

## Future of Ecological Sanitation (EcoSan) Globally

Nam Raj Khatri\*,  
Thecho-9, Lalitpur, Nepal,  
namrajkg@gmail.com,  
+9779841644198/namrajkg

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*Abstract:* EcoSan is a holistic concept, to save water, prevent contamination and pollution of water and return the nutrients of human excreta back to the soil. The EcoSan concept considers human excreta as a resource rather than as waste as earlier understood.

EcoSan is the way towards a clean environment. It will be widely adopted globally in the future, mainly due to its potentiality to recover nutrient, save water and energy and linked to climate resilient. Current barrier of social, technical and economic nature will be overcome due to advance technology suitable for everyone.

For the promotion of EcoSan effort should be made to establish a resource center at country, regional and global levels as EcoSan hub. The researcher should be encouraged for technology development and create a global forum for information sharing so that everyone contribute to the common effort. Increased value of EcoSan is possible through its linkages with various aspects of life and environment.

The paper explores why the EcoSan will become important options of sanitation in the future and what are the ways to synergy the global effort. Technology is continuously improving. Concept and principles remain same but the system will change in the future.

The paper will also get into better form after the experienced gained at the conference.

**KEYWORDS:** Ecological sanitation, Future of EcoSan, Global synergy.

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## Introduction

EcoSan is a holistic concept, to save water, prevent contamination and pollution of water and return the nutrients of human excreta back to the soil. The EcoSan concept considers human excreta as a resource rather than as waste as earlier understood. For EcoSan, toilets are specially designed such that urine and feces are separated. Urine is collected in a tank and used regularly on the farm with appropriate mixing with water. Similarly, feces are allowed to decompose in the chamber for about six months before applying in the farm and then used as manure. Since urine is chemically richer than NPK fertilizer farmers feel that vegetables grown with the use of urine is tastier and yield higher.

EcoSan is the way towards a clean environment. It has the potentiality to recover nutrient, save water and energy and linked to climate resilient. But due to current barrier of social, technical and economic nature, it is not spreading.

The paper explores why the EcoSan will become important options of sanitation in the future and what are the ways to synergy the global effort. Technology is continuously improving. Concept and principles remain same but the system will change in the future.

## Materials and methods

Paper is mainly based on review of literatures and ideas generated based on the prevailing situation. Here, in the paper six reasons towards the bright future of the EcoSan has been explained. Similarly, six actions to be carried for the promotion of EcoSan have been explained.

The future of EcoSan is bright because of the following reasons:

1. Increasing environmental concern globally will give positive pressure to go for EcoSan as a best option of sustainable sanitation.
2. Because of its potentiality for low carbon emission in comparison to other options EcoSan will be appreciated.
3. Due to recovery of nutrient in a close loop it will attract many people demanding ecological sanitation options.
4. Improved technology for EcoSan will automatically overcome current social barriers and every one and every setting will be in a position to accept the ecological sanitation options.
5. Its potentiality to operate with low water will address water scarcity and complexity of sewerage system will be also overcome.
6. EcoSan becomes solution for many schools and institution where there is water scarcity.

Following actions has been proposed for the future of EcoSan:

1. Promoting EcoSan and resource center at country, regional and global levels as EcoSan hub.
2. Encouraging research and development of technology addressing comfort of the diverse nature of social groups.
3. Creating a global forum for discussion on ecological sanitation and information sharing.
4. Everyone contributing to the common effort with scope for innovations.
5. Establishing linkage with health, sanitation, water, energy, tourism, agriculture, food safety, climate change, ecology and creating value.
6. Analyzing equity needs of diverse groups and potentiality of contribution from diverse group

## Result and discussions

Why the future of EcoSan is bright?

**Increasing environmental concern globally will give positive pressure to go for EcoSan as a best option of sustainable sanitation:**

The main objective of a sanitation system is to protect and promote human health by providing a clean environment and breaking the cycle of disease. In order to be sustainable, a sanitation system has to be economically viable, socially acceptable and technically and institutionally appropriate.

Furthermore, it should also protect the environment and the [natural resources](#). The EcoSan can be instrumental to avoid the need for a complicate system for wastewater management and treatment.

The sustainable approach to sanitation requires a systems thinking approach, rather than only focussing on the toilet itself. The experience of the user, waste collection methods, transportation or conveyance of waste, waste treatment, and reuse or disposal all need to be thoroughly assessed. The EcoSan simplifies the complex system into a simple one with all process on the site.

Environment and natural resources aspects involve the required energy, water and other natural resources for construction, operation and maintenance of the system, as well as the potential emissions to the environment resulting from the use. It also includes the degree of recycling and reuse of excreta practiced and the effects of these, for example reusing wastewater, returning nutrients and organic material to agriculture, and the protecting of other non-renewable resources, for example through the production of renewable energy (e.g. biogas or fuel wood).

**Because of its potentiality for low carbon emission in comparison to other options EcoSan will be appreciated:**

People are using various ways of disposing waste and excreta. Different options have different level of potentiality for CO<sub>2</sub> emissions causing climate change. A person excretes about 300 grams of faeces and 1 liter urine in a day. This makes about 3.5 kg nitrogen, 0.5 kg phosphorus and 1 kg potassium per year. That much nutrients are sufficient to apply fertilizer in 500m<sup>2</sup> land at the level of 70kg / hectares of nitrogen and to produce sufficient food for one person.

Carbon dioxide emission related to production of NPK is about 9kg for Nitrogen, 4 kg for phosphorus and 12 kg for potassium. This is equivalent to 45 kg/person per year, which will be avoided by using urine.

A theoretical analysis revealed that one person contributes about 30 gm/day BOD equivalent organic waste. One kg BOD produces 1.4 kg CO<sub>2</sub> in aerobic process and 1.68 CO<sub>2</sub> in an anaerobic process with gas used. One kg of BOD produces 0.68 Kg CO<sub>2</sub> and) 0.25 kg CH<sub>4</sub>. Considering widely used on-site pit system as base line, relative carbon emissions of other systems are: same in anaerobic pond, 69% in septic tank, 29% mechanical aeration system, 32% in anaerobic process, 29% in biogas system and 24% in natural oxidation system.

One person produces faeces that is about 30 grams of BOD equivalent. Considering that one kg BOD makes emission of about 0.68 kg carbon dioxide and 0.25 kg methane gas per kg and considering the climate change factor of methane as 20 times carbon emission of one person in a year becomes 62 kg. If faeces are used as fertilizer or soil conditioner, then emission that would occur in the pit can be considered as avoided by using the EcoSan toilet. Hence, total carbon dioxide emission that can be saved by use of EcoSan system is about 107 kg/person/year. In addition, it saves water in terms of toilet flush and kitchen farm saves energy in terms of fertilizer transport. Vegetables grown from urine application are normally healthy and tasty which does not require the use of pesticides. It is very difficult to quantify all but saving is very clear due to its capacity to close the ecological cycle within close premises of the household and it is felt environmentally friendly in Nepal.

**Due to recovery of nutrient in a close loop it will attract many people demanding ecological sanitation options:**

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year. That much nutrient is sufficient to apply fertilizer in 500m<sup>2</sup> land at the level of 70kg / hectare of nitrogen and to produce sufficient food for one person.

Vegetables grown from urine application are normally healthy and tasty which does not require the use of pesticides. It is very difficult to quantify all but saving is very clear due to its capacity to close the ecological cycle within close premises of the household and it is felt environmentally friendly in Nepal. In addition, water in the urine also fulfills water demand, which becomes meaningful amount if used drip irrigation methods. This can be a solution in the dry area where rainfall is decreasing and sources are drying due to the impact of climate change and water scarcity has been felt.

**Improved technology for EcoSan will automatically overcome current social barriers and every one and every setting will be in a position to accept the ecological sanitation options:**

Present barrier to expansion of EcoSan is mainly due to social acceptance and health risks. People in the part of the world were using human urine and faeces as manure in their own way and they were used to handling them. But it is not possible to handle the excreta in the way. Both are related to technologies. Appropriate technology can overcome both problems automatically. Technology developing now is very different from the technologies we used in the past. Therefore, the future of EcoSan lies in seeing its potential and investing on research development and infrastructure. We can not simply imagine the EcoSan system they may exist 50 or 100 years from now. There is no doubt that there will be much more sophisticated technologies than now. However, even in the future, the EcoSan principle of containment, pathogen destruction and nutrients recovery principles remains same because biological principles remain same. But EcoSan becomes easy to use because of technology, a barrier will be removed and benefits will be clearly visible and achievable in the simplest form.

**Its potentiality to operate with low water will address water scarcity and complexity of sewerage system will be also overcome:**

Water is the essential environment for sustaining life. Water is principal chemical components and makes up about 60 percent of human body weight. Both water and food have been limited by the effect of climate change in some part of the Himalayan region. In many locations due to unavailability of water sources nearby community water scarcity has been realized. In such situation EcoSan which does not require water flushing can be the solution for the villages facing an acute shortage of water for drinking and irrigation.

In addition, urine can be applied as water plus manure with proper combination using a drip irrigation system. Drip-irrigation technology delivers water directly to the plant root at the required time through a system of plastic tubes, thereby preventing losses due to evaporation or runoff. Drip-irrigation systems are 90% efficient, and therefore require minimum water for growing vegetables. This will make efficient use of precious water for reproducing fresh vegetables. Urine mixed with 1:4 water and used with drip irrigation system fulfills both water as well as fertilizer needs. Theoretically urine excreted by one person is sufficient to grow vegetables sufficient to one person. This is an idea to for keeping people in the same location to which they have sentimental attachment and have adapted in many other ways.

**EcoSan becomes solution for many schools and institution where there is water scarcity:**

Water, Sanitation and Hygiene are the essential external environment of the school, which has directly linked to their external environment, health as educational environments. Global guideline of UNICEF for WASH in School (WinS) has proposed three star approach for the WinS. For star one it has been proposed to have bottled water with student, toilets for both boys and girls and mass hand

washing facilities with soap. School management committee can gradually move to two star and three star to meet national standards. Hence, all three elements of the WinS require water. Many schools are facing water problems because that are not connected to public water supplies or that are located at difficult place. EcoSan can be solution for the school by avoiding water need for the toilets. A study revealed that mass handwashing with soap needs one liter of water per student per day. Water for drinking and washing can be arranged by rainwater harvesting from the rooftop. If the water need for the flushing is avoided water scarcity in the school will be solved.

### What can be done for promoting EcoSan?

#### **Promoting EcoSan and resource center at country, regional and global levels as EcoSan hub:**

There are some self motivated people who are doing very effective contribution towards EcoSan. But overall development takes place by collective effort. This is the era of information and knowledge management. A country should have a resource center where everyone can exchange their ideas and learn from them. Best resource center is one which demonstrate best practices, provide information and promote research. Similarly, there should be a wider knowledge management center at regions and global level for mainstreaming the global effort.

#### **Encouraging research and development for technology addressing comfort of every social group:**

As the future of the EcoSan lies in technology development. Research is needed for the technology development. Research should focus on technical innovations and focus on the need of the people. Gates foundation is promoting innovative sanitation globally. Research should be promoted from country, regions and global level. People with a a technical mind and innovative ideas should be encouraged.

#### **Creating a global forum for discussion on ecological sanitation and information sharing:**

There is a lack of single forum or global networks where everything can be shared relating to EcoSan. This condition is required for combining knowledge of everyone in a common platform.

#### **Everyone contributing to the common effort with scope for innovations:**

People globally are working in their own way. There may be so many duplications and doing the same thing with insufficient effort. There should be a system for common effort and taking forward of idea and innovations from the existing one.

#### **Establishment linkage with health, sanitation, water, energy, tourism, agriculture, food safety, climate change, ecology and creating value:**

EcoSan has linkage with health, sanitation, energy, tourism, food safety, climate change and ecology. Proper linkage has to be established so that every sector can contribute to the EcoSan. This will highlight the value of the EcoSan. The best way of life is that no one harm other people, animal and environment while enjoying self life. EcoSan may help in this philosophy in various ways which needs to be shared. Handling the excreta within one premises is one aspect which will end up the cycle without harming wider environment.

**Analyzing equity needs of diverse groups and potentiality of contribution from diverse group:**

Like every development element EcoSan also have diverse relations with diverse groups in the society. How the diverse nature of people can contribute to the EcoSan and how the diverse nature of the people can benefit from the EcoSan should be analyzed. This will help develop EcoSan for all.

**Lesson learned from fourth dry toilet conference 2015**

To be continues after the conference. (One page)

**Conclusions:**

EcoSan is the way towards a clean environment. It will be widely adopted globally in the future, mainly due to its potentiality to recover nutrient, save water and energy and linked to climate resilient. Current barrier of social, technical and economic nature will be overcome due to advance technology suitable for everyone.

For the promotion of EcoSan effort should be made to establish a resource center at country, regional and global levels as EcoSan hub. The researcher should be encouraged for technology development and create a global forum for information sharing so that everyone contribute to the common effort. Increased value of EcoSan is possible through its linkages with various aspects of life and environment.

**Autobiography**

Mr Nam Raj Khatri is resident of Nepal. He has worked with the Government of Nepal for 20 years in water and sanitation and with World Health Organization (WHO), for four years in Environmental Health. He completed Masters degrees in Environmental Engineering from the Tribhuvan University of Nepal in 2000 with distinction. He has published various papers on Water, sanitation and climate change. He was involved as coordinator for SACOSAN-V and facilitator for WinS (WASH in School) International ILE.



Address: Thecho Ward No 9, Lalitpur Nepal.

E-mail: namrajkgmail.com