

5 Ecological sanitation latrines: The experience of Nepal

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Abstract

The urbanisation trend in developing countries including Nepal is accelerating, thus exacerbating the condition of proper sanitation coverage. Despite greater sanitation coverage in urban areas compared to rural parts of Nepal, access to sanitation facilities does not solve the problem of improved sanitation. This is because conventional latrines normally lead to various other pressing environmental problems, along with the injustice of scarce water resources for flushing latrines to keep excreta out of sight, which means that other community-accepted sustainable solutions are needed. Therefore, considering the present context and sanitation situation of

the country, there is a need for a holistic approach to call for hygienic, sustainable and eco-friendly alternatives and hence, ecological sanitation toilets.

This paper argues that Nepal's historical acceptance of ecological sanitation, and its recent experience in using the approach - set out in the evidence presented here - mean that Ecological Sanitation (Ecosan) could be very valuable. It could confront these problems and provide potential "added value" to the livelihood link through agricultural production and water and environment conservation. This paper highlights acceptance and use related issues, lessons learned and challenges experienced for scaling up.

Background

Global context

There are at least 2.6 billion people (ie 80% of the global population in the world) without improved sanitation. But technically, even access to improved sanitation does not solve the problem of sanitation because conventional latrines (usually pit latrines or pour flush latrines) often fail to sanitise and therefore do not provide safe sanitation access to the maximum number of people. Among the reasons for this are: in many areas soil conditions are inappropriate for conventional types of sanitation, and elsewhere, the water table is often too high, rendering ground water susceptible to pollution. In addition, conventional latrines (ie the septic tank and sewage treatment systems) often discharge into the environment with little or no sanitisation, or nutrient removal. Therefore, the figure for people in need of access to hygienic and sustainable sanitation is actually higher than 2.6 billion.

While the proportion of people having access to sanitation services is considerably greater in urban areas than in rural areas in Nepal, the situation is changing because of the demographic change taking place, and which is characterised by rural to urban drift. This rapid and uncontrolled drift has been fuelled by rural dwellers' desire for jobs, which they seek to provide a better income and standard of life.

Additionally, the reality of the situation in urban areas may be compounded by overstated estimates of coverage; this is due to the nature of informal settlement in and around towns and cities. There are large disparities between "haves", who reside in the formal city and have access to

reasonable levels of service (often at subsidised rates), and the "have-nots", who have created settlements that are not yet adopted by the city authorities.

Context of Nepal

The current global trend of urbanisation is creating pressure on Nepal's eco-system. Nepal is also struggling with the most rapid urbanisation trend in the South Asian sub-continent, with around 15% of its total population living in 58 designated urban areas. This figure is expected to reach 23% by 2016 because the urban population is increasing at 6.6% a year, reflecting an increase in migration to towns as an escape from rural poverty, conflict and the reclassification of emerging towns from villages to municipalities.

Present sanitation coverage in Nepal indicates that only around 46% of the total population has access to some kind of latrine facilities. The scale of the problem is further illustrated by the present achievement made by the country to meet Millennium Development Goal (MDG) targets. The toilets constructed in some parts of the country often fail to meet required level of hygiene. The challenge is to increase the toilet coverage and its accessibility by increasing the depth of understanding among communities to ensure sustained use and hygiene behaviour. In all circumstances, a toilet must be hygienic, safe, environmentally friendly and affordable.

Need for alternatives

Most of Nepal's major cities are short of water and subject to critical environmental degradation. Their urban areas are among the most polluted; the peri-urban areas are also gradually being

polluted, as sewerage discharged from centralised systems is polluting surface water and seepage from sewers and septic tanks, while pit latrines are polluting groundwater. Even if the sanitation crisis can be communicated to and understood by more people, the need to find eco-friendly alternatives to conventional technologies for developing countries like Nepal remain. Therefore, considering the present context and sanitation situation of the country, there is a dire need of holistic approach to call for hygienic, sustainable and eco-friendly alternatives, and hence the option of ecological sanitation toilets.

An introduction to Ecosan

The goal of closing the nutrient and water cycles needs to be fulfilled on a large scale to render current sanitation practices eco-friendly. However, it is generally agreed that it is wise to re-use nutrients and save resources. The Ecosan toilet technology fulfils this aim and provides effective alternative solutions, with or without water, because this technology can be viewed as a three-step process, dealing with human excreta: ie containment, sanitisation (treatment) and recycling.

Basic principles of Ecosan latrine:

FIGURE 1 Ecosan – closing the sanitation loop



- Offers a safe sanitation solution that prevents disease and promotes health by successfully and hygienically removing pathogen-rich excreta from the immediate environment
- Environmentally sound because it doesn't contaminate groundwater and also saves scarce water resources
- Recovers and recycles the nutrients from the excreta and, thus, creates a valuable resource to reduce the need for artificial fertilisers in agriculture from what is usually regarded as a waste product.

The Ecosan latrine, therefore, represents a conceptual shift in the relationship between people and environment, being built on the necessary link between people and soil. The technology helps to maintain healthy humans and a natural environment by using affordable and appropriate technologies, and matching the needs of the country.

Objective

The basic objective of this paper is to share the status of Ecosan latrines in Nepal and the experiences achieved so far in promoting Ecosan latrine technology in Nepal. In addition, the paper has the following specific objectives:

- To understand the historical context behind the promotion of Ecosan latrines in Nepal and its relevance in its urban context
- To highlight the status of Ecological Sanitation (Ecosan) latrines in Nepal and share the experiences regarding gender roles, livelihood link, financing systems and the lessons learnt
- To understand and analyse the major issues and challenges in acceptance and use of Ecosan latrines in Nepal for scaling up
- To understand the options pointing the way forward to scale up this technology to

confront various environmental problems in an acceptable and affordable way.

Methodology

The methodology below was adopted while preparing this paper:

- The paper was prepared with reference to the report: “Study of Ecosan assessment in Nepal” prepared by WaterAid Nepal (WAN) and the Environment and Public Health Organisation (ENPHO)¹ in 2007.
- Besides this, additional sources of information to shape this paper were the review of various available literature, research papers, articles and reports on various sanitation options including ecological sanitation; re-use of human excreta, pathogen die-off, etc
- Field observations through visits to the settlements and interaction with Ecosan users, their neighbourhood and Ecosan promoters were also conducted to flavour this paper with field-based experiences.

Ecosan latrines in Nepal

Understanding technology and types of Ecosan latrines in Nepal

The Ecosan latrine technology, promoted in Nepal to date, works on a three-system process. The first system collects faeces in shallow pits separating them from urine and the second system processes faeces for composting (ie two of its three main systems process the excreta in shallow pits). The third system keeps urine separate from faeces where they are processed separately.

All the Ecosan latrines in Nepal are promoted and built on the principle that when soil and ashes 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. Ecosan latrines are permanent, easy to handle, generate rich compost over time, and are cheap compared (limiting not only to initial investment) to other sanitation technologies.

Therefore, Ecosan latrine technology, having three step structures – containment, sanitisation and recycling – takes the principle of environmental sanitation a step further as it is structured on the aforementioned three key steps. This means it keeps the nutrient and water cycle in a closed loop sanitation process with a low energy approach that uses a complete natural process.

The Ecosan latrines constructed in Nepal are more or less the same design but with slight modifications in design, construction materials and use. Based on the principles of operation, the following types are the major ones:

- Double Vault Urine Diversion (DVUD)
- Single Vault Moveable Container Type (SVMCT) – also called indoor Ecosan
- Two Vault Solar Model (TVSM)
- Urine Diversion Pour Flush (UDPF) - also called wet Ecosan toilet

Relevance of Ecosan latrines in urban context of Nepal

Growing cities such as Kathmandu have been affected by water crisis and environment imbalances in the recent decade of urbanisation. Thousands of migrants and concrete cultures demand a water and sanitation facility. Ironically, more water is being wasted for flushing toilets than is used for drinking. A conventional sanitation facility is intricate in terms of commission and operation. It harbours many

¹ ENPHO is an implementing partner of WaterAid Nepal

loopholes. It adds more wastewater than is manageable. Rivers and ponds now are merely an open sewer for most periods of the year.

An alternative approach to the gradual decline of the existing scenario has been put forward in recent years as a solution to the water crisis and pollution control. However, the approach adopted by the Ecosan toilet technology is not new for farmers of urban and peri-urban areas of Nepal, particularly Kathmandu Valley, which has been practicing the use of “night soil” in combination with animal waste, kitchen and other agricultural waste as the main fertilisers in the agricultural fields for decades. In this context, apart from fulfilling the sanitation purpose, the Ecological Sanitation (Ecosan) system is reviving the traditional, yet forgotten, art of applying night soil to agricultural fields. In addition, the Ecosan toilet also incorporates almost all the dimensions of environmental sanitation concerning water conservation, pollution minimisation and environmental soundness.

The Ecosan latrine – a hygienic sanitation option – prevents pollution, fights infections, saves water, promotes zero waste management and encourages food production. Realising these benefits, the urban farmers of Nepal, particularly urban and peri-urban dwellers of Kathmandu valley, historically accepted the technology and created an environment to persuade others to replicate it. Considering its potential to “add value” to agricultural production and to water, and its environment conservation, it has become gradually easier to promote this technology in other peri-urban areas. Ecosan latrines, therefore, seem to be the right product at the right time, particularly for the urban and peri-urban dwellers. Based on

the literature, the demand for these latrines seem to be fuelled by:

- Declining fertility of land
- Increased cost of artificial fertiliser, and related poverty
- High number of subsistence farmers in the urban and peri-urban areas
- Minimum use of water
- Possibilities of groundwater contamination reduced (where there is a high water table).

Status of Ecosan latrines in Nepal

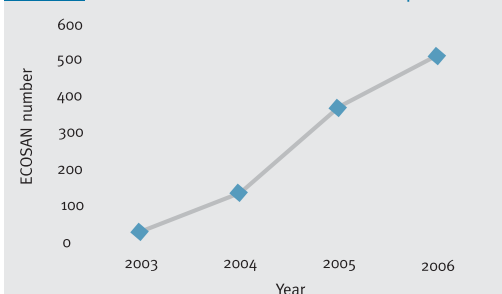
In Nepal, the concept of Ecosan toilet technology was piloted in Nepal in 2002 with the implementation of Double Vault urine diverting dry toilets by ENPHO (with the support of WAN in Khokana, by the Department of Water Supply and Sewerage (DWSS), and with technical support from the Development Network (DNet) Pvt Ltd) and financial support from the World Health Organisation (WHO) in Siddhipur. Both Khokana and Siddhipur are the peri-urban areas and are located in the outskirts of Lalitpur sub-metropolitan city but within the Lalitpur district of Nepal. Both programmes were well accepted and admired by the community as they had two advantages. Firstly, for the service of latrine facilities and, secondly, because the human waste produced therein was recoverable and recyclable, creating a valuable resource for agricultural needs. This was for the first time in Nepal that latrines were linked to economic benefits and livelihood opportunities for people.

With the success of the pilot programmes, the Ecosan latrine technology was gradually promoted to various other parts of urban and peri-urban areas of Nepal by many leading organisations

including: Water Aid Nepal (WAN) through partners such as ENPHO, LUMANTI (Support Group for Shelter), Centre for Integrated Urban Development (CIUD), Nepal Water for Health (NEWAH), and DWSS. During the pilot stage, Thimi municipality was engaged with NEWAH in promoting this type of technology. However, support was sporadically also being provided at municipal levels, which are not now fully involved in promoting and developing this technology. The passivity of municipalities may be because of vacant local bodies, ie lack of elected representatives in local governments or may be put down to their inadequate knowledge of Ecosan and its three-fold benefits, which made them suspect the functioning of Ecosan in urban areas.

Within five years of experiences in Nepal, 517 Ecosan toilets were constructed and practiced, with 97% of them in proper use, ie kept clean, well maintained and subsequent use the compost as fertiliser for their local agricultural fields. Similarly, around 100 Ecosan toilets are under construction under WAN's support through its implementing partners. The majority of the Ecosan toilets were constructed within the peri-urban areas of Kathmandu Valley, and as few as 8% were constructed outside the valley.

FIGURE 2 Number of ECOSAN toilets in Nepal



Source – WAN and ENPHO, 2006

Some 81% of Ecosan users list agriculture as their main occupation, with 73% owning agricultural land of more than 510 m² and some 8% do not own any land. Around 91% of Ecosan users do not have any alternative toilets except open defecation, 4% have pit san, 4% have pour flush san and the remaining 1% have modern flush san.

The Nepalese government recognised the Ecosan toilet as one of the most important and inevitable sanitation options available and suggested, in its paper on sanitation, that Ecosan needs to be promoted (SACOSAN, 2003). This technology is also being gradually piloted in rural areas of Nepal by ENPHO and DWSS, with slight modifications in the concept and design. Based on the acceptance of the technology by the rural community, ENPHO, DWSS and other agencies (mentioned below) are also trying to replicate this modified Ecosan toilet technology in rural areas, under the name: WET Ecosan toilet.

Actors involved in promoting Ecosan technology in Nepal work on two levels:

- a. *Implementation level:* ENPHO, Lumanti, CIUD, NEWAH, NRCS, CODEF, DNet Pvt Ltd, Plan Nepal, DWSS etc
- b. *Donor level:* WaterAid Nepal, WHO, UN-HABITAT and Practical Action Nepal as of now.

Assessment of Ecosan latrines in Nepal: an indication of success

The assessment study of the Ecosan toilet in Nepal was conducted by WaterAid Nepal through ENPHO in 2006 in 440 households of 18 clusters, including five clusters outside Kathmandu Valley. In addition, the neighbours (32% of the surveyed households

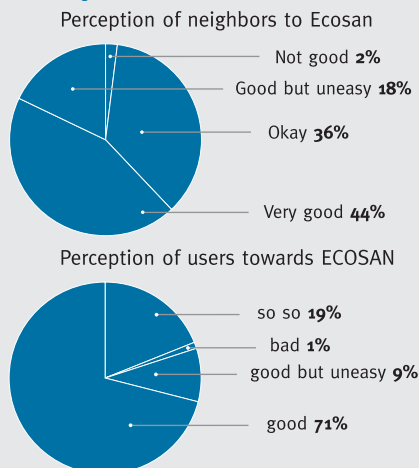
using Ecosan toilets) are also included in the study so their perception on the merits and pitfalls of this technology can be documented and considered.

Perception of Ecosan users

The general perceptions of people on ECOSAN were found encouraging. 71% of the users felt excited whereas 19% expressed their satisfaction. However 9% expressed the need for further improvement whereas 1% expressed negative perceptions towards this technology. Similarly, the majority of the neighbours of the ECOSAN users (44%) expressed a positive perception of ECOSAN whereas 36% expressed satisfaction and 18% expressed the need for further improvement and 2% of them are not convinced.

The motivation for becoming attracted to the Ecosan toilet is mainly due to easy availability of

FIGURE 3 General perceptions of users and neighbours towards ECOSAN



Source – WAN and ENPHO, 2006

fertilisers (according to 71% of respondents). Similarly, 17% expressed that Ecosan offers safe sanitation and environmentally sound technology and, thus, protects the environment. Some 9% of respondents were influenced by their neighbours' use of Ecosan latrines, and 3% were attracted by the subsidy.

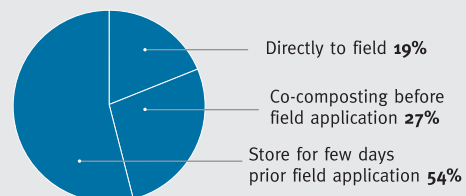
Around 93% of Ecosan toilets are used by all family members, including children; some 4% are used only by adults, and the remaining 3% are used only by female family members. Similarly, 98% of respondents use Ecosan for defecation and urination, while 2% do not use it for urination, particularly males, which may be due to difficulties they might have in urinating in standing positions.

Use of faeces and urine

Technology of the Ecosan toilet, as already mentioned, constitutes three steps (ie containment, sanitisation and recycling), which are practiced by collecting in the vault, composting and finally applying the compost in the field as fertiliser.

Composting of organic waste is one of the traditional practices of farmer families in Nepal, especially in Kathmandu. Most families are aware

FIGURE 4 Uses of faeces after emptying vault chamber



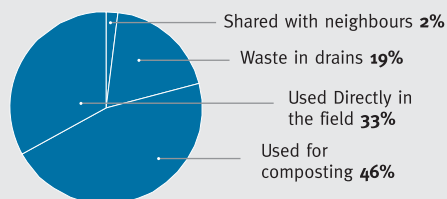
Source - WAN and ENPHO, 2006

about the need to store the content of the vault (ie faeces for few days) before applying it in the field.

So, the majority of the users (54%) practice this by storing for a few days either in the sun (24%) or in a shed (30%) before field application. After emptying the vault, some 27% mix the faeces with other composting materials in a compost pit for co-composting before applying to the field. The remaining 19% said that due to lack of space for composting, they apply the vault content (digested faeces) directly in the field.

Though toilet owners are very much aware of the importance of urine and its nutrient value, its application is not practiced as much as expected. Only 33% of the users apply in the field, whereas 46% of them prefer to use it for composting. Similarly, due to lack of agricultural land on which to apply urine, 2% of them shared with the neighbours once the urine collection tanks are full while the remaining 19% used to throw it down the drain. Some 70% use urine for vegetables, 22% for all kinds of crops and 6% use it in annual crops such as wheat, maize, and paddy, etc. However, efforts to improve the collection, storage and use of urine are necessary for better outputs by preventing the possible loss of nutrients through waste of urine down drains.

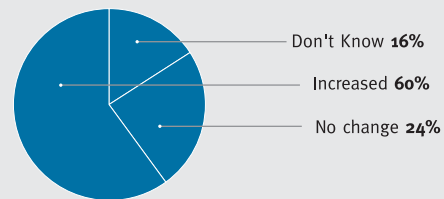
FIGURE 5 Application of urine



Source - WAN and ENPHO, 2006

All Ecosan users collect urine in a urine collection tank, kept inside the toilet and used in the

FIGURE 6 Changes in production due to application of urine

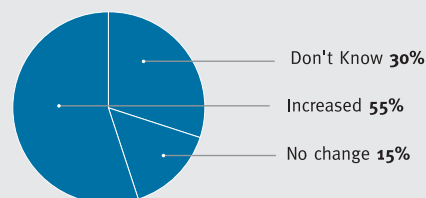


Source - WAN and ENPHO, 2006

agricultural field in a 1:3 ratio of urine to water. Some 60% of the Ecosan users had experience of increment in production, 24% noted little difference, and 16% found no change in production at all. Regarding quality of taste, 55% experienced improved quality and taste, 15% found no change and the remaining 30% didn't notice any difference.

None of the Ecosan users expressed concerns regarding a decrease in production in quantity and quality when urine was applied as fertiliser. Indeed, the majority expressed positive results in production when compared to that grown without the application of urine. They also responded that urine acts as a pesticide.

FIGURE 7 Changes in quality due to application of urine

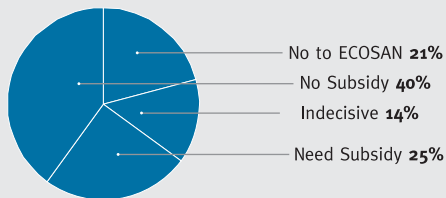


Source - WAN and ENPHO, 2006

Willingness to install Ecosan latrines

In project areas where Ecosan toilets are being promoted, every household does not have an Ecosan toilet. Some are using conventional sanitation options like primarily pit san, flush san and open defecation. Some 60% of Ecosan users expressed that their neighbours hold a strong interest in and appreciation of the technology; 32% are generally positive, and 11% feel dissatisfied and unconvinced with this technology. Around 65% of the people practicing open defecation (ie without any form of toilet facility) expressed willingness to build Ecosan toilets (40% with and 25% without subsidy), 14% are indecisive, and 21% are not willing to invest in any form of toilet.

FIGURE 8 Willingness to install ECOSAN toilets



Source - WAN and ENPHO, 2006

Link with agriculture

It is encouraging to know that only 2% of the users are against Ecosan toilets, whereas the majority (69%) expressed their satisfaction of this technology and requested to scale up as far as possible. Some 14% indicated the need to expand the coverage (but with modification as per the location and individual needs) whereas 13% expressed the need for awareness while promoting the technology to scale up in new areas.

Most of the Ecosan users are agriculturalists by occupation and so, more or less, familiar with the

BOX 1 Research on pathogen die off in stored faeces

Untreated human faeces contain large amounts of pathogenic organisms, which may be of high risk to the users. For safe handling, it is imperative that the faeces should be free of pathogenic organisms. Hence, a better understanding on the fate of micro-organisms (including pathogens) during the storage period is essential to provide safe and sanitary use of human faeces as fertiliser. A storage period of six months has been set for the complete inactivation of micro-organisms in Ecosan of various countries.

Research on the investigation of pathogen die off in stored faeces was conducted in different design of Ecosan latrines, with different storage periods ranging from 180 to 300 days by WAN and ENPHO in 2005 in Nepal. The study revealed that the faeces storage period of 300 days is sufficient for the complete inactivation of pathogen (Ecoli, Total coliform and Enterococci) indicators as per the standards given by WHO and USEPA. Similarly, it was also revealed that the pathogen die off is more significant in co-composted faeces.

methods of making compost and co-compost through mixing the humus formed in toilets with infertile and worked-out soil. They mostly appreciate that all the fertile materials can be mixed to form an enriched soil suitable for planting vegetables and other crops. Such humus, when properly used in agriculture, helps to improve food yields considerably, thus providing more food security and improving the nutritional status of the beneficiaries. The urine on the other hand can be used as the main fertiliser source for growing crops, such as green vegetables and maize, etc. The potential for an important relationship between sanitation and agriculture has been appreciated and users are further motivated by this to use Ecosan toilets.

Gender roles in Ecosan latrines

Ecosan has had an interesting effect on the gender roles associated with latrine construction. During the assessment study, it was found that in households with Ecosan toilets (dry Ecosan or wet Ecosan, ie urine diversion toilets), the task of emptying the urine container and the vault (also called faecal bin) seems to be that of males, but when it comes to conventional pit-san toilets, the task was usually carried out by women. Thus, Ecosan related task has not contradicted societal norms about the division of duties, while new ideas regarding benefits of recycling nutrients can introduce new values. In addition, the production of fertiliser through the use of Ecosan toilet has influenced both genders in the importance of latrines and their proper maintenance to benefit from the compost produced. However, some concerns were shown by some communities about disposing of menstrual blood in the Ecosan toilet, and such a practice also poses a challenge for the reuse of urine as fertiliser.

The experience, based on the findings of the Ecosan assessment study conducted by WAN and ENPHO in 2006, showed that the use of Ecosan is accepted not only by the adult members of the family, but also by the children (as they were made aware by the family) and in schools through a value-based water and sanitation education programme. The men shared opposite interests to the women, who were more interested in the hygiene aspects of latrine use than the fertiliser. However, the end result is the same, a reduction in children's faeces around the compound and settlements' surroundings. Apart from the children, women too, who otherwise practiced open defecation, now used this toilet with greater confidence, privacy and

security at any time (particularly at night) as they used to during open defecation.

Financing Ecosan

Costs of Ecosan: a comparison with other sanitation options:

The ecological sanitation (Ecosan) toilet is a new type of toilet in which urine and faeces are collected separately and used as fertiliser and manure, respectively for growing crops and vegetables. The farmers of the community accepted the technology and created an environment to persuade others to replicate it considering its potential to “add value” to their agricultural production, to the water and to environment conservation.

Similarly, the quality of toilets relating to water conservation and environmental soundness are least discussed. However, the Ecosan toilet incorporates all of these dimensions and therefore seems to be a little bit costly at the time of investment. But this apparent costliness is felt before people have really analysed its future benefits – more than any type of other sanitation option. On this very basis, the Ecosan toilet should not be considered as expensive sanitation option, although the community people often shared this misconception.

Despite all its merits, one of the common criticisms faced by Ecosan promoters is that the toilet is expensive. No doubt, there is a cost associated with building structures that can separately collect and store faeces and urine properly; Ecosan toilets do cost more than simple pit latrines. However, one needs to understand that Ecosan is more than a toilet; it is actually a toilet and a treatment or recycling system. In this context, the cost of Ecosan

is significantly less than other toilets and treatment systems.

Further details can be found in Annex 1.

Subsidy policy for construction of an Ecosan toilet

WaterAid Nepal considers subsidy as a promotional tool, not a crutch, ensuring that the rate at which latrines are built remains acceptably high while simultaneously, the level of subsidy is not so high that the product is devalued. However, achieving the right balance is difficult and should be regarded as more of an art than a science. When we look at the subsidy policy for promoting Ecosan toilets in Nepal, every household should always make a financial contribution towards the cost of their Ecosan toilet, even though in some cases this may be relatively small. The programme contributes only to the pan level, which includes two vaults for faeces storage, a urine storage tank, and two pans in case of dry Ecosan otherwise one for wet Ecosan toilet.

The Ecosan promotion programme however considers the materials, which would include bricks, grass, bamboo and labour (unskilled) works, etc, provided by latrine users while discussing the financial aspects of latrine construction. The reason behind this is that the value of labour (ie 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, and thus considered this an "opportunity cost" in community contribution for latrine construction.

So far, various organisations, including ENPHO, have been promoting Ecosan toilets by providing

technical assistance as well as financial assistance to cover the cost of the toilet till pan level. The project provides financial contribution to the pan level only and wants the rest of the superstructure to be built by the owners. So, out of the total cost of an Ecosan toilet: ie (Nepal rupees) NRs 16,000 (GBP £120); NRs 6,000 (GBP £45) will be contributed by the toilet user and NRs 10,000 (GBP £75) by the project to ensure financial contribution up to pan level, again excluding unskilled labour works. This contribution from the project, which amounts to around 60% of the total costs, is considered a subsidy and has been instrumental in generating demand even when the technology is relatively new. As people become more aware about the benefits of the technology, the subsidy can be gradually reduced or replaced by provision of low-interest loans through revolving funds.

Challenges in development and scaling up

Social status of Ecosan toilets: There is a misconception among potential users that more costly and water consuming toilets are the best, which has led them to install water carriage toilets. At present, most Ecosan toilets are constructed in poorer communities with financial subsidies as a promotional tool. Unfortunately, this feeds the existing misconception that the Ecosan toilets are specifically developed for poorer sections of the community.

Orientation to the outsiders on the use of Ecosan toilet: The major problem raised by the users of the Ecosan toilet is the need to orient and familiarise outsiders or guests with how to use the toilet. There were hardly any complaints regarding the odour and cleaning of toilets (unlike other toilets, one cannot pour water freely to clean an

Ecosan toilet). In fact, the majority of users didn't report any problems with their Ecosan toilets.

Odour: A few Ecosan toilet users did complain about a bad smell and it is still considered an issue by them. It was observed that a shift from conventional pit or flush toilets to Ecosan will be more easily accepted if there is little or no odour from the excreta. Covering the faeces with additives (such as ash, rice husks, saw dusts, lime, etc) effectively reduces the smell, and zero smell can be achieved by ventilation. Problems experienced with the odour are not a result of a fault with the technology, but a lack of sufficient level of awareness and knowledge on proper functionality and maintenance of the Ecosan toilet among users.

Space constraints: Despite being a good and environmentally friendly technology, a lack of space within people's houses obstructed the installation of some Ecosan toilets. Similarly, the lack of an agricultural field also discouraged the community people to install this type of latrine. Despite the absence of agricultural land, some people installed an Ecosan toilet with some modifications in their households and provided the content of the vault to the neighbours for application in their field. It is believed that the constraints of space within premises or the lack of agricultural land are the main challenges faced to scaling up this technology. The driving factor for the promotion of the Ecosan toilet is due to its economic value rather than its health value. Because of this reason, as in peri-urban areas, it has not been possible to promote and scale up this technology in the informal settlements (eg slums and squatters) in most of the dense urban areas, where other options of sanitation facilities are being promoted.

Level of awareness and knowledge on the importance and management of urine: The level of satisfaction from the use of urine as a fertiliser is low compared to the use of human excreta (faeces). This may be due to a number of reasons:

- a. Lack of understanding, knowledge and awareness regarding the effective methods of urine handling, recycling and its use in co-composting. It is either simply not collected and therefore wasted, or collected in small vessels (in most cases) that are not airtight, leading to nitrogen loss
- b. Transportation of urine from toilet to farm area is problematic
- c. Confusion regarding quantity of urine application in the field and for co-composting
- d. Low level of knowledge on the importance of urine, its nutrient potential and subsequent impact on agricultural production. Lack of quantitative benefits of urine application is hindering the motivation for the use of urine.

Less consideration of environmental soundness attributed by Ecosan toilet: The environmental benefits of the Ecosan toilets are not considered much by the users. The main reason for this is due to a lack of proper rules and regulations for the prevention of pollution in natural water bodies. People are discharging the highly polluted black water directly into the natural water body. In this situation, it is very obvious that the value of environmental protection that can be derived from this Ecosan technology will be insignificant.

Initial investment: Initial investment for an Ecosan toilet is relatively high compared to other sanitation options. As a result, the people normally expect and demand subsidy to adopt the technology.

Subsidy is nothing more than a promotional tool and is financial assistance to the hardcore poor for adopting sanitation facility. People need to be convinced, however, about the future benefits that can be reaped from this technology from an agriculture and an environmental perspective.

Changes in people's perception and behaviour:

During the course of promoting the Ecosan toilet within the communities, it is felt that one of the major challenges is to change the existing perception and behaviour of the people. Obviously, it and cannot be expected to change perceptions that are centuries-old overnight. This is more challenging in the rural areas and urban areas, particularly out of the Kathmandu Valley. The reason might be that Ecosan toilet technology, as such, is not new for farmers of urban and peri-urban areas of Kathmandu Valley, who have used a combination of night soil with other organic waste as the main fertilisers in their agricultural fields for decades. However, piloting has already started in other urban and peri-urban areas outside Kathmandu valley and in some rural areas to pave the way for identifying methods of promotion with the required modification.

Way forward for scaling-up

Promotion: Based on observation and experience, I believe that the one-size-fits-all approach is not appropriate. Different cultural, geographic and demographic situations produce different reactions to Ecosan technologies. Many communities are interested in these technologies in light of the convincing demonstration of improved crops due to the value of faeces as organic fertilisers. Whereas some communities are still attracted to a permanent structure inside the house, but showed little interest in content re-use. The promotion of Ecosan may,

therefore, have more success when presented as an option in a range of technologies rather than through a doctrine position that states: "this is the only way".

Do not scale up too fast: first create appropriate 'sellable' toilet devices, eyes are watching you!

Technology: Approaches to technology must be more flexible in terms of choice of toilet type and use of materials. Over designed, expensive or imported components make replication difficult without subsidies.

Every sanitation technology needs some user education and orientation. For new users, Ecosan may introduce another level of complexity at the initial stage. Therefore, users need to be made fully aware of their responsibilities and provided with appropriate instructions and follow-ups until confident in handling operational problems.

Awareness generation

- The generation of awareness about Ecosan latrines among users, activists and at the political level is strongly needed. At present, it is insufficient to enhance sanitation coverage.
- The IEC (Information, Education and Communication) materials for the promotion and use of Ecosan toilets currently being carried out are not sufficient. More audiovisual, IEC materials and media campaigns on the topics are necessary for generating increased awareness.
- The major principles of the Ecosan toilet and its potential benefits should be disseminated among school students who make excellent

representatives for Ecosan toilets by encouraging potential users in their community.

- A bigger awareness programme on the use of urine and faeces with a nutrient recycle concept should be designed with the aim of providing knowledge on the merits of Ecosan toilets.

This agenda should be set, however, as one of advocacy while promoting and expanding Ecosan latrines. While scaling up, the pros and cons should be disseminated widely, allowing users to take the final decision between the various sanitation options available.

Management requirements

- The practical demonstration of the usefulness of the by-products of human excreta in agriculture is seen as an important component of all ecological sanitation programmes. Consequently, the crucial step of linking toilets with a method of producing humus or urine for use in agriculture (or forestry) must be emphasised. This very important management procedure is vital to the success of Ecosan toilets.
- In Ecosan toilets, success depends on proper management, and thus depends on user participation to a far greater extent than conventional sanitation systems. It is no longer a case of sit and flush or squat and deposit. Ecological sanitation embraces a philosophy, which the users must believe in and practice daily. Disseminating and convincing of such an understanding and practice takes time.

Role of subsidies

- Almost all the projects used some form of subsidy to promote or support widespread

use of this new technology. The subsidy approach for promoting Ecosan latrine technology must be adopted as a promotional tool and should be promoted only in such a way that users require some form of “buy-in” from it, on one hand or alternatively, must avoid distorting decision-making to the extent that wrong choices are made.

- While discussing the role of subsidies in promoting Ecosan toilet, the poorest members of the community should gain access to the benefits that improved sanitation can bring. There are areas for potential improvement and experimentation by developing various options including graded subsidy systems.
- Hardware subsidy should be governed by a clear subsidy policy of the promoting organisation, with explicit objectives and political commitment to the total amount of funds that would be necessary if programmes were scaled up.

Research and development: The initiations of WAN through its local level partners are primarily designed to implement and demonstrate alternatives (or complementary approaches) to conventional sanitation practices. Alongside the emphasis on research and development to be placed to adapt technologies to local conditions, here are some areas recommended for R&D for further promotion of Ecosan technology:

- a. Concept of trading in urine and faeces should be developed. Commercialisation of nutrient recycling from human excreta, thereby linking with livelihood is necessary for further promotion of this technology
- b. More research on sanitisation of faeces should be done to find out the effective and easy way of sanitising the excreta

- c. Research on reducing the volume of urine is also deemed necessary as a reduction of urine volume may be the best way to ease its transportation.

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.

Conclusions

In summary, the advantages of Ecosan toilets – as perceived by users – indicate mostly the fertiliser value of excreta and nutrients recycle; and cheaper substitution of organic fertiliser to expensive chemical fertiliser, resulting in a reduced use of chemical fertilisers. Water saving is another potential merit in addition to the contribution made by this technology in protecting the natural environmental and preventing groundwater pollution.

Ecosan latrines are well accepted by all the members of the families without any gender conflicts. They are gender friendly, as indicated by their satisfactory maintenance shared among male and female counterparts. This appreciation for Ecosan latrines extends to the majority of their neighbours, who also showed a positive attitude. Some 65% of the neighbours without any latrine facility, showed their willingness to build an Ecosan latrine. This demonstrated the good impression of Ecosan in the peri-urban settlements of Nepal, where agriculture is a common livelihood.

Similarly, the level of knowledge among Ecosan users regarding use of human excreta is comparatively better than the level of satisfaction from the use of urine as a fertiliser: which is low

compared to the use of human excreta (faeces). The majority of users found their production increased when using human excreta as fertiliser and this stimulated their neighbours towards Ecosan latrine.

The rate of direct application of urine in the field is comparatively low and is not impressive compared to the efforts made, despite disseminating the importance of urine and its nutrient value among the Ecosan users. However, the users preferred to use urine for composting rather than in the field directly. The reason for this is the difficulty in transporting urine to the field.

It is known to all that because of their pressing priorities in fulfilling other basic needs, the majority of people in developing countries do not want to invest in toilets, believing them to be a sheer waste of money. Nepal is definitely not an exception to this. This indicates that people do not fully understand the importance of toilets. Investment in Ecosan toilets is also the same. People are interested to install the Ecosan toilets, but without investing their own money. That people expect subsidies for constructing Ecosan toilets despite the cost of Ecosan (dry toilet is comparatively more than wet ones) is simply reasonable and is within the reach of any person, either poor or non-poor. The cost-effectiveness of Ecosan is justifiable if one considers the potential for Ecosan latrines to “add value” to agricultural production and to conserve water and the environment.

The use of subsidy policy in promoting any sanitation technology must be cautious. It will definitely help to achieve some short-term gains, but appears to militate against long-term affordable solutions of the type that will be necessary to

achieve meaningful progress for further expansion of this technology. Future approaches must be more sensitive to what local economies and customs can embrace.

In summary, the people using Ecosan latrines have started to view excreta as a resource, rather than a waste, and realised its economic value to the process of developing a sustainable latrine building programme. This is definitely because of the ability of Ecosan latrines to produce fertiliser and link with the livelihood opportunities through generating income from existing agricultural practices. This has added a much needed, direct and easily recognised benefit to building and using a latrine. Ecosan, in addition, will no doubt help to improve health, water saving and food production. It is logical

and cost effective in theory and practice and can be equally pro-poor and pro-rich. Thus, the level of acceptance of Ecosan by the users and willingness to install by non-users indicated possibilities of further scaling up this technology within the peri-urban settlements. However, scaling up in rural areas, where it is being promoted on a pilot basis, still remains a challenge, as it requires further awareness on behavioural changes.

Despite its many positive aspects, this approach will be of little use unless the target communities are willing to adopt it. Therefore, it is important that general principles of Ecosan toilet models are adapted to local conditions rather than introducing universal, specific technologies developed under different conditions.

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Annex – 1

Costing of an Ecosan toilet and its comparison with other latrine options

The construction cost associated with Ecosan can vary from place to place depending upon materials used, designs adopted and fluctuations in market price. The average cost of a dry double vault Ecosan toilet with brick and cement superstructure in Kathmandu Valley is around Rs 16,000 (US\$ 230). Overall the construction cost can be divided into two parts:

a. Construction up to pan level: This includes two vaults for faeces storage, a urine storage tanks

TABLE 1 Breakdown of material cost for Ecosan latrine up to pan level for Kathmandu Valley

S.N.	Description of work	Quantity	Unit	Rate (NRs.)	Amount (NRs.)
1	Bricks	650	bag	3.50	2,275.00
2	Cement	5	cuft	500.00	2,500.00
3	Sand	35	cuft	22.00	770.00
4	Aggregate	15	cuft	33.00	495.00
5	MS bar	10	kg	50.00	500.00
6	Mason	6	nos	250.00	1,500.00
7	Pan	2	nos	350.00	700.00
8	Pipe and Fittings				
	* 3" Poly bend	1	nos	55.00	55.00
	* 3" Poly tee	1	nos	60.00	60.00
	* 3" Poly cowl	1	nos	30.00	30.00
	* 3" Poly pipe	6	rft	20.00	120.00
	* 2" PVC tee	1	nos	110.00	110.00
	* 2" PVC bend	3	nos	90.00	270.00
	* 2" PVC net cap	3	nos	20.00	60.00
	* 2" PVC pipe	1	m	45.00	45.00
	* 1/2" GI nipple	2	nos	24.00	48.00
	* 1/2" GI socket	1	nos	20.00	20.00
	* Plastic tap	1	nos	15.00	15.00
	* 100 liter plastic container	1	nos	550.00	550.00
				Total	10,123.00

and two pans in case of dry Ecosan. The cost of Ecosan up to pan level in Kathmandu is NRs 10,123 and its breakdown is presented in Table 1 below:

b. Construction above the pan level: This is almost the same as for any other toilet and this cost will vary significantly depending on the materials used for building the walls and roofing. The cost is estimated to be around NRs 6,000 if built using brick and cement with a CGI roof. The cost comparison of the Ecosan toilet with other toilet options is given in a Table 2 below:

While comparing the cost of an Ecosan toilet as a whole with the other types of sanitation facilities prevailed in rural and urban areas of Nepal (based on the study conducted by ENPHO under WaterAid Nepal's support), it was revealed that the cost of the Ecosan toilet ranks as the third cheapest. While accounting the additional value (both positive and negative) of the by-products (eg urine and faeces) of these toilets (as mentioned below in Table 3), one will definitely express that Ecosan toilet is cost effective and sustainable in the long run. Generally, the cost of handling of faeces, treatment of waste, etc, is not usually included for other sanitation options.

TABLE 2 Cost comparison of various latrine options (up to pan level)

SN	Toilet options	Cost (NRs)	Remarks
1	Single pit latrine	10,000	The indicated cost is only for construction up to pan level
2	Double pit latrine	12,000	
3	Soak pit	3,500	
4	Ecosan	10,100	

TABLE 3 Cost comparison of sanitation options in rural and urban areas

Description	Toilet with septic tank	Twin pit sulabh	Single pit sulabh	Flush toilet with modern treatment facilities	Flush toilet with reed bed treatment facilities	Ecosan toilet	Remarks
1 Individual toilet cost	6,000	6,000	6,000	6,000	6,000	16,000	
2 Septic tank and soakage pit	12,000	6,000	3,000	12,000	12,000		@ 2000 per capita assuming average HH size is 6
3 Sewer line							@500 per capita excluding land cost
4 Treatment plant cost				3,000			@11000 per family excluding land cost
5 RBT treatment plant cost					11,000		@ 50/ capita/year in modern treatment and 10/capita/year for RBT
6 Operation cost (basically for de-sludging)	600	200	300	300	60	200	@1% maintenance cost for all types of facilities
7 Maintenance cost	186	140	100	250	300	185	Extracted from financial analysis of Ecosan toilet
8 Monetary value of urine and faeces	No	Low	Low	No	Low	2,100	*[= (sum of 1 to 8)–(9)]
Total	18,786	12,340	9,400	21,550	29,360	14,285*	Note: All amounts expressed in Nepalese currency
9 Fertiliser value	No	Low	Low	No	Low	High	
10 Water requirements	High	Medium	Medium	High	High	Low	
11 Risk of ground water pollution	Medium	High	High	No	No	No	