

A Way Forward to Promote Ecosan Programme in Nepal

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ABSTRACT

The concept of Ecosan first struck in the minds of policy makers of Nepal after one of the authors of this paper participated in the first International Conference on ECOSAN in 2000 in Germany. Eventually, DWSS piloted Ecosan programme in Siddhipur nearby Kathmandu in 2003. The Ecosan technology appropriate to the local community was developed, tested and modified. The community overwhelmingly accepted the Ecosan technology and application for mainly vegetables. Simultaneously ENPHO and Lumanti also implemented the Ecosan programme in Khokana and Thimi within the Kathmandu valley. The technology was further modified and tested.

Acceptance of Ecosan latrine was very promising in Kathmandu valley during the piloting phase, however, it was a big challenge to promote even conventional types of latrines in *Terai* as the practice of open defecation is most common and loved by the people in this region. People in this region use enormous amount of chemical fertilizers for agriculture production, thereby requiring high level of fertilizer-investment input for agriculture. People, however, lack knowledge on importance of human wastes as manure and its economic value. They are "faeco-Phobia" and hence think human waste as a "hatred thing".

The ground water table is specifically very high during rainy season in the *Terai* region. The flood occurs rampantly and water level raises above the ground level which causes difficulties to maintain human faeces dry as needed for the dry Ecosan. Despite the challenges, DWSS strived to pilot Ecosan programme appropriate to the *Terai* geography, culture, norms and practices. Sabaithuwa village of Parsa district in the central development region was selected for the piloting programme. The pan was designed with water seal and connected with twin concrete pits under the ground, yet separation of urine and faeces is there. The single pan can serve the toilet purpose, bottom cleansing can be done in the same pan, flushing can be done after the defecation, cleaning of pan with water is possible. All these modification has enabled to lessen foul smell, to maintain neat and cleanliness. The use of the latrine is more like the conventional ones and hence is more users friendly. The application of urine as manure has been replacing the use of chemical fertilizers. This is a between conventional latrine and dry toilet- a way forward to ensure high acceptability of sanitation among the *Terai* people, whereas, the policy makers, donors and implementers will have to establish very effective and efficient market strategies and support mechanism.

BACKGROUND

Nepal, a mountainous and land locked country, has an area of 147,181 square kilometer with a total projected population of 24.7 millions in 2005. The *Terai* (low land) covers about 23% of the total land but population in this region is 47% of the total population. Over 80% of the total population live in rural areas and the recent data shows that 32% population fall below poverty line. The national sanitation coverage as of 2004 is 39%, whereas, the coverage in *Terai* is below 20%. (NLSS-2004). An estimate shows that 10 million tons of urine and 0.6 to 1.1 million tons of faeces are produced in a year in Nepal. The financial value of the nutrients of the urine and faeces based on existing prices of chemical fertilizers is about NRs 7.11 billion which is equivalent to 50% of the total fertilizers imported every year and the equivalent value of the fertilizer produced by a family of an average size of 6 is estimated about NRs 2,000, which is about 50% of the cost of the latrine structure up to the plinth level (Mishra, 2001). Considering the benefit of saving money from purchasing fertilizers and utilizing for building Ecosan latrines, the opportunities lies for remaining un-served 61% of the total population.

The concept of Ecosan first struck in the minds of policy makers of Nepal after one of the authors of this paper participated in the first International Conference on ECOSAN in 2000 in Germany. Eventually, the Department of Water Supply and Sewerage (DWSS) strived for appropriate local technology, funding and recipient community to initiate Ecosan programme in Nepal. With efforts, Siddhipur, 7 Km south from Kathmandu was selected for a piloting Ecosan Project for the first time in the history of Ecosan in Nepal in 2003. The pilot project implemented for one year with financial supports from WHO and technical supports from Development Network, a research institution where the other author is associated (DWSS, 2004).

The Ecosan latrines were used by every family members and the urine and faeces were applied in growing vegetables. Appropriate orientation training on use of latrines, agriculture application, health and hygiene was imparted to capacitate the people and ensure sustainability of the programme. Some local masons were also imparted "On the Job Training" to build the Ecosan latrines. Farmers who built the latrines had multiple benefits-- they have now latrines; they have saved money by not procuring fertilizers; there is improvement in household and environmental sanitation, etc. The Ecosan latrine was overwhelmingly accepted by the community people and there was a long list of other households seeking supports to build such latrines in their homes also.

With the start of the pilot programme in Siddhipur, ENPHO and Lumanti that are national NGOs also initiated Ecosan programme almost simultaneously in Khokana and Thimi within the Kathmandu valley with the financial support from WaterAid Nepal. Initially, the same type of design of the Ecosan latrines as developed in Siddhipur was adopted by all of them. Later the design of Ecosan latrine particularly pans were modified by ENPHO (Fig ...). The pans which were cast-in-situ on the concrete slab were modified as a separate pan made of mosaic surface and non-sticky materials. The modified pans were then easy to install and more aesthetic in looking. Interestingly, people also used urine as a catalyst to decompose household garbage and cow dung. They had the belief that the decomposition with the urine was faster and the manure contained more nutrition values. Some people also applied urine as pesticide to kill pest in the vegetable and fruits. The quality and taste of the agriculture products when urine was applied as manure was reportedly good and liked by the community people. This type of latrines was later significantly scaled up in Siddhipur and Khokana, through financial support from UN Habitat and the level of acceptance of such type of pans was high in those communities.

Although the Ecosan latrine was overwhelmingly accepted in those villages, there were some problems and issues which need to be addressed to make them more users friendly and acceptable to all kinds of people in the community. The preliminary assessment revealed that there were some drawbacks of the Ecosan latrines initially developed in Siddhipur, Khokana and Thimi. Position required to shift to cleanse the bottom, visibility of fresh faeces through the dropping hole, husk/ash/or lime required to put on the excreta after each defecation and foul smell due to lack of water sealing provision in the pans were some of the major drawbacks which were the challenges and opportunities before the promoters and policy makers to effectively overcome the problems to increase the adoptability of the technology and scale up to wider mass in Nepal.

CHALLENGES TO IMPLEMENT ECOSAN IN TERAI REGION OF NEPAL

Acceptance of dry Ecosan latrine was promising in Kathmandu valley during the piloting phase. However, in the context that the practice of open defecation is most common and widely accepted by the people in the Terai region, it is a big challenge to promote even conventional types of latrines in this region. People also lack knowledge on importance of human wastes as manure and its economic value. They are "faeco-Phobia" and hence think human waste as a "hatred thing".

Over 90% people are dependent on agriculture farming in the *Terai* region. People with an average land holding size of less than one hectare and annual income of less than US \$ 220 are poor enough to afford latrines. Studies have shown that the major reason of not building latrines is lack of affordability for over 60% people who don't have latrines (WaterAid, 2006). It is a challenge and opportunity for the policy makers how best the Ecosan concept would be materialized to scale up in the context of typical *Terai* region of Nepal to increase the sanitation coverage and save money from being invested on import of chemical fertilizers.

With the understanding of social norms, behaviors, attitude, socio-economic condition and participatory discussion with the selected farmers of the *Terai*, DWSS with financial support from WHO and in collaboration with a national NGO-Community Development Forum (CODEF) launched a Pilot Ecosan Programme in 2005 in Parsa, one of the *Terai* districts to assess technical, financial and cultural acceptability of ECOSAN and hence to develop appropriate ECOSAN technology and approach to further replicate and scale up in the country. The pilot programme was designed in such way that it would overcome the problems being faced in dry Ecosan in the previous piloting programme and also to save the losses of under-utilization of urinal in the conventional types of latrines. The policy makers, donors and other promoters will have to establish very effective and efficient market strategies and support mechanism to scale up sanitation throughout the nation

SELECTION OF PROJECT SITE

Of the various districts in *Terai* belt, Parsa district was identified as one of the vulnerable districts in terms of sanitation coverage. Parsa lies in the central development region and near to the East-West Highway. As one of the objectives of the pilot programme was to replicate Ecosan in other *Terai* districts, Parsa was deliberately selected as it had the easy access from the national highway. Due to easy access, farmers from neighboring districts can make the visit of Parsa and vice-versa. Moreover, there are regular and frequent flight services available to Simara, just 20 Km from the project site. This also eased frequent central level support and monitoring of the programme. Parsa is also a potential district for vegetable production with established market linkage to nearby districts and even Kathmandu.

Sabaithuwa village of Parsa Biratauni VDC in Parsa district was selected as the most feasible community for implementation of the Ecosan project. The community, with majority of *Kohir* caste (vegetable growers) lies nearby from Birgunj, the district headquarters of Parsa district. Only about 20% of the total households had latrines in the community and the environmental sanitation was very poor. Over 80% households were dependent on agriculture and among them about 50% households used to grow vegetables (DWSS, 2005). The vegetables were mostly grown nearby their homesteads by using chemical fertilizers and manure produced by cow dung. When reconnaissance survey was conducted for five communities in Parsa district, this community was considered the most feasible in terms of sanitation, existing vegetable occupation, willingness to adopt Ecosan latrines and use of urine and faeces as manure in their agriculture farm.

CHOICES OF TECHNOLOGY

As the project area falls in *Terai* region, the ground water table is specifically very high during rainy season. The flood occurs rampantly and water level raises above the ground level which causes difficulties to maintain human faeces dry as needed for the dry Ecosan. It is commonly believed that pathogens (ascaries) die when the faeces are kept dry for about six months; otherwise it takes about two years to die the pathogens in case of wet faeces. As such any latrines to keep faeces dry in *Terai* area require a considerable elevated chamber resulting high cost. Alternatively, chamber can be constructed below the ground surface to accommodate the human faeces for two years to allow the wet faeces free from pathogen.

Therefore, a unique wet Ecosan latrine was designed particularly for *Terai*, in such way that human faeces are simply disposed alternatively in twin pits lined with concrete rings. Once one pit is filled up, the faeces is then disposed to another one, and vice versa. In such latrines, as sludge volume is reduced due to provision of soaking action of liquid, the cost of this type of latrine is less. In case of urine, it is stored in a separate plastic jars (Fig. 1). In this model, bottom cleansing can be done at the hole of the pan itself, which are more users friendly as compared to dry latrines. Pan being water sealed, people can clean the pan with water and hence the latrine can be maintained clean and odorless. Moreover, the use of wet latrine is also simpler than dry latrine. Specifically visitors and guests can also use the latrine easily with a little instruction.



Fig 1: Plastic jar for urine collection

In conventional latrines, urine is mixed with faeces; by doing so, large portion of nutritious contents is likely to get lost in the soak pits. Studies have shown that urine contain about 85% manure value whereas, human faeces contains only about 15 %. As such faeces after storing for two years can be taken out from the pit just before rainy season so that the faeces are dry for using it in the agriculture land. The urine which is separately stored can be used at any time with or without dilution as highly nutritious organic fertilizer for vegetable and fruits. Research has also shown that E-coli can not penetrate more than 1.5 m radial distance in medium fine sand soil (Cadwell, 1938 a) which is typical soil type in Teri region. This fact can help to resolve the general mis- conception that latrine pits might pollute bacteriologically the ground water..

Research in South Africa has shown that the leachate produced by the manure obtained from the dry Ecosan latrines over a period of six months contained significant amount of E-colis and nitrates. This has given the evidence that even the dry Ecosan could not produce pathogen free manure in six months time. Therefore in the typical context of *Terai* where maintaining faeces dry is almost impossible due to flood and high ground water, water sealed pan with a provision of separation of faeces and urine could be a unique latrine option acceptable to the communities in terms of technology.

MAJOR ACTIVITIES ACCOMPLISHED

The programme activities were grouped into three phases- Predevelopment, Development and Implementation. During the Pre-Development Phase, a first task was to select a community that was the most potential one in terms of sanitation, accessibility, willingness, agriculture potentiality, market, etc. In order to find the project site, reconnaissance survey was conducted in five communities in the vicinity of Birgunj; and Sabaithuwa village in Parsa Biratauni VDC was selected. Then club-Jyoti Youth Club was selected from the project site for community mobilization and implementation of the project as the local partner. At the beginning of the programme, baseline survey was conducted to assess sanitation, water, health, socio-economic situation, agriculture potentialities, market, etc. Based on the base line survey, a number of activities were devised to implement during the development and implementation phases. A total of twenty units of latrines were built during the project period. Followings were the major programme activities carried out:

Households selection for latrine construction

Once the club was selected, the local club announced who would be willing to build the Ecosan latrines. The club also put a notice on a public place and on the club's office calling application for the latrine construction. Then there were response from over 100 households expressing willingness to build latrines. The club made a certain criteria to select the households among applicants. The criteria for selection of households were- i) having agriculture land and vegetable garden, ii) willingness to afford for superstructure, iii) acceptability to handle decomposed manure and iv) readiness to apply manure in agricultural field. Then 20 households were selected based on "first come first service" among the households who met the above criteria.

Door to door visit

The club members made door to door visit to promote Ecosan latrines particularly to aware on importance and use of the latrines, nutrition value of human faeces and urine, agriculture use, operation and maintenance of the latrines, etc. During the visit, they were also discussed with latrine options, types of superstructures, unit cost for each type and their willingness to pay.

Mason's training

There was obviously a challenge before the Project to introduce an affordable and culturally acceptable Ecosan technology in the community. A mason of Lalitpur who was involved in Siddhipur Ecosan programme was requested to be resource person for the training in the Sabaithuwa community but he was reluctant thinking that his opportunities would be lost if his knowledge was transferred to others. Therefore engineers and technicians of CODEF were first oriented at Kathmandu on construction of the Ecosan pan and then mobilized to the community. They provided training to the local masons to build Ecosan pan, concrete rings and superstructures.

Modification of design and construction of pan

The Siddhipur Ecosan pan was cast-on-situ in the concrete slab over the chambers (Fig 2). Later, separate units of pans were developed by ENPHO with mosaic surface and non-sticky materials (Fig 3) and were to install similar to the conventional pans in the latrines. The pan was made to dispose the excrement to the direct pit, whereas, urine to plastic jars. The modified pans were then used in Khokana, and later in Siddhipur where ENPHO expanded the Ecosan programme with financial supports from UN Habitat.

The pans were again significantly modified in Parsa to suit the requirement and willingness of the Terai people and also to overcome the problems being faced in Siddhipur and Khokana models. It was modified in such way that urine and faeces could be separated and the bottom cleansing could be done in the same pan's hole without shifting the position. The pan consisted of water seal which enabled flushing and hence avoided foul smell. The pan is connected with twin off-set pits made with concrete rings with a provision of junction box (Fig 5). Hence a single pan could serve the purpose unlike the dry Ecosan which needed in contrary double pans.

After imparting on-site training to the local masons to build pans, a mason from the same community made few pans and showed to the villagers for its suitability. The pans were experimented by men and women in the community for few days. Then the pans were modified to ease bottom cleansing and stop splash of urine. The mason kept modifying the pan until the users were fully satisfied (Fig. 4).



Fig 2: First Ecosan pan developed in Sidhinur



Fig 3: Ecosan pan modified by ENPHO



Fig 4: Ecosan pan modified in Parsa



Fig. 5: Concrete rings at twin pits

Construction of concrete rings

The size of pits was designed to accumulate the faeces of a family of six members for two years. With this design, a pit needed concrete rings at least there in numbers, each of 40 cm height and 100 cm diameter (Fig 5). The local masons built the rings after they received the training. The local club managed cement and iron reinforcement bars and the users managed sand and aggregate required for the rings. Parsa Water Supply and Sanitation Division Office provided the iron mould of the rings. People realized that the quality of the rings was also far better than those ones available in Birgunj Bazaar. This increased more participation and ownership of the community towards replication and scale up of the Ecosan project.

Construction of superstructures

People were provided different options for making superstructures on their own. The most discussed options were bamboo and bricks made structures. The cost for one superstructure with bamboo was calculated almost one fourth of the brick made structures. However, as the season was off, they could not harvest bamboo during the construction period and hence all of the 20 households made the structures with brick masonry (Fig 6).

Exposure visit of the farmers

An exposure visit of the farmers of the Project site was made to Siddhipur and Khokaka to share experience on latrine use, maintenance, agriculture application of urine and faeces. After the visit, they were highly convinced to apply urine to vegetables, fruits and wheat, etc. They were also convinced to use urine as a pesticide and also to use it as a catalyst to make compost of household wastes. The farmers were also excited to observe the process of borrowing and lending urine as an economic commodity (Box 1).

Financial supports

The local club was supported with an amount of NRs 200,000 to build 20 units of Ecosan latrines. As they massively mobilized local resources and every component they made themselves such as pans and rings, they saved some amount. The support was provided only up to the plinth level, the cost of which was about NRs 6,000. An additional NRs 1,000 was also provided to support for building the superstructure as they could not harvest the bamboo during the project period. The farmers managed the remaining cost for superstructures. The club has a plan now to build additional 10 units of latrines with the saved amount. The farmers will be supported with pan and rings, the cost of which is about 3,000 only and the remaining will be borne by them.

Dissemination workshop

At the end of the project, a dissemination workshop was organized in the project site to disseminate the learning, success stories, technology, acceptability and agriculture use of Ecosan project. The participants were from farmers from neighboring districts- Bara and Rautahat including Sabaithuwa villagers. After the workshop, the participants committed that they could also build latrine, provided Ecosan pan and concrete rings worth of about Rs 3,000 were supported

Agricultural Application

In order to design the doses of urine for various vegetable and fruits, purposive five samples of urines from male and female representing various castes and economic status were collected and tested for obtaining value of Nitrogen, Potassium and Phosphorous (NPK). Similarly, five purposive samples of soils were also collected and tested for their NPK values. The total Nitrogen (N) varied from 744 to 6776 mg., Potassium (K) from 216 to 1603 mg and Phosphorous (P) from 257 to 1171 mg per

Box 1: Urine recognized as an economic commodity in Khokana

In Khokana, a Newar community in Lalitpur district, more than 50 units of Ecosan latrines were built and used. Mr. Ganga Dongol a leader farmer in Khokana borrowed urine from the village households and stored in drums. He used the urine for wheat, fruits and vegetables. He returned back the urine when the farmer were needed back. People in Khokana thus initiated a system of borrowing and lending of urine as an economic commodity. They see the importance of urine and wonder why such latrines were not being promoted for so long in the past

*Even before the Project, they used to apply faeces and urine in the farm unscientifically. But the project helped them to use faeces and urine as manure scientifically. A Nepali proverb saying **Pet ko Khetma, Khet ko Petma** (from stomach to farm and from farm to stomach) is very much applicable in Khokana. The proverb which is being used since centuries denotes the correlation of faeces/urine and crops. In other words, what has been developed in the farm is useful to the stomach and vice versa.*



Fig 6: Urine application in potato in Parsa

liter of urine. The variation might be due to different levels of quality & quality of food and liquid consumptions of people. Similarly total Nitrogen (N) value varied from 1176 to 1386 mg, Phosphorous (P) from 535 to 1074 mg and Potassium (K) from 7.33 to 87.33 mg per kg of soil. However, while calculating the urine dose, mean NPK values of urine and soils of all the samples were taken (Fig 7).

Based on the lavatory analysis of the urine and soil samples, the dose of urine was calculated at about 32 liter in each plot of 4 sq.m. for potato (Fig 6). The dose was applied in four splits at the interval of ten days, with about 8 liters of urine at each split. It was suggested to use in a dilution ratio of urine and water as 1:3. For the purpose of the comparison, three plots, each of 4 sq.m. were developed as demonstration plots; one plot without any fertilizer, second plot with chemical fertilizer and third plot with urine application. The on-going monitoring has shown that the growth of potato in the plot where urine was applied is better. After harvesting the potato, the yield (weight) and taste of the potato grown in each plot will be assessed. Farmers have been oriented on precaution to be taken on dose and timing while applying urine..

COMPARISON OF VARIOUS LATRINES

Based on the experiences, four parameters- cost, uses of urine and faeces, technology and applicability were assessed to compare among the conventional latrines (two pits with pour flushing), dry Ecosan and wet Ecosan latrines (Table 2). The comparison shows that the wet Ecosan can be very effective technology to convince farmers especially poor to promote sanitation. It is a way forward to increase sanitation coverage to meet the Millinium Development Gaols (MDGs) and the national targets and also to contribute in poverty alleviation.

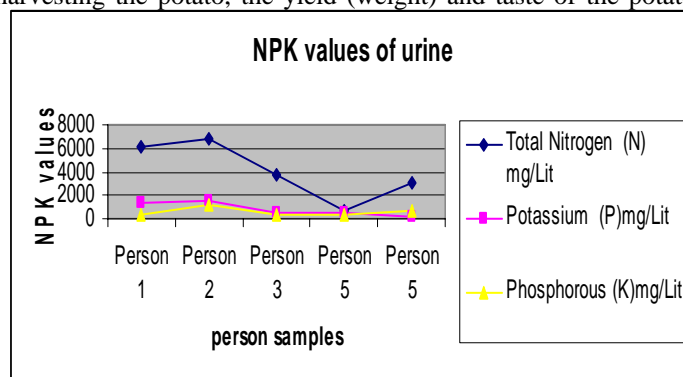
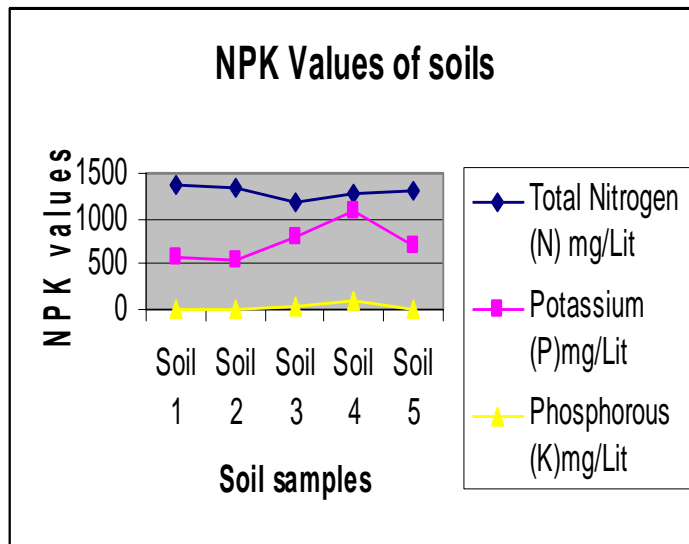


Fig 7: NPK values of urine and soils

Table 2: Comparison of various latrines

Parameters	Conventional latrines Off-set two pits, pour flush)	Dry Ecosan (developed for Siddhipur/Khokana)	Wet Ecosan (developed for Terai)
Cost (up to plinth level)	• Rs 5,000	Rs 7,000	Rs 6,000
Use of Urine	• No	• For vegetable, wheat and fruits	• For vegetable, wheat and fruits
		• Decomposition of cow dung and household garbage	• Decomposition of cow dung and household garbage
		• Used as pesticide	• Used as pesticide
Use of faeces (as a manure)	• Sometime used	• Used after one year	• To be used after four years
		• Used for vegetables. wheat and fruits	• Used for vegetables. wheat and fruits
Technology	• Faeces and urine mixed, flushed and decomposed to pits	• Faeces and urine separated;	• Faeces and urine separated;
	• Pan with water seal, flushing the pan after defecation,	• Faeces kept dry, husk, lime and ash put on the faeces after each defecation	• Pan with water seal, flushing the pan after defecation,
	• Cleansing the bottom in the pan itself	• Cleansing the bottom by shifting the position	• Cleansing the bottom in the pan itself
	• Sufficient water needed	• Only little water required; Water required only for bottom cleaning	• Sufficient water needed
	• Off set pits	• Direct pit	• Off set pits

	<ul style="list-style-type: none"> • Users friendly O&M, No odor 	<ul style="list-style-type: none"> • Emits some foul smell and difficult to maintain clean 	<ul style="list-style-type: none"> • No foul smell due to water seal pan and easiness to clean the pan
Applicability	<ul style="list-style-type: none"> • Hills and Terai where water is adequately available 	<ul style="list-style-type: none"> • Hill and Terai where water is scarce 	<ul style="list-style-type: none"> • Hill and Terai where water is water is adequately available

FINDINGS AND CONCLUSIONS

Acceptability

One of the objectives of the project was to assess the cultural accessibility of Ecosan latrine. Community people overwhelmingly accepted to adopt and use Ecosan latrines. They used urine in their vegetable, cereal crops and fruits. They started replacing chemical fertilizer by urine, thereby saving money on procurement of the fertilizer. It is expected that the nutrition intake of the farmers will also be subsequently increased due to high value nutrition contents in the organic vegetables. The hundreds of households waiting to build Ecosan latrines in the Sabaithuwa village shows the promising results on acceptability.

Technical aspects

The dry Ecosan latrine developed in Kathmandu was modified by the local community people themselves. The pan was provisioned with water seal which helped minimize foul smell. Bottom cleansing was possible without shifting the position. Operation and maintenance was more users friendly. These were the positive aspects which enabled sustainability and acceptability of technology.

Replication

The local CBO-Jyoti Yuba club committed to scale up the Ecosan programme throughout the VDC within three years. The DDC and other district level agencies have also shown the interest to replicate in other VDCs. The farmers from Bara and Rautahat also made commitment to replicate the Ecosan concept, provided a support in the form of pans and rings.. the cost of the ring and pan to build latrines is insignificant as compared to the benefit expected to gain. It is advisable to make a provision to support poor farmers in the beginning of advocacy an piloting phases as it is given in bio-gas programme. . There is high potentiality of replication throughout the country if the programme is properly marketed.

RECOMMENDATION

Followings are some of the major recommendations:

- Piloting of Ecosan programme should be done further to develops Ecosan modalities.
- The awareness programme on acceptability of Ecosan concept should be developed
- Effective advocacy and campaigning programme on ECOSAN should be launched to aware communities in Ecosan to help them decide on their own compatible to their own situation through development and dissemination of appropriate IEC materials.
- Options of both the dry Ecosan and wet Ecosan should be offered to the community people.
- Low cost options of the Ecosan latrine should be further promoted.
- Exposure visit should be encouraged to motivate people.
- Government, donors and NGOs should establish networks with finance institutions for soft loan to promote sanitation.
- Some sort of supports should be provided in the beginning to encourage farmers as it is given for bio-gas plants.
- Local latrine entrepreneurs should be encouraged to build Ecosan pans through marketing, training, exposures, incentives, etc.

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