The project has channeled a portion of these funds to assist the Impetu Joven youth group in constructing the eco-station as a support mechanism to the 30 domestic ecosan systems.

In addition, WASTE--Advisers on Urban Environment and Development, The Netherlands, through their government supported ISSUE program, has provided a small grant to assist in regional outreach, networking and capacity building.

Perhaps most important is the fact that international donor funds have been used to leverage local and national resources to support ecological sanitation initiatives, including input from local families, the municipal government, the farmers association, CEAMA, Fundación Comunidad AC (with sponsorship from a large private enterprise), and INDESOL, among others.

## Conclusion

TepozEco is one of three urban ecological sanitation pilot projects supported by EcoSanRes (along with China and South Africa) and shares research experiences with other ventures in Africa, Asia, Scandinavia and Eastern Europe. These local actions are designed to implement and demonstrate alternatives (or complementary approaches) to conventional sanitation practices. As such, there is a strong emphasis on research and development to adapt technologies to local conditions.

TepozEco is unique in that, unlike other ecosan pilot projects, which are primarily developing new systems, this project works in an established settlement. It must, therefore, compete against conventional systems and faces the obstacle of dwellings that were not conceived with ecosan in mind. TepozEco has thus been described as “retro-fitting a small town”. The challenge is partly technical: to design and refine ecosan systems for management and treatment of separate domestic and community “waste” flows – human excreta from UD ecotoilets, greywater, and organic solid waste. However, the project is also confronted with the more difficult task of establishing an appropriate framework for ecosan to be considered in policy, planning and budget allotments, while most government decisions and programs are geared towards often unsustainable waterborne solutions.

Since its outset, the TepozEco project has pioneered the links between sanitation and urban agriculture. Decreasing soil fertility, escalating prices of chemical fertilizers, and contamination of water bodies due to leaching and runoff of agrochemicals, highlight the need to develop alternatives that recover the valuable nutrients found in human excreta for agricultural purposes. Adequately stored urine is sterile and most nutrients in human excreta are found in urine – in forms ideal for plant uptake. Aside from its direct use in agriculture, urine can improve composting processes, both as an activator and accelerator. Compost may then be used as a soil conditioner.

Public collection of urine is feasible and could provide a significant source of nutrients for urban agriculture. Nevertheless, given present agricultural practices, the total potential amount of urine in the municipality would be insufficient to substitute for all commercial fertilizers. To fertilize large-scale crop production, it will be advisable to combine urine application with other sustainable, organic agricultural practices. Urban urine harvesting (UH) can also have significant impact on water conservation, resulting in environmental, health and economic benefits. Finally, the project has demonstrated that local population – at least in Tepoztlán – can, through demonstration and education, quickly overcome initial cultural hesitation or rejection.

It is likely that urban and periurban collection services for surplus ecosan domestic by-products would have to be subsidised in the initial phase, just as wastewater treatment plants generally are. The advantage, however, is that a neighbourhood or community eco-station and composting facility would ensure proper treatment while encouraging the adoption of sustainable sanitation practices. Lobbying for the inclusion of UH within

existing state and municipal legislation is crucial to allow and encourage activities to close the nutrient loop, while maintaining environmental and health risk standards. The WHO guidelines for the safe use of urine in agriculture, proposed by EcoSanRes, are a major step in that direction.

By questioning the prevailing water-focused paradigm, TepozEco is demonstrating a feasible alternative to improve health, conserve water, and prevent pollution – while safely returning valuable nutrients to the soil for improved agriculture and food security. It is indeed clear that in water-scarce communities, ecosan can be a leapfrogging mechanism to bypass expensive, wasteful and non-functional conventional infrastructure, while obtaining similar standards and additional benefits. Just as cellular phones now thrive in areas that awaited cable telephones for decades, we expect ecosan to provide a long sought-for solution to almost half of the world's households. We are thus working today to ensure that this option for the future is available when needed.

The project has contributed significantly in the regulatory and institutional framework. Undoubtedly a great challenge of the 21st century is to shift the momentum of the W&S sector, which is currently driven by linear, end-of-pipe uni-sectoral thinking, into a more holistic and sustainable perspective. On the one hand, it is becoming increasingly evident that the challenges of the MDGs cannot be addressed through conventional centralised top-down approaches. On the other, existing laws, institutional arrangements, and financial mechanisms seriously inhibit, if not prohibit, alternative, community based decentralised actions. It is for this reason that TepozEco has joined hands with other national and international experts to reconsider the setting in which present W&S programmes operate, while encouraging local, state, and national stakeholders to engage in a constructive dialogue to consider testing sustainable alternatives on a pilot basis.

Although solutions will be context-specific, the basic approach can be readily applied to most of Latin America and other regions. Indeed, this is already happening through south-south (and north-south and south-north) partnerships and exchanges of ecosan technologies. Inspiring, training, and supporting others are an essential part of the Sarar/TepozEco mission. During the next phase, activities will intensify the delivery of technical support and capacity building services to community groups, NGOs, private entrepreneurs – such as housing developers – and the general public. One of the most important by-products of the process has been the consolidation of a skilled, experienced and committed team of ecosan professionals who are poised to share their unique knowledge and capacity.

Finally, perhaps the key achievement of the project has been the number of satisfied local “customers”, who, in turn, generate increased demand for ecotoilets in San Juan. The project has demonstrated that by providing an aesthetically appealing, functional and affordable ecotoilet system, it is possible to overcome the stigma of the “dry toilet” as the inferior, temporary solution only until sewerage becomes available. These lessons have also underscored the need to pay more attention to design elements to stimulate demand,

financial and credit mechanisms to increase access, and improved service delivery and maintenance support to assure user satisfaction and sustainability. All of these, together with an appropriate regulatory and institutional environment, will be critical for institutionalising ecosan in Tepoztlán, and beyond.

## 8. Assessment of ecosan technology in Lima (Peru) and its possible applications

Anne Delmaire and Ron Sawyer

### Introduction

Despite Latin America being the second biggest reservoir of fresh water of the world, 70 million inhabitants lack drinkable water. Yet, the basic services of water and sanitation in a suitable house and a safe habitat are fundamental human rights.

According to global data, 31 countries with an approximate population of 480 million inhabitants have chronic lack of fresh or drinkable water. By 2025, 48 countries will face this situation and the Peruvian coast is among the most affected along with Ethiopia, India, Kenya, and Nigeria (Population Reports). Providing basic services would reduce health problems for more than 6 million people in Peru.

Peru is located in the central western part of South America with a land mass of 1.285.216 km<sup>2</sup> divided into three distinct geographic regions, coastal, sierra (mountain region) and tropical forest. The Constitution of 1993 divided the country into 24 departments subdivided, into 194 provinces, which in turn are divided into 1818 districts. Lima is located on the central coast of a country on an extremely barren strip of South America desert and will continue to need urgent attention.

The National Statistical Institute (INEI) puts the current population of Peru at 26.3 million, with a growth rate of 1.9 % over the last decade.

Studies indicate that by 2025 the Peruvian coast will have only 1.000 m<sup>3</sup> per person per year of fresh water available. Sanitary coverage in Peru is also low. Only 52.7% of the population have a domestic connection, with another 5.2 million people using some kind of latrine. This leaves 6.5 million people without any kind of water or sanitary service. (OPS-OMS, 2000)

The investment required to provide adequate water and sanitation service and to fulfil the Millennium Development Goals (MDGs) in Peru by 2015 is US \$3.59 billion US \$1.44 billion for water and US \$2.15 billion for sanitation.

In Peru more than 2.6 thousands of millions of cubic meters (MMC) of water are produced each day of which 1.5 MMC are produced in Lima. Due to a lack of investment in treatment infrastructure, no more than 20% of this waste is treated, and this figure is only 4% in Lima. The rest is thrown into rivers, the ocean or the ground. Of the 53 coastal rivers, 16 are contaminated by mining company waste and from garbage dumps. At the moment, the distribution of water is rationed in Lima; but drinking water is still used to irrigate parks while there are urban areas around Lima which lack drinkable water.

These systemic problems need a long-term, progressive and sustainable solution. The Peruvian government needs to promote policies based on the fact that fresh water for human consumption is an exhaustible resource. Ensuring that everybody has enough clean water will require a national collective will to modify personal behaviour, and structural changes in the way that the government manages of water and sanitation. This objective motivated NGOs like CENCA and Gt. Ecosan Peru to promote ecosan in Peru. They have supported demonstration experiences and pilot projects that have begun to impact on users and have been adopted and implemented by other NGOs like Alternativa.

### Research Objectives

The aim of this research is, to understand the current situation in relation to the eco-sanitation systems that two NGOs, CENCA (the Urban Development Institute), and Alternativa, have implemented in different parts of Lima, and to evaluate the performance of the ecosan technology they adopted. Understanding how to improve the acceptability of this technology and satisfaction levels by inhabitants, will be a major step towards scaling up ecosan technology and developing strategies to apply the system in other areas.

### Research Questions

The main research questions that this case study aimed to answer are as follows:

- A. Which key technological elements of the ecosan systems are considered the most important for their performance?
- B. What future interventions and planning strategies are needed to solve the principal problems in the implementation and performance of the ecosan technology successfully to replicate this system in other places?

Some specific questions will help to answer the research questions.

- 1. What characteristics are common to the eco-sanitation systems of both NGOs?
- 2. How far do the systems achieve water quality, compost quality and user satisfaction?
- 3. How satisfied are users with their new sanitary systems?
- 4. Which changes to the basic technology have users carried out after the systems were constructed?
- 5. To what extent are the inhabitants willing and able to pay for improvements in sanitation and drainage?
- 6. Why did some inhabitants with drainage and sanitation problems not opt for ecosan?

## Methodology of the research

The research methodology consisted of several components:

- Literature research to gain insight on the following issues:
  - Sanitation and drainage infrastructure coverage in the areas of study.
  - Practice and lessons learnt from different projects in sanitation with ecosan systems.
  - Treatment of grey water, faeces and urine.
  - Environmental impact and quality standards for grey water, compost and urine reuse.
  - Management of eco-sanitation.
- Collecting necessary data and documents relating to natural, socio-economic conditions of the areas of study; for example topography, population density distribution, population origin, culture and so on.
- Conducting household surveys in the areas of study to assess the status of the eco-sanitation system, what the users consider its main problems and the willingness to pay to solve these problems.
- Comparison of survey results between areas, using statistical methodology for evaluation.
- Collection of samples of treated grey water and compost to analyse if they are of a quality and safe standard to be used.

## ECODESS concept

ECODESS (Ecology and Development with Sustainable Sanitation), is a technological system based on an ecological approach to sanitation; an integrated micro-system of collection, treatment and use of domestic solid and liquid waste. It is based on two basic principles that are completely opposite to the conventional system of water borne waste. The principles are 1) avoid contaminating water mainly by stopping the use of drinkable water to flush toilets (which would reduce by more than 50% the drinking water consumption per person per day); and 2) use domestic liquid and solid waste to irrigate and fertilize green areas.

ECODESS, in most cases, is divided in two sub-systems:

- **A domestic system**, located entirely in the house, that includes a complete bathroom, laundry and collection network for grey water and urine, that culminates in a “fat-keeper container” to retain fats and suspended solids, before the water goes for on site treatment and then runs through a channel into the local system. The domestic system also includes two composting chambers where solids are collected to turn into compost.

- **A neighbourhood system**, with a second collector network which collects the water coming from all of the units that use the ECODESS system and channels it to another filter before storing it in a cistern, from where it will go to an irrigation network to maintain green areas. ECODESS re-uses grey waters in urban irrigation, closing the loop with consumption and avoiding the need to use drinkable water for irrigation.

## The experiences of CENCA and Alternativa

### *CENCA experience:*

CENCA, the Urban Development Institute, started to work with ecosan in 1998 when a pilot project was implemented in the district of San Juan de Lurigancho, one of the most densely populated districts of Lima with more than 800,000 inhabitants. The pilot included 36 ecological toilets in the houses and an irrigation system for 700 square meters of green area. Since then, two more additional projects have been developed to the east of Lima. One is in Casa Huerta La Campilla of Cajamarquilla implementing 12 ecological toilets where the treated grey water is used to irrigate trees, and other is in Los Topacios of Nievería including 43 ecological toilets where the grey water cannot be used for irrigation, due to the geography of the area. CENCA has also been consulted by other groups who have implemented ecological toilets at institutions and households outside Lima, for example in mountain areas.

The pilot project was selected by the program APGEP SENREM/USAID from more than 150 projects to be executed. Its successful execution has demonstrated another viable alternative for development of a worthy, healthy and sustainable environmental and economic habitat, so in 2002 this project was recognized and awarded the VI edition of the ECO-Efficiency Prize by the Pontificia Universidad Particular Católica of Peru and Coca-Cola.

CENCA and other organisations have formed a National Work Group of Ecological Sanitation, GT. ECOSAN PERU, made up of 30 institutions including three universities, two local governments and a number of NGOs and organisations including Alternativa. The objective is to promote and spread Ecological Sanitation in Peru by developing experiences that generate policy proposals in the agriculture and sanitation sectors. This means proposing laws that promote the advantages of using organic nutrients from urine and treated sewage for agriculture, re-using treated grey water for the irrigation of green areas, constructing ecological toilets and implementing alternative sanitation programmes to make urban areas healthier and more ecologically sustainable.

### *Alternativa experience:*

Alternativa is a NGO that focuses on the north of Lima, in this case in an area called Ciudad Nuevo Pachacutec, in Ventanilla. Ciudad Nuevo Pachacutec was a deserted area close to the sea where there was only sand. In February 2000, it was declared the new home for people who were ordered by Alberto Fujimori's government to leave Villa El



Salvador, in the south of Lima. A total of 10,000 families were relocated, after they had squatted on private land in Villa El Salvador. At the beginning, the government gave big support to this new area, but two months later, in April 2000, the government of the country changed completely and the support from the new government for this area was much lower. This change caused a drastic increase in the mortality rate of the population due to lack of fresh water, drainage and sanitation, lack of decent food, high humidity and the bad condition of the sandy land together with bad housing conditions, with most homes made from mats.

In 2001, Alternativa, together with German Agro Action, intervened in Pachacutec to meet short term basic needs for water, sanitation and food security. They established a project to build reservoirs of water at the top of the dunes to provide a gravity feed water system to all the sectors through public water pipes. At the same time, they developed another project in two stages. They selected 70 families in each of the two stages to implement 140 ecological toilets with the ecosan technology. They also opted for the version with two composting chambers, a fat keeper container and a wetland for the treating grey water and urine. After in situ treatment, the liquid was used to irrigate a green garden that each family had at their home. Alternativa also provided a system to irrigate the green garden and plants, mostly Lucerne (alfalfa), to feed rabbits that the NGO also provided with the aim of increasing the amount of meat in the family diet.

In the second stage of the project, Alternativa attempted to solve problems shown up by the evaluation of the first stage. The project had not achieved its expected results, as will be shown later. It is significant that Alternativa did not know the ecosan technology before they implemented it, and they opted for this solution without visiting any other examples in Peru. To solve their lack of knowledge about this technology, they contracted one of the engineers who had been working with CENCA in their first project with ecosan.

## The research

To answer the research questions the first task was to identify the main stakeholders and design a way to work with them to get the necessary information. Two NGOs were involved namely CENCA and Alternativa. The research has focused on:

- Interviews with the two NGOs, CENCA and Alternativa.
- The daily work at CENCA as they worked on existing projects and developed new ones about sanitation, and in their work as coordinators of GT. ECOSAN PERU developing new actions at the national level.
- A survey of 80 users of ecosan systems and 20 non-users (40 users and 10 non-users per NGO).
- An evaluation of each part of the implemented ecosan technology (wetland, irrigation system and so on) in all 80 ecological toilets.
- Interviews with community leaders, those responsible for sanitation at the Environment Department of The Housing, Sanitation and Constructions Ministry, the people in charge of the fund "Mi Vivienda" ("My House") which builds new houses for the people

with low incomes (and is part of the same ministry), other NGOs who have worked with ecosan toilets or the treatment of grey water by wetlands, and teachers and students from the Agraria University who have done related studies.

- Workshops with users at some communities (this was only possible in the CENCA project area).
- The collection of other data of interest for the research.
- Visits to other experiences with ecosan toilets, ecosan technologies and non-ecological solutions in other areas of Peru with different characteristics from Lima, (for example the Mountain Region).

It is planned to continue with the research by analysing water and compost from at least two toilets to check the viability of the system, and by collecting more information and documents. An agreement has been signed between GT. ECOSAN PERU and La Agraria University of La Molina which should allow data to be analysed in the University labs.

The survey

*CENCA survey:*

The survey was done in two of the three locations where CENCA has implemented ecosan. Los Topacios of Nievería and Casa Huerta La Campiña of Cajamarquilla were chosen partly because they are close to each other. However, maybe the most important reason was that the NGO currently is not developing any action in San Juan de Lurigancho, the third location, and because the place is quite dangerous and interviewing people is more problematic. The questionnaires were therefore used in the two locations where the NGO is in a certain sense present. There is the added benefit that the two selected locations are different from each other, in that one uses treated water for irrigation and the other one does not. The characteristics of the people in both places are also different.

As main characteristics of the study areas it can be said that:

- Both areas were rural and are becoming more urbanised.
- Residents have very low incomes.
- There is an unplanned development process, with rapid building of houses, sometimes in a chaotic way.
- There is inadequate supply of or lack of water, sanitation and drainage infrastructure. Wastewater is discharged in an uncontrolled way and the drinking water is of very low quality.

A description of both communities is derived from the ten day survey carried out in 50 households. These days were not consecutive due to the difficulty in finding adults at home, since families work in the fields all day. To solve this problem the areas were visited mostly during weekends. There was some resistance on the part of householders to allowing the interviewer to access their homes and toilets. To increase the likelihood of being accepted, the interviewer took part in some NGO activities in these communities in

the weeks preceding the visit and organised two workshops for users of ecosan technology. Because of these difficulties, it was decided not to pre-select households to receive a questionnaire, but simply to interview users who were present when the survey was done.

This section provides a description of the socio-economic characteristics of the community, satisfaction levels with the ECOSAN system, its weakness and strengths and an evaluation of their condition.

## **Results**

70% of people interviewed in the study area were female and 30% were male. Surveys were done during the hours of daylight and the men often returned from work later. However, around the same percentage, 70% identified themselves as head of households.

The vast majority of the houses (87.5%) surveyed included four or more residents, most of them permanent.

All of the houses had a property certificate: the area is still considered agricultural land and the inhabitants have formed an association to process the certificates. This is the same association created to work with NGOs to build a network of water connections to the well. Each household pays only 5 soles/month (1.25 euro) for the water for the association to look after the well and maintain the pipes. As this is totally independent from the regional government, the only people with access to the system apart from the local association are technical staff from the Health Ministry.

Users have no domestic water connection but buy water each day from tankers. The price they pay for water is much higher and they try to use as little water as they can. As will be seen, this affects the operation of the ecosan system.

Only one person interviewed used to have a conventional flush toilet. The others used to go in the countryside or they had a latrine. Only one still keeps the latrine as a second alternative toilet at home. From all the people interviewed, only one family is not using the ecological toilet but goes in the countryside instead. They don't feel completely comfortable having a toilet inside their house and all the substances that it involves. Some members of this family can hardly speak Spanish, only Quechua, and this could be a clue that they do not find the changes in their society easy.

All the ecological toilets are built as an integral part of the house, and made of the same material (in this case bricks). They are always inside the house or at least inside the area marked for future expansion. Users paid with the support of a micro-credit scheme for the toilet and the network of pipes inside the house. The NGO CENCA gave them the composting vaults, the fat keeper container, the wetland, sanitary equipment and the network of pipes up to each house.

In Nievería, most families had plants on which to use the fertilizer. Families in Cajamarquilla lacked plants due to the difficulty of finding the right type of plants.

Most families did not report specific problems. However, some noted that problems appeared if they omitted to do the weekly cleaning of the fat keeper container. The most common problems were that the wetland became jammed and the system became smelly. In a couple of cases, small aquatic worms were observed in the fat keeper container if there had been a long period since it was cleaned. None of the toilets presented odour if the mixture (3 parts of lime and 1 of sand) was added after each use. In some, small mosquitoes and butterflies were apparent, a situation that users associated with the arrival of the summertime. Some users opted to dry clean the toilet and the upper parts of the composting chamber, and to use a higher proportion of lime after each use together with an insecticide. Some families also cover the top of the aeration pipes of the composting vaults and the windows with mesh. However, some toilets don't have any kind of door and sometimes only a piece of plastic.

To prevent the system getting jammed up, most families had placed filters at the waste pipe of the shower and the washbasin to collect hair and other solid waste before it got into the system.

In a couple of toilets, the urine vault was jammed because the pipe is quite narrow and sometimes children leave paper in the vault. The wetlands and fat containers were built mostly on the ground outside the house and as the area is very sandy, the dust sometimes gets into the system jamming it. It was recommended to clean the wetlands and the stones inside and to use bigger stones so that the dust would not cause jams. Some people build a kind of barrier around their wetlands to prevent the dust getting in.

All the users said they were very happy with the system and with the maintenance. They admitted that at the beginning, they were sceptical about such a different toilet, but they have got used to it and find it easier to work with. They know that they have to be more careful about children and elderly people but still everybody is happy with the system. They appreciate that the whole community has to get into hygiene habits like taking a shower (a shower is included in the toilet infrastructure). At least three new families, neighbours of those who had benefited from the project, had designed their houses to include an ecological toilet and these were operating perfectly. There were many more families interested in having one.

These communities have been able to organise themselves successfully and the organisation they created in the implementation stage still exists. They organise and do the monthly cleaning of the general networks together. Significantly, health indicators have shown a huge decrease in the number of people affected by diseases such as cholera and tuberculosis.

### *Alternativa survey*

This survey was done in Ciudad Nuevo Pachacutec. It was intended to do the survey in all the different sectors according to the number of toilets per sector but this proved impossible due to problems in finding householders in, and in identifying the houses. As a result, the interviewer identified houses on his own in an area of 532 hectares.

The main characteristics of this study area are almost the same than the ones of the areas of the previous survey. The main differences between them is determined by the origin of the people living in Pachacutec, most of them young families from Villa El Salvador (in the south) used to receiving help from the State, NGOs and other organisations, so that people are not so used to working to survive, compared with the people from Nievería. The physical characteristics of this landscape very close to the sea are completely different. Agriculture is almost impossible because all around are dunes, there is no water despite high humidity, and the wind is quite strong. Most houses are made from woven mats and plastic. Only when the economic situation of the family is quite good do they have the possibility to buy a wooden house.

The survey of 50 households took place over eight days, (not continuous). There was a problem that many people were drunk during the weekends, when the survey was done. The interviewer tried to make contact with the leaders of different sectors, but relations between them and the NGO Alternativa was not very good, so in many cases so it was not a very useful idea. Contact with one inhabitant who was involved with the implementation of the project was the biggest help as he provided information about the location of houses with ecosan toilets.

The following section give an idea of the socio-economic characteristics of the community living in the area, their satisfaction with the ecosan system, the weakness and strengths of the system and the state of the project at the point of the evaluation.

### **Results**

The population interviewed in this area had the same profile as in the other area – 70% were female and 30% were male. This could be due to the high number of single mothers in the area and the greater likelihood that housewives would be at home. In this case, 85% identified themselves as head of the household. It should be noted that 65% of those interviewed were in the first stage of the project initiated three years ago.

None of the surveyed households had less than four people living there, and almost one in three (27.5%) had more than six people.

The vast majority of households interviewed had a property certificate, but those with greater economic problems did not have one. In this young town, there is no domestic water connection but they get the water from public water stands. Families paid an average of 34.28 Soles/month (8.5 euros) for water. Although the water at the stands is of

better quality than what used to be sold through water tanks, it is not as good as water that flows to the home through a network. Here it is stored many times and that, in general, decrease its quality. First, it arrives at the reservoir in a tank and then it is stored in the reservoir until employees fill the containers of each family with the help of hoses connected to the public water pipes.

In this case, everyone interviewed had a latrine before they received the ecological toilet and all the toilets visited were being used. In most cases, the ecological toilet wasn't being used properly.

In this project all the toilets were built as an independent room outside the house, in the courtyard. This could be an important factor in concluding that users never understood the toilet as an integral part of their home and did not adopt hygienic habits as a daily practice. There is no washbasin inside the bathroom and the one placed outside, is in most cases, so high that nobody can use it. Sometimes it is almost taller than the users.

Another important aspect is that people here did not have to pay anything for the system, as the NGO gave it to them for free. Because of this, users didn't accept any responsibility for the system. A present is not as valued as much as something that you have paid for.

Many factors emerged about the way the system operates.

- Only one household surveyed still operates the complete system: ecological toilet, green garden and rabbits.
- Lime was only found in the 15% of the toilets. The rest didn't have anything, so the composting vaults had very high humidity. In all these cases the urine was entering the composting chamber, especially from the toilets installed in the second stage, because the design of the vault was too small and sometimes toilet paper was included. There was a strong odour, with many mosquitoes and butterflies. Some big worms were observed in one vault. The high humidity inside the vault was leaking around the door seals.
- Plants were only found in wetlands at two of the surveyed ecological toilets and the rest were not working properly. In most cases there were no plants and in many, the place for the wetland was used as water container or other things. Many plants had died due to the weather. Many people said that the plants had a bad odour and attracted mosquitoes, and so they removed them.
- It was observed that the design of the fat containers in the first stage was too wide and did not have enough depth to work properly. This aspect was addressed in the second stage of the project but the fat keepers were now too narrow and too deep. Lack of a well-functioning fat keeper container causes problems for wetlands.
- The amount of water in the system in many cases is very low because almost nobody uses the high washbasin, and this was a cause of very high concentrations of urine in the fat keeper and the wetland, and therefore a cause of the bad smell. To solve this problem, many users closed the connection of the water and urine pipe with the

treatment system and connected it instead directly to the ground, consequently polluting the top layers.

- There were problems with the toilet construction. The cement was poor quality and cracking. In many cases, the urine vaults were jammed due to the small diameter of the pipes and the stagnant urine was a big danger for the users of the toilet.
- People said that nobody had told them to clean the fat keeper container weekly, so some of them never had been cleaned. In general, users in this project took the view that if a maintenance problem appears, the NGO should solve it. They never thought of the toilets as being their responsibility. In many cases, people asked the interviewer for more support from the NGO. Sometimes she received complains about lack of attention from the NGO two years after the ecological toilets were built.
- Depending on situation, families continued with green gardens and rabbits, or not. In general, there are not many green gardens due to the difficult weather, lack of time to take care of a garden, or the mosquitoes that appeared when the wetlands were malfunctioning. In spite of problems, those gardens that were being cultivated looked good and the agricultural products were consumed by rabbits or ducks.
- In general, families were satisfied with the rabbits project. Some people had more than 60 rabbits. Families eat them or sell them at the market. However, many people do not have any today, because they had no time or space or they ate them before the number of rabbits increased to a sustainable number. Only those who had enough time to take care of them or to run the rabbits as a family business, still have them.

Although most systems surveyed were not working properly, almost all users expressed themselves very happy with them and considered them very easy to maintain. It is important to point out that before this project, the only system they had was a latrine which filled up after a maximum of one and a half years. For them, this toilet is very useful as they do not need to build a new one every 18 months. Despite the fact that they are using the new toilet in the same way as a latrine and the consequences can easily be seen to be worse, the hygienic aspect is not seen as so important, as with the new toilet, they have privacy, WC and a shower.

However, five houses in the survey had abandoned the ecological toilet, turned it into a latrine or destroyed it to build a latrine because they had not been satisfied.

Due to the big distances between one ecological toilet and the next, there was no kind of cooperation between users to solve frequent problems and no common body of knowledge. The neighbours had almost no idea of how the ecological toilet operates, but everybody showed their preference to have one.

## The interviews

From interviews with different departments of the Household Ministry, it is clear that for them the main problem is the lack of decent houses. They have designed some plans to construct houses in the more problematic districts of Lima. And although one of their plans

is to increase green areas, they do not have any plan to provide the amount of water that these would need. Since there are problems in providing water to the whole of Lima, they should recognise that they have a problem that is increasing over time and start to think how to solve it. After the interview, they asked the NGOs that had worked with ecological sanitation to tell them if that would be a good option for the new houses they have to build.

They are very interested in the system and would like to opt for it, but the problem for them is how to include it in the National Regulations and prove that the system works and is safe for human health and plants. CENCA is working with them to try to develop a pilot project to show that the system is valid or use one of the projects that the NGO has already developed to do the necessary studies there.

In the same way, the GT. ECOSAN PERU is working with all the NGOs and organisations that are interested in this. They intend to check all the projects that have been done in the country related to ecosan, ecological toilets, the treatment of water using wetlands and the composting process to try to arrive at the perfect design for the future. At the same time, they are also working to try to get approval of the system from government, to develop a proposal for the Regulations.

Ecosan is growing quite fast in Peru, not only at NGO level, but also at government level which is much more important. Without government backing, all the projects that already exist would be illegal for ever and not useful for the future, because as soon as a conventional system arrives in those places, the ECOSAN systems would be cancelled.

In the meantime, until the system is known by everybody, one of the most important aspects of this new technology is the way in which implementers work with local communities. It is important to take into account the characteristics of the inhabitants and give them correct knowledge on how to use the system and keep it in good running order. An understanding of ecosan has to be present amongst all the stakeholders.



## Concluding remarks

Sanitation is still referred to as the Cinderella of the drinking water sector, the poor relative who is put in second place and must remain out of sight. Yet, as this occasional paper has described, better sanitation has large environmental, socio-economic and health benefits. If sanitation is the poor relative, the question should be how sanitation programmes can be improved to focus on the missing slipper and the path to the happy ending.

Many of the main points and possible solutions which should be considered regarding environmental sanitation have been discussed in these case studies. These issues can be reflected in the following diagram based on the key challenges. The “need for focus” list in the table reflects those areas which have been shown to need most attention – these are the issues which will help to find the ‘missing slipper’. They need to be taken into consideration to create successful environmental sanitation programmes, for it is only through experience that we learn how to move into the future.

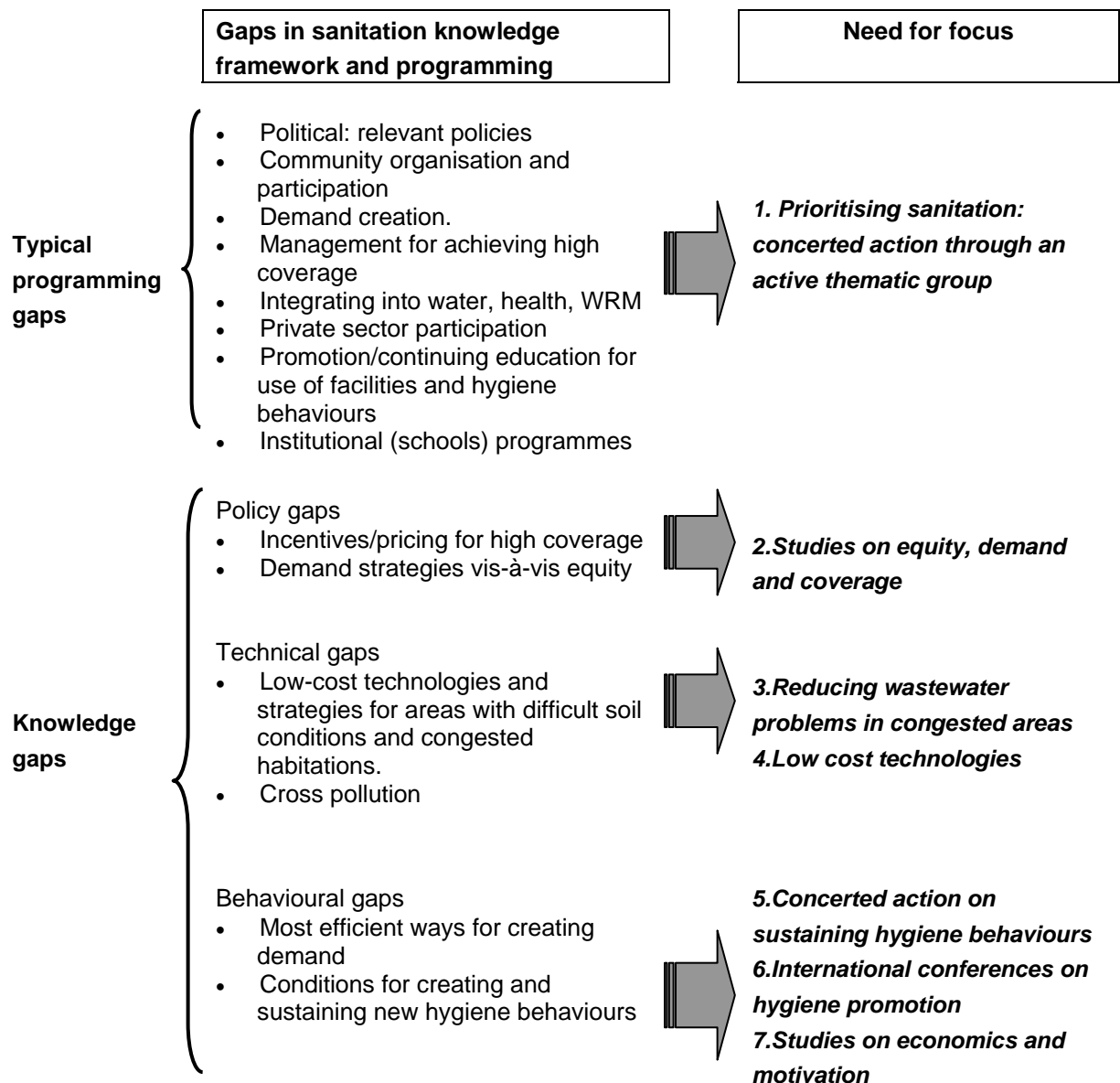


Figure 1. Sanitation Gaps

As a final note to the reader, we point out again that this compilation of environmental case studies is an on-going process. The case studies will hopefully raise some fundamental issues regarding aspects of environmental sanitation and more specifically ecological sanitation. Hopefully through on-going forums, international workshops and other events more knowledge sharing on this issue will take place so that we are able to find a better balance for more effective and efficient environmental sanitation programmes and projects. On a last note, this occasional paper hopes to have provided information towards the larger debate regarding development work and the critical role that sanitation plays in this area.

## Contributions of the authors

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## About IRC

IRC facilitates the sharing, promotion and use of knowledge so that governments, professionals and organisations can better support poor men, women and children in developing countries to obtain water and sanitation services they will use and maintain. It does this by improving the information and knowledge base of the sector and by strengthening sector resource centres in the South.

As a gateway to quality information, the IRC maintains a Documentation Unit and a web site with a weekly news service, and produces publications in English, French, Spanish and Portuguese both in print and electronically. It also offers training and experience-based learning activities, advisory and evaluation services, applied research and learning projects in Asia, Africa and Latin America; and conducts advocacy activities for the sector as a whole. Topics include community management, gender and equity, institutional development, integrated water resources management, school sanitation, and hygiene promotion.

IRC staff work as facilitators in helping people make their own decisions; are equal partners with sector professionals from the South; stimulate dialogue among all parties to create trust and promote change; and create a learning environment to develop better alternatives.

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