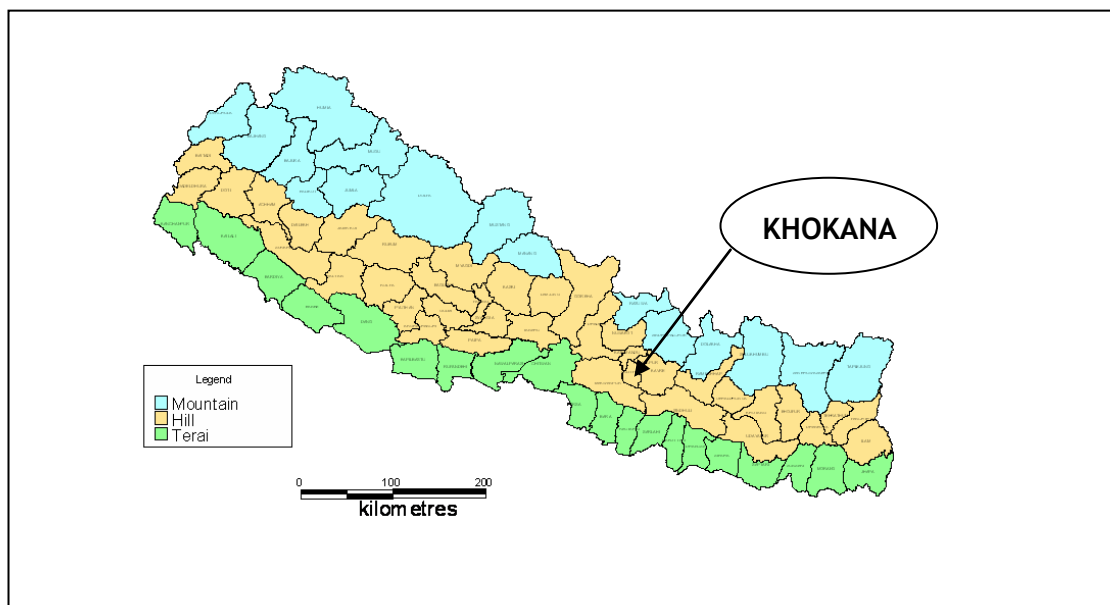


Khokana Water Supply and Sanitation Situation



N-04

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1. SUMMARY OF KHOKANA WATER SUPPLY AND SANITATION SITUATION

Khokana is the first village of Nepal where ECOSAN technology has been introduced by ENPHO. The strong agricultural character of the village and the poor sanitation situation are the main reasons why Khokana was selected for piloting the new technology.

ENPHO established partnership with a local based organisation - People Welfare Organisation (PWO) - which had a leading role in the social mobilisation of community. Social acceptance was the first challenge of the intervention which was overcome through repeated discussion sessions and trainings.

Initially only one latrine was built in the area to demonstrate the benefits of ECOSAN technology. Later, several households applied for the installation of the subsidised ECOSAN latrines. 65 latrines have been installed so far, and still many applications are pending until additional fund is available for subsidy.

Number of beneficiaries: 4,542
Number of households: 818
Hardware: 64 latrines
Main implementing agencies: ENPHO and PWO.
Supportive agency: WaterAid Nepal
Type of community contribution: cash, unskilled labour, materials and O&M
ECOSAN latrine cost: NRs.15,000-20,000
Main features:
✓ Introduction of ECOSAN latrines which turn waste into a resource.
✓ Introduction of several mechanisms to ensure collaboration of the beneficiaries.
✓ Great success of the intervention and increasing demand for ECOSAN latrines.

The total cost of an ECOSAN latrine ranges from NRs.15,000 to NRs.20,000. Latrines are subsidised up to pan level; and unskilled labour and the cost of superstructure is to be borne by the household. Community contribution for the pan level is around 20% of the total cost. As implied, operation and maintenance of the household latrine is carried out by the owner itself.

Several instruments were used in order to ensure the cooperation of the applicants. Regular research and monitoring work is undergoing to evaluate the sanitary units in consultation with users in order improve the ECOSAN technology. By now the results of the intervention are encouraging. Users are very satisfied with their sanitation option, human waste is no longer a problem of the community and has been turned into a resource with added value for the farmers.

As water quality was not satisfactory in Khokana, ENPHO with support of PWO also introduced an innovative water treatment technology called Solar Water Disinfection (SODIS). Awareness development and discussion with users was very important during all the intervention for the successful introduction of both ECOSAN latrines and SODIS technology.

2. BACKGROUND AND CONTEXT

According to the historical evidence, the Khokana village was settled during the 13th century. Historically, Khokana was situated on one of the major trade routes of Kathmandu Valley to the Southern economic centres through Bagmati gorge. With the construction of Tribhuvan Highway and advent of modern means of transportation, the importance of this major economic centre of medieval time lost its significance. At present Khokana seems an ancient settlement lacking modern services (see figure 1). The settlement has been proposed as a World Heritage Site and this proposal is raising hopes for the development of Khokana.

SOCIOECONOMIC FEATURES

Average family size: 6

Average household monthly income:
NRs.4,349

Illiteracy*: 77% female - 47% male

Main castes or ethnic groups: Newar

Main occupations of the head of the HH*: self-employed in agriculture (64%) and housewife (14%)

Type of house ownership: owned house

Khokana is situated on the Southwest of Lalitpur Sub-Metropolitan City. According to Population Census 2001, the total population of Khokana was 4,542 living in 818 families. The population growth rate was low 0.65% during 1991-2001 because of out-migration.

Literacy rate of Khokana is above the national average for both sexes. Almost all residents of this community are Newar. Currently, average monthly income per household is estimated at NRs 4,349. Agriculture is the main income source of the Khokana village. Operation of traditional mustard oil mill, small cottage industry and handicraft production at micro level are other supplementary sources of income of the community. Underemployment and disguised unemployment is also prevalent.

3. DESCRIPTION OF THE WSS SITUATION

Khokana was trade route to Tibet and India in the medieval period. Taking this opportunity, people of this town requested to the high level Rana administrators, who used this route to go to Dakhshin Kali and Terai, for appropriate management of drinking water in this town. As a consequence, in 1907 free tap water was provided through public taps from a gravity flow system with water source located at Hattiban of Chalankhel, Kathmandu. There was 24-hour water supply and water quality was good. It is held that probably it is the residents of Khokana who were the first users of tap water in Kathmandu valley.

When the settlements surrounding Khokana started to grow fast, water supplied from the said source started to decline gradually. Later, Nepal Water Supply Corporation (NWSC) brought water from Farping Power House to fulfil the needs of present Lalitpur Sub-metropolitan city. Thus, as Khokana was located at the route it has been linked with the NWSC system.

* Data obtained from a household survey conducted among 70 households in January 2007.

At present NWSC is distributing water for the residents of Khokana from 310 private and 13 public taps (figure 5). Supply of water is intermittent from the beginning of NWSC service in this town. Water supply has further declined and now on an average less than four hours is provided by the NWSC. Most of the traditional dug wells, spouts and ponds are still in operation and are used for different purposes other than drinking and cooking to supplement the shortage of water. However, condition of these sources now is very poor due to lack of maintenance. This case study report delves on the sanitation component as the drinking water system is described here is not a system for Khokana as such but of Patan municipality.

Figure 1. General view of one of the streets of Khokana



Figure 2. Drainage system in Khokana.



People used to defecate openly nearby their houses, courtyards (chowks), public places, etc. Water drains constructed for rainwater had turned into sewerage and blocked from human faeces (see figure 2). In the extreme, all the streets and roads were looking like an open latrine! Consequently, people were suffering from communicable diseases like diarrhoea, dysentery, and large number of people, especially children, was dying of these diseases.

To escape from this problem, a group of youths took initiative, and later with the help of UNICEF and Ministry of Local Development, 384 Sulabh Sauchalayas (pit latrine) were constructed in 1978 with the aim of improving sanitation on the one hand and using treated faeces from the pit for agriculture on the other. Because agriculture is the major occupation of almost all residents of Khokana and its people were traditionally using human waste as manure, the concept of Sulabh latrine was introduced in the community. Unfortunately, majority of the latrines were suffered from a common problem of quick overflow due to high ground water table in the community. After this event, a concept of Sanitation Master Plan was initiated which came out with the approach of **developing sewerage and latrine simultaneously**.

Because of poor sanitation situation and its marked agricultural characteristics, Khokana was selected by Environment and Public Health Organisation (ENPHO) for launching and piloting **Ecological Sanitation (ECOSAN) latrines** in 2002 (see figures 3 and 4). Khokana became the first village in Nepal where this technology was

introduced as a planned intervention. ECOSAN latrines, also known as 'Mal Charpi' (manure latrines) in the community, are a low cost eco-friendly sanitation technology suitable for farmers.

The ECOSAN latrine has urine-separating system that enables separate storage of urine and faeces and minimises use of water required for toilet. The urine is led through a pipe into a special container. The faeces are also collected in a separate container and they are mixed with ash, soil, husk, leaves, saw dust or any other suitable material available in the community. Separating urine from faeces and adding ash, husk, saw dust, reduces bad smell from the latrines. And ultimately both of these are used in agricultural field as fertiliser. The collected urine is retained for 15 days in the tank before its application to the field. Likewise, the faeces are being collected in one vault and need about 5-6 months to dry up to be good compost. After filling the first vault a second vault is used for the same purpose.

The design of latrine introduced in Khokana blends both Indian and Vietnamese styles. The vault system is taken from Vietnamese style and Indian style adds anal cleansing area. The vaults are above the ground level and lined with cement concrete at the base which checks the seepage of moisture from ground. There is no need for excavation. In between the two squat holes an area is provided for the purpose of anal cleansing. The anal cleansing area is also provided with pipe connection to drain water to the adjoining reed bed next to the urine collection tank. The reed bed which is a scale down version of reed bed system for wastewater treatment treats the anal cleansing water. Treated water can be used in flowerpot, flowerbed, and kitchen garden.

Figure 3. General view of an ECOSAN latrine.



Figure 4. Different compartments of an ECOSAN latrine



Major benefits of ECOSAN latrine are as following: control of environmental pollution, save water from contamination while using septic tank or sewerage, make available free compost for farmers and save money, substitute imported chemical fertiliser and maintain quality of land, etc. This technology is proved useful for this community who are eager to use their urine and faeces as manure in their field.

Initially, only one ECOSAN latrine was constructed for sample demonstration and promotion of social acceptance. Later, additional 9 latrines were constructed for the same purpose. Attraction of people on such latrine increased after observing the benefits of the new technology. A second and a third phase of the intervention were also launched with 30 latrines constructed in 2004 and 25 in 2005. Still large number of applications is pending due to lack of fund for subsidising the latrine.

Figure 5. Public tap with reservoir



Figure 6. Solar Water Dis-infection System



As the sources of water in and around Kathmandu valley are polluted, and treatment plants are costly, people are compelled to drink unsafe water. Along with the construction of ECOSAN latrine, ENPHO also introduced in the community a very cheap technology called **Solar Water Disinfection (SODIS)*** to make people use safe drinking water (see figure 6). SODIS is an easy and economic technique of treating drinking water at household level. It requires transparent plastic PET bottles of 1-2 litres capacity and solar energy for about seven hours. The solar ultraviolet rays disinfect harmful micro organisms. Now this is proved as one of the most effective technologies for the reduction of communicable diseases. Thus, both ECOSAN and SODIS systems have been gaining popularity among the people of the town.

4. ORGANISATIONAL AND INSTITUTIONAL ASPECTS

Different institutions like NWSC, World Vision, Lumanti, Urban Infrastructure Development Project, Water Aid, ENPHO, CCL, are involved for the overall development of Khokana. Among them NWSC is responsible for water supply and ENPHO is working with People Welfare Organisation (PWO) known as Jankalyan Sangh in Nepali parlance, in construction of ECOSAN latrines (figure 7 and table 1).

* DWSS, UNICEF - Nepal, EAWAG - Switzerland, SANDEC - Switzerland and ENPHO were involved in a research entitled "Measuring Effectiveness of SODIS in Nepal" in 2004. The SODIS system of water treatment is not only implemented in Khokana but it is implemented in all the districts of Kathmandu valley, Terai districts through ENPHO, Lumanti Support Group for Shelter, ECCA and other community organisations.

The current drinking water system was built by Patan Branch of NWSC. Moreover, all management functions of drinking water including operation and maintenance are performed by the NWSC Jawalakhel branch. There is not much involvement of community other than paying their water bill to NWSC at the standard rate. This section therefore mainly focuses on institutional arrangements for sanitation intervention.

Figure 7. Stakeholder’s map and their interactions for the sanitation intervention

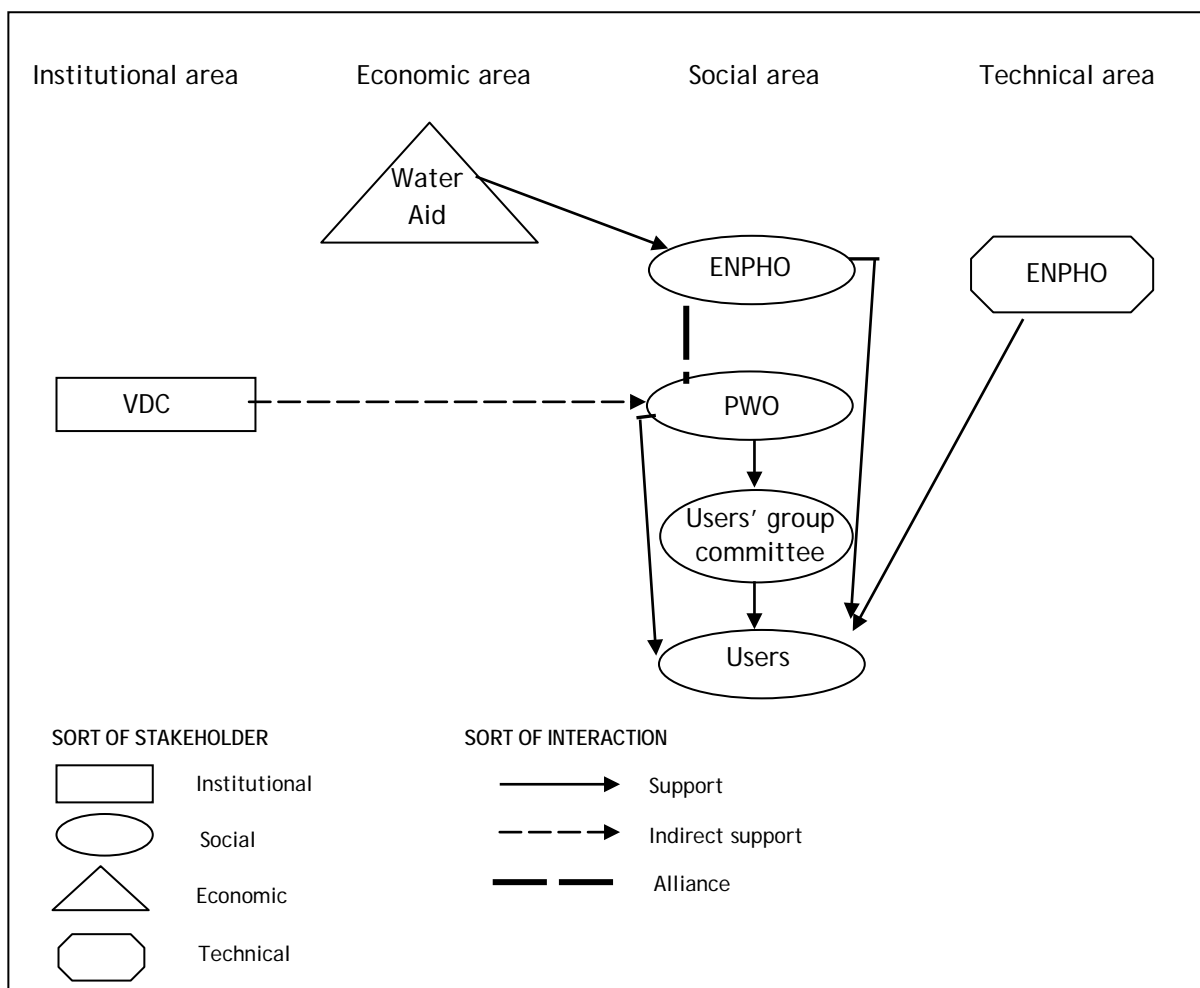


Table 1. Role of the stakeholders

Stakeholders group	Main activity
WaterAid Nepal	Financial assistance
ENPHO	Implementing agency: provision of guidelines, technical assistance, training
PWO	Mobilisation of community, support during construction activities and supervision and monitoring
VDC	Support of PWO
Users' group committee	Exposition of main difficulties and ideas
Users	Construction and maintenance of the latrine

ENPHO selected Khokana as an intervention area because there was a lot of scope to improve its sanitation situation through the construction of ECOSAN latrines. ENPHO conducted consultation and interaction programme with community people and the authorities of PWO to analyse the feasibility of the intervention.

PWO is a local based organization formed by non-political youths of Khokana. It has been working for the socio-economic development of Khokana since 1996. From the observation and discussion with PWO and community people, ENPHO authorities reached at a conclusion that ECOSAN latrines could be a good solution for this agro-based community.

For the effective implementation of ECOSAN latrine programme a framework has been worked out by ENPHO that helps push forward the programme in a coordinated manner. The programme includes selection of local partner, formation of user's group committee, interaction with users' group committee, selection of households for socio-economic study, design and construction of system, development of IEC materials to make the community aware of the system, orientation, operation and overview.

PWO is selected as a local partner by ENPHO during the whole phase of the ECOSAN latrine programme. This organization helps ENPHO to identify and select households where the ECOSAN latrines are to be constructed. It is also involved on regular monitoring of the programme and assisting in the implementation of training and orientation programmes. Besides, it assists in organising meetings, orientations, trainings and conducting research works. Similarly, it also supports in procuring construction materials, keeping records of financial transactions, deploying masons and labours, and providing monitoring report of the on going activities.

After the completion of household survey, ENPHO with the consultation of local partner has developed criteria to construct ECOSAN latrine. The lowest administrative level for the implementation of the programme is a ward.[†] Once a ward is selected, households are selected using the following criteria:

1. Household should be economically poor.
2. There is no latrine in a household or if there is one then it is in bad condition.
3. Household from scheduled caste and from poor groups.
4. Household interested to construct ECOSAN latrine.
5. Household willing to use human waste as manure.
6. Household with agriculture as a major occupation.
7. Household with private land within the project area.
8. Household ready to provide contribution to install the latrine.
9. Household ready to fulfil all the contributions immediately after the sanction of the application.

With the selection of the households, a written agreement is made between ENPHO and each household for the construction of latrine. During construction period a

[†] Ward is a lowest administrative unit of a Village Development Committee or a municipality. A VDC is divided into 9 wards.

supervisor from community is contracted by ENPHO to observe the day-to-day construction work and to monitor quality of work. This also helps in proper utilisation of the subsidy.

ENPHO also provides training on how to build latrines and prepare compost from latrines. Masons from community have been hired by ENPHO and trained on technical aspects of ECOSAN before the construction of the latrines.

One of the most difficult parts of the intervention is the mobilisation of community and development of social acceptance towards the new technology. For this purpose, demonstration latrines have conducted in the community. A seven-member **user committee** has been formed consisting of local people, village heads and members of PWO (local partner NGO) with the main aim of sharing common problems and ideas and foster community involvement in intervention. The user group committee also works as liaison between ENPHO and selected households.

ENPHO has also given emphasis on awareness programme and developed IEC materials such as brochure, poster, flash card informing about the use and benefits of ECOSAN latrine and SODIS technology. Similarly, ENPHO has organised several trainings focussing on improving water, sanitation and hygiene behaviour in the community. PWO is also involved in training and demonstration activities of both ECOSAN and SODIS technology and developing awareness of community people.

5. FINANCIAL ASPECTS

5.1. Latrine Programme

As mentioned before, ENPHO has supported the community for the construction of ECOSAN latrine in three different phases. The latrine is subsidised in order to promote environmental sanitation. The subsidy provided by ENPHO is granted by Water Aid - Nepal. As the latrine built in a household has a positive externality to the other household, offering a targeted subsidy to the poor is not unjustifiable.

The cost per unit of latrine is given in Table 2. On the average, the total cost for a ECOSAN latrine ranges from NRs.15,000 to 20,000 depending on size, structure, material and time. The construction of ECOSAN latrine cost has declined due to improvement in design of latrine even though the material cost during this period has increased. Community contribution has increased markedly from the first phase to the third phase.

Users should contribute at least 20% of the total cost of latrine. However, users can contribute more than this proportion; it mainly depends on the socioeconomic status of the household. The amount of subsidy provided to the user is discussed between user and ENPHO technician and upon the design and size of finalised toilet. Community contribution is in the form of cash, labour and materials. Labour and materials contribution is limited to the supply of necessary unskilled labour during the construction period, and providing door and roofing materials apart from some little amount of cash. The full cost for the operation and maintenance of latrine is also borne by owners themselves where PWO provides advice to them if necessary.

The households interested to construct ECOSAN latrines have to fulfil the following conditions:

1. The applicant should deposit NRs.1,000 immediately after the approval of the application. Out of it, half is returned back once the household supplies necessary unskilled labour for the construction of sub-structure (up to pan level) and complete the construction of superstructure.
2. Rest NRs.500 is spent on mutual agreement between consumers and PWO, but preference is given to fulfil the difference or adjust the labour cost.
3. The consumers are responsible for transporting all construction materials provided by the ENPHO from the nearest delivery point to the construction site.
4. Well-informed members of household should compulsorily attain the training/workshop and discussion organised by ENPHO on water and sanitation.
5. Consumers should be ready to provide necessary help to ENPHO on research and study on ECOSAN latrine (designing, impact study, etc.)
6. Consumers should be ready to use compost produced from latrine in agriculture field properly or should manage it by selling or providing to others free of cost.
7. Consumers should be ready to use water treating from SODIS technology and help to promote this system in the community.

Table 2. Cost of ECOSAN Latrine Construction, Khokana

Phases	Total cost (NRs.)	Number of units	Avg. cost per unit (NRs.)	Avg. community contribution per latrine (NRs.)	Avg. subsidy per latrine (NRs.)
I	192360	10	19236	3000	16236
II	467573	30	15586	5539	10047
III	377225	25	15089	6358	8731

A meeting is held between ENPHO, the PWO and households selected following the above conditions for the construction of ECOSAN latrine. They discuss on working module, and amount or type of contribution from the household. Construction work starts only after a tripartite negotiation among the ENPHO, PWO and users.

Currently, 65 households have fulfilled the above conditions and constructed latrine with the subsidy. A large number of households have made applications, which shows willingness to fulfil the criteria mentioned above. During the field work it has been found that it is not only the households without latrine but also those with latrine connected to sewerage are interested in ECOSAN latrine because of the benefits that it has.

5.2. Water and Sewerage System

Sewerage facilities are available in most of the main street of the town with the support of VDC, DDC and with the community contribution of 25 percent of the cost either in the form of labour or cash. Sewerage facility was constructed by Village Development Committee through users' committee. The responsibility of the users' committee was limited only to complete the work managing labour from the community. It has been dissolved after finalising the account of the project. People do not pay any charge for the use of sewerage as all the responsibility of operation and management lies with the VDC now. This is not a good approach from the viewpoint of sustainability. In fact, problem has started in sewerage requiring for maintenance.

As per the drinking water system, households with private connections have to pay for the water consumed to NWSC. Minimum water tariff for private connection is NRs.50 for up to 10 cubic meters of water and then NRs.15 for each additional cubic meter. More than half of the households having private connections are paying NRs.50-100 per month for water used and only 37% of the households are paying the minimum monthly tariff of NRs.50.

The connection fee is NRs 2,265 including deposit for meter cost, which is the same all over the country in the NWSC system. However, public tap users of Khokana are consuming water free of cost. Only limited contribution in the form of labour was offered by public tap owners during the construction of public tap stand and a small amount of money, labour cost or materials while constructing reserve tank of particular tap stand.

6. SUSTAINABILITY OF THE INTERVENTION

The level of awareness in this community is increasing. As a consequence, people of this community are ready to contribute in those projects which are started in their consultation. Past experience shows that people will be ready to contribute in those activities which are beneficial to them in particular and their society in general.

In Khokana there is discrimination among men and women in several respects. Role of women in decision-making is very low in the community. This is mainly because women of this town are not competent as of male as they are discriminated in the provision of services including education. Women lack knowledge about outside world because they have no or very little exposure outside their village. However, discrimination by caste/ethnicity is not a problem of Khokana because almost all households of this community are Newar, and they have friendly relationship even though there are various sub-casts within Newar community.

Building ECOSAN latrines is not the first and ultimate goal of the ENPHO project. Another important aspiration of the intervention is that operation and maintenance of the ECOSAN latrine is carried out by the users themselves. Accordingly, users have been trained to solve the operation problems themselves. However, this is not always the case yet in Khokana and regular monitoring and consultation is still needed to guarantee the sustainability of the intervention. Some users contact PWO looking for

advice and support to repair their latrines. Sporadically and when requested by PWO, ENPHO also visits Khokana and provides aid to users to repair their latrines. Moreover, an agronomist from ENPHO assists and provides technical advice regularly to farmers for the use of fertiliser prepared from ECOSAN latrine. One of the farmers interviewed during the fieldwork said that *their potato crops grow better with the urine fertiliser*.

As ECOSAN technology is still new in Nepal, research work and follow up process are of great importance to gradually improve the method and technology. In 2003, when the second phase of the intervention started, ENPHO carried out a follow up of the first intervention in order to learn from the first experience. Research studies to make latrines more cost-effective and analyse the impact of human urine and compost faeces on crops and yield in the field of the farmers are still undergoing.

Of the total latrines constructed in Khokana, 90 percent are fully successful, whereas 10 percent households have faced little operation problem basically caused by the incorrect use of the latrine. One of the most common problems encountered was the mixing of faeces with water used for anal cleansing which disrupts the process of compost production. However, none of the households consulted during the survey stated to be dissatisfied with their present sanitation option and most of them seem to be fully satisfied.

ECOSAN latrine now become very popular in this community and many applications to construct an ECOSAN latrine has been received but could not be satisfied due to lack of fund. Therefore, PWO is looking for support from donors to get fund to construct more latrines. However, it is difficult to say that it will be sustainable in the future as there is drastic change in the behaviour of youths, and many of them will not be following the agriculture occupation.

Now about 80 percent households of the town have latrines of different types - connected in sewerage, connected in septic tank and ECOSAN latrines. Among the rest, 10 percent could not construct latrine because of poverty and other 10 percent due to lack of enough space for latrine construction at and around the house. To solve the space problem now ENPHO is designing indoor ECOSAN latrine which can be constructed within the houses. Similarly, the community leaders and social activists are seeking appropriate donors to provide full subsidy to the ultra poor families for latrine construction. In spite of 80 percent latrine coverage, some old people of households with latrines are still using open space for defecation. It is because they could not change their traditional habit.

The quality of currently supplied water is good but compared to the old source of Hattiban, the quality is low. Moreover, the quality differs by season. The water is supplied after chlorination but it is not filtered. Thus, people of this town are compelled to use muddy water in the rainy season. Community people said that *sometimes they get insects too while fetching water from tap*. Despite all this, 96% of the households believe water is safe to drink.

Now water is supplied intermittently, 2-3 hours daily, pressure/force of water is low and supply hour is declining year after year. Because of the geographical

characteristics of the area pressure and duration of water supply differs. People living on high land part of Khokana are deprived of regular water supply and get only few hours with low pressure, whereas in low land the opposite is the case. The quantity of water supplied by the NWSC in this town is sufficient in rainy season but not enough in dry season and people are compelled to use unsafe water from well and ponds. Regular cleaning of reservoir (main and constructed at the public tap stand), increasing its capacity and extending distribution line according to the increase in population are the main demands of community for improvement of the drinking water system.

Sanitation system in this community at present is very effective, especially after the connection of some latrines to the sewerage. However, the community is not raising maintenance fund for the sewerage system. Thus, it will affect the sanitation service in the near future. Provision of Aakshya Kosh (eternal fund) and collection of regular fee for operation and maintenance of any system is necessary for the sustainability of any project.

7. CONCLUSION

ECOSAN technology has been found growing popular in the community and has also been disseminated outside Khokana community. Actually, Khokana serves as an example to other villages where this technology is being introduced. Beneficiaries from Khokana are collaborating in the dissemination of the benefits of the ECOSAN technology in other localities.

The ECOSAN latrine not only conserves resources and eliminates pollution but also helps to improve sanitation system through reducing pollution and minimising excessive use of water used in the conventional latrines. Introduction of ECOSAN system in Khokana is a new technique to use human waste as fertiliser in agricultural field. Khokana residents are aware of the fact that human excreta can be used as resource to increase the quality and quantity of yield. It is also useful for the reduction of chemical fertilisers which is costly as well as dangerous for human health and agricultural field if not used properly.

The users have appreciated the benefits of the ECOSAN latrines and therefore public interest towards this type of latrine is growing. People from other households in the Khokana community and elsewhere are equally interested to build one such latrine in their houses.

8. LESSONS LEARNED

- **Awareness is important for improving hygiene and sanitation in a community.** Khokana community is located just 6 km away from Patan. However, it was a dirty community because most of the households did not have latrine mainly because they lacked awareness on hygiene and sanitation. With the increased awareness, most of the households have latrine now, and the environmental sanitation of the community has been significantly improved now compared to before.
- **A sanitation technology appropriate in one place is not necessarily appropriate for other place.** The latrine built under the UNICEF support has not been used longer because of the overflow of the tanks due to high water table. However, with the invention of the ECOSAN technology, which requires little water, there is great demand for such a latrine.
- **The demand for a technology is high when people think that it is beneficial for them and their livelihoods.** The demand for ECOSAN latrine is high because it consumes less water and therefore pit does not fill fast on the one hand, and it offers compost manure on the other. However, the level of the sustainability of the technology partially depends on whether younger generation will also follow agriculture as their main occupation.
- **A community can get services when they demand for it.** There was lack of tap water in the community. The youths and other people of the community demanded for water and therefore they received it. The fact that the community was not much advanced compared to many other surrounding communities and that it was the first community surrounding Kathmandu Valley that got water, suggests that people have to demand for services if they have to fulfil their needs.
- **Mechanisms to ensure the commitment of beneficiaries to complete the construction of their latrines are of great importance for the successful implementation of a sanitation project.** Several mechanisms were used in this intervention to ensure community collaboration and the complete construction of the latrines:
 - **Written Agreement:** Before starting the construction of the latrine ENPHO and every household signed a written agreement with their main responsibilities.
 - **Payment of a fee that is partially returned back after successful completion of the latrine:** if household cooperation is satisfactory half of the deposit is returned back to the applicant.
 - **Attendance to the training is compulsory:** one member of the household should compulsorily attend the training and discussion organised by ENPHO on water and sanitation.
 - **Remunerated supervisor from community:** ENPHO employed a supervisor of community to supervise household-by-household latrine construction and operation.

- **When a new technology is to be introduced in a community, social acceptance needs to be developed first. A demonstration action is a good strategy to overcome this challenge.** It was through the gradual demonstration of the new technology that community people started demanding latrines.
- **Research work is necessary to improve the effectiveness of the interventions.** ENPHO is continuously performing research activities and evaluating the systems in consultation with users. Cost of the technology could be significantly reduced between first and second phase of the project thanks to the research work.
- **Community put more emphasis on drinking water than sanitation.** This is evident from the fact that community people demanded for water as it was their felt need but not latrine. However, it is only when they were compelled due to difficulty in moving around the community that they demanded for a latrine. This hints that drinking water is must but latrine is not for poor communities in developing poor communities.

Table 3. Problems faced during the sanitation intervention

	Problems faced	Strategies to solve the problem	Extent to which the problem was solved	LESSONS LEARNED
FINANCIAL	Relatively high cost of the ECOSAN latrine.	Research has been conducted by ENPHO to optimise the price of the latrine.	The price of the latrine has been substantially reduced.	Improvement of the technology and effectiveness of the intervention can be improved through research work.
INSTITUTIONAL	Social acceptance of the new ECOSAN technology.	Construction of a demonstration ECOSAN latrine. Repeated informative and demonstration sessions. Formation of a users' committee to share ideas and common problems.	Popularity of ECOSAN latrines is very high now.	Social acceptance needs to be developed when a new technology wants to be introduced. Demonstration activities are good methods of improving community acceptance.
SUSTAINABILITY	Operation problems due to inappropriate use of the latrine.	Repeated trainings and demonstration sessions to show the proper use of the latrine. Guidance and technical support by PWO and ENPHO when operation problem comes out.	Very few households face operation problems.	Proper use of the hardware is essential to guarantee long operation of the system. A sound dissemination campaign is needed in order to ensure proper use of the new technology.

Table 4. SWOT Matrix

	SOCIAL	INSTITUTIONAL	ECONOMIC	TECHNOLOGICAL	ENVIRONMENTAL
Strengths	<p>Attendance to the training organised by ENPHO was compulsory.</p> <p>Masons and supervisor were members of the community.</p>	<p>Written agreement between the household and ENPHO for the construction of the latrine.</p> <p>Accurate criteria to construct ECOSAN latrine.</p>	<p>Reduction of total cost of the latrine because of research activities.</p> <p>Half of the deposit is returned back if household cooperation is satisfactory.</p> <p>Much higher contribution of community in the second phase of the ECOSAN intervention.</p> <p>There are different rates of subsidy provisions for different groups of households in the ECOSAN intervention.</p>	<p>Development of sewerage and latrine simultaneously with ECOSAN technology.</p> <p>SODIS is an easy and economic technique to treat water.</p>	<p>Improved environmental sanitation of community.</p> <p>Control of environmental pollution.</p> <p>Reduction of chemical fertilisers use.</p> <p>Minimisation of water used.</p>
Weaknesses	<p>Role of women in decision making process is very low.</p>	<p>Degree of involvement of local authorities is very low.</p>	<p>Because of subsidy to all, the demand for ECOSAN latrine was not fulfilled.</p>	<p>ECOSAN latrines require more maintenance care than conventional latrines.</p> <p>Quantity of water supplied by NWSC is scarce.</p>	<p>Low quality of water supplied by NWSC.</p>
Opportunities			<p>Research of fund for construction of more ECOSAN latrines.</p>	<p>Further improvement of the technology to make it more cost-effective.</p>	<p>Further number of ECOSAN latrines which helps for the reduction of latrines connected to sewerage.</p>
Threats	<p>Less involvement in agriculture activities of the youngest generation.</p>		<p>No collection of maintenance fund for maintenance of sanitation system.</p>	<p>Improper use of ECOSAN latrine disrupts compost production.</p>	<p>Still many households do not have latrine.</p>

REFERENCES

Environment and Public Health Organisation (ENPHO) (2003), *Implementation of Ecological Sanitation (ECOSAN) Toilet in Khokana VDC*, Lalitpur.

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List of Key Informants

1. Madan Krishna Dangol, former Village Development Committee Chairman
2. Jagannath Maharjan, former ward chairman, ward no. 3
3. Gopal Dangol, Social Activists and directly involved before and during construction of ECOSAN latrine
4. Sher Bahadur Maharjan, Employee of Khokana Village Development Committee Nepal Dangol, Coordinator of ECOSAN latrine construction project on behalf of People Welfare Organisation
5. Prajwal Shrestha, Environment and Public Health Organisation (ENPHO)

Group discussion with the executives of PWO including Chairman, Secretary, consultant.