Reuso

SUSTAINABLE SANITATION, ECOLOGICAL SOLUTIONS

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Sanitation history

Visit to Sweden:
Water and sanitation knowledge sharing

Interview with Swedish Embassy

ALTITUDE MILK
BLOSSOM OF MILK, BLOSSOM OF COMPANY

Reuss
SUSTAINABLE SANITATION, ECOLOGICAL SOLUTIONS

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Project: Decentralized Sustainable Sanitation NODE as a Knowledge and Impact Generation Platform in Sustainable Solutions

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UR COVER

Fotography: Hölö – Decentralized Wastewater Plant Telge Nät, Suecia.

SNV

NODO DE CONOCIMIENTO EN SANEAMIENTO SOSTENIBLE DESCENTRALIZADO

SUECIA

CONTENT

EDITORIAL

Safe access to water and sanitation is an issue of global concern and a challenge posed through national policy as a human right to achieve the benefit of these basic services for all Bolivians.

Thanks to that approach, progress has been made significant achievements in increasing households today have improved their quality of life with water supply and sanitation services in their households. In spite of this significant development challenges remain regarding the quality and efficiency of services for their own sustainability.

From this perspective, it is vitally important to generate more knowledge on water and sanitation in favor of complementary sanitation options because with these innovative actions based on successful experiences are promoted and, above all, it contributes to the achievement of assigned goals.

Decentralized Sustainable Sanitation system (DSS) is a new model of ecological sanitation to promote social, economic and environmental benefits and they are able to ensure the sustainability of their services.

In this issue of the REUSSO magazine innovative approaches and alternative technologies are shared; interviews, reports, inquiries and articles In which the contributions and benefits of Sustainable Sanitation Decentralized are described and highlighted, which are implemented through ecological dry toilets modules and technologies for decentralized wastewater treatment plants, incorporating elements of the value chain of sanitation service in order to promote reuse resources in the water treatment systems and organic waste, as well as to influence the exchange of information and knowledge for sanitation.

SNV is pleased to present the third issue of the specialized Sanitation REUSSO magazine, a means for the dissemination, reflection, research and exchange of experiences, focused on knowledge generation.

Jorge Julio Garrett Kent
Country Director SNV Bolivia

INTERVIEW TO AURORE LUNDKVIST, CHARGE D AFFAIRS SWEDISH EMBASSY IN BOLIVIA AND EVA OHLSSON, ADVISOR AT SWEDISH EMBASSY IN LA PAZ.

"WE ARE IN THE BEGINNING OF A NEW STAGE"

Interview conducted by Sol Bagur
SNV-NODE Project Consultant

"It is pleasing for the Embassy to see how we can improve the situation for Bolivian male and female thanks to a small grain of sand by the Swedish contribution."

In 2009, the Swedish Government designated a Special Fund for Adaptation to Climate Change (ACC), as part of Sweden's contribution to the "immediate climate finance", under the United Nations Framework Convention on Climate Change (UNFCCC).

In Bolivia, through the Swedish International Development Agency (SIDA) 200 million of Swedish kronor (SEK) (about USD. 29.5 million) additional were allocated to the regular 2009 to 2012 budget of cooperation to Bolivia, to be allocated to initiatives with a focus on adaptation to climate change.

1. What is the balance of the Embassy regarding the work done in recent years in terms of sanitation?

Well, it was an important work because it is closely linked to the policy of Sweden. We have tried to work together with authorities and organizations, since this works quite well in Sweden, but in this case adapted to the Bolivian reality. What can be observed is that up to now it has been a great success which is reflected by experts and own users. For the Embassy is pleasing to see how we can improve the situation for Bolivian male and female by a small grain of sand by the Swedish contribution.

2 From your point of view, which have been the most important aspects of Swedish support in the advancement of sanitation in Bolivia?

Water and sanitation interventions were strongly marked with the approach to take possession alternative technologies and management models, to enable better use and management of water resources at a time that provide inputs for public policy.

Photography: Workshop on Natural Resources, Water and Forest. La Paz, April 16, 2015

3 What do you think are the main advantages that Bolivia has currently in sanitation?

Definitely, the ongoing challenge concerns water shortages and that, in fact, will be increasingly limited. In this sense it is important to consider all technologies, not only to the highlands but also for the Amazon where water dominates. The interesting thing, in the case of Bolivia, it is that it presents many challenges and allows various enterprises; moreover that this is a very organized country. On that understanding, technology and management are very important components that require the participation of communities and there Bolivia is well advanced

It is vital that participation is accompanied by training to be able to address in a sustainable manner as it is the challenge water shortages and thus avoid, wasting resources existing in the country.

> *"It is important to consider all technologies, not only to the highlands but also for the Amazon where water dominates. The interesting thing, in the case of Bolivia, it is that it presents many challenges and allows various enterprises; moreover that this is a very organized country."*

Photography: Aurore Lundkvist, Charge D Affairs Swedish Embassy in Bolivia and Carlos Ortuño, Vice Minister of Water Resources and Irrigation.

4 What are the key actors and strategic partners with which the Embassy has worked on water and sanitation?

Well, Central Government, Departmental Governments, Municipality, universities like the University San Francisco Xavier de Chuquisaca, the University of San Simon in Cochabamba, AGUATUYA Sumaj Huasi and Water for People foundations, SNV, etc., are extremely important stakeholders. This may allow counting on new stakeholders join to the already known ones and are framed in Government policy.

Having increased the capacity of stakeholders on the issue of Adaptation to Climate Change it was supported in making decisions related to the use of natural resources and therefore in social governance.

5 What do you think about the activities developed by SNV?

The support to SNV/NODE project contributes strongly to the efforts of Sweden to take possession of Adaptation to Climate Change issue through technology, capacity building and management models. They were put into practice models proposing practical solutions to issues of sanitation, which influenced public policies at local and national level.

Photography: Eva Ohlsson, Advisor at Swedish Embassy in La Paz.

6 How the Government of Sweden, through its Embassy, plans to support Bolivia in the future, specifically on the issue of sanitation?

Although the portfolio of Sweden achieved the objectives defined in the Special Initiative on Climate Change and therefore contributed to the reduction of poverty, it's necessary to consolidate the process. Currently, it has been decided to continue as the international development cooperation between Sweden and Bolivia. It is planned to develop a new strategy for the period 2016-2020, but only in the near future we will be able to give more details on its strategic guidelines. We can say that we are just at the beginning of a new era

PUBLIC UNIVERSITY EL ALTO:

CLOSING NUTRIENT CYCLES THROUGH BIOPROCESSES

Photography: Kallutaca Experimental Station greenhouses

Humberto Sainz M.
Dean of Agricultural Sciencies, Natural Resources and Livestock area of UPEA

Initiative "Closing nutrient cycles through bioprocesses in El Alto Private University" comes as an effort from student-teachers community aimed at preserve health, improve environmental quality, prevent pollution and promote sustainable production in the Kallutaca Experimental Station (La Paz), site where the three careers composing the area of agricultural sciences, livestock and natural resources of the Public University of El Alto (UPEA).

As is the case with most of the localities in rural areas in the country, Kallutaca does not have collection service of solid waste or potable water or sewer, so with support from theUPEA technical procedures are implemented at low cost, accompanied by the necessary measures for the management and treatment of waste generated, transforming them into innocuous and useful products for agriculture (Bioprocess).

Foundations of process

Solution to the problem involves a series of actions that comprise a management system for the generation, treatment and valorization.

Thus waste management in the UPEA includes a set of operations that, in the case of solid waste, includes the "selection" or material separation to be treated biologically. These actions are followed by treatment, where it proceeds to the "recovery" of the contents of organic materials (fermentable) and application of these as organic fertilizers. Below are some of the components of the system are described.

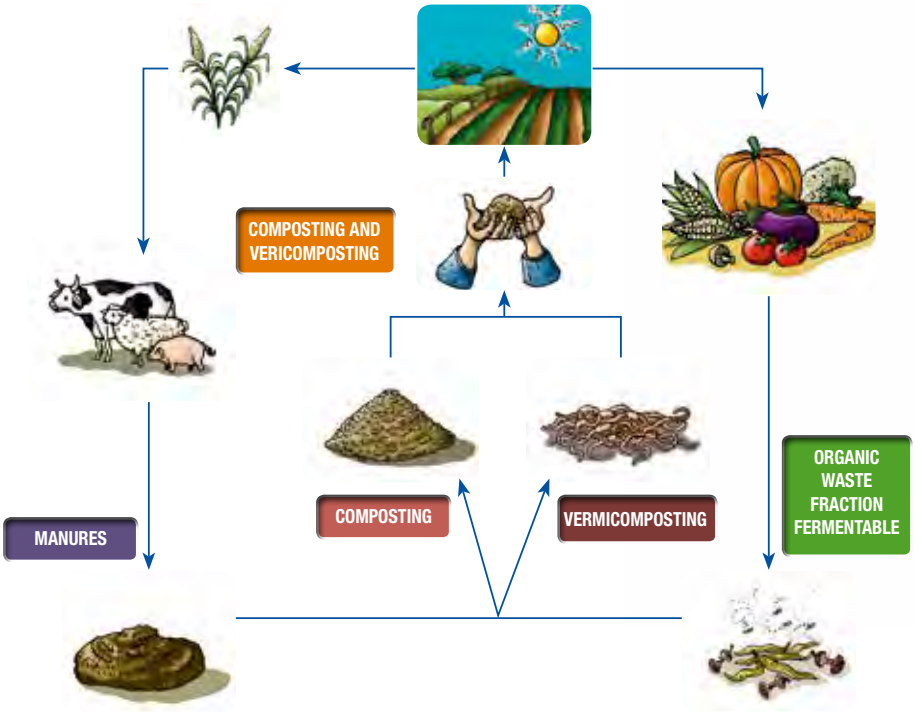
Separation at source

At the station a significant volume of agricultural, waste fruit of productive activities is generated. They are collected and "reserved" at a specific area until treatment.

photography: Visit to UPEA Kallutaca area.

photography: Visit to UPEA Kallutaca area.

NUTRIENT CYCLING IN COMPOSTING AND VERMICOMPOSTING BIOPROCESSES



Composting

Composting becomes a low-cost technology for the stabilization of organic waste (fermentable material) transforming it into an innocuous product called "compost" and a viable technique for the treatment of the organic fraction of solid waste. The process is facilitated by the separation of the components that is made in the generation sources.

Under the environmental conditions of the area, it has been observed that the fermentation is complete after 120 days of composting. Having established the fermentation process, detected through the reduction in temperature of the batteries, the composted material remains static for a period 45 days. During this period called "maturation stage," the material reduces its moisture and humidification processes are favored and other biochemical reactions that enrich and stabilize the material.

In Bolivia there are still no specific regulations for organic amendments as "compost" from organic waste. However, it is considered that at least the product obtained should meet the requirements shown in the next table:

TABLA 1. COMPOST MATURITY CRITERIA

Criteria	Maturity conditions
Odor	Moist soil
Temperature	Stable after turning
Color	Dark (brown-black)
Humidity	<40%
Particle size	90 % will pass through 25 mm mesh
pH	7,0 – 8,0
Cation exchange capacity	>60 meq/100 g compost
Chemical oxygen demand	<700 mg/100 g compost
Total organic material	>25%
Organic nitrogen	>1%
Ammonium	<0,04%
C/N solid stage	<20
C/N extract	5 – 6
P2O5 y K2O (recommendable)	> 1%
Escherichia coli	<1000 NMP/g compost
Salmonella spp.	Ausente en 25 g compost

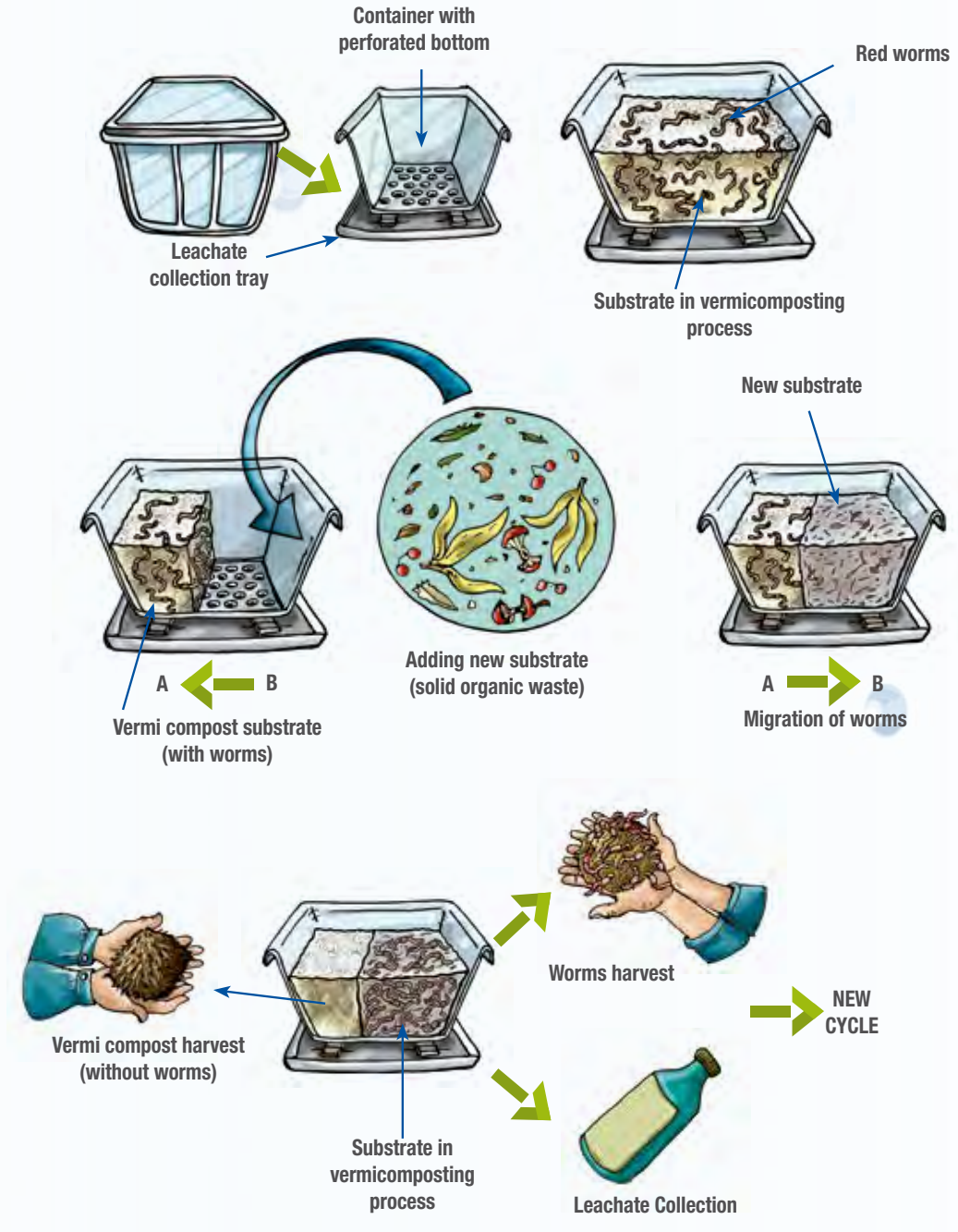
Source: Nogales R., Elvira, C., Benítez, E. y Gallardo-Lara, F., (1995). Agricultural use of compost and vermicompost of municipal waste (I): Processes, maturity and quality of the products. Waste material, 26, 53-57.

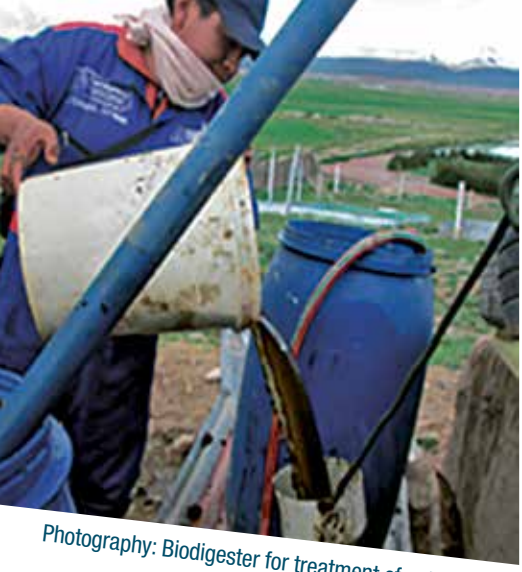
Photography: Final stage of the composting process and sifting of mature "compost"

Vermicomposting

Vermicomposting, worm composting vermi stabilization is a process of bio-oxidation and stabilization of organic material, mediated through the combined action of worms and micro-organisms. To do this, we proceed to the inoculation of the Californian red worm (Eisenia foetida) on that fraction of waste with plenty of liquid draining (remains of fruits, shells and other remains of food preparation).

INOCULATION PROCEDURE AND HARVESTING VERMICOMPOST, WORMS AND LEACHATE ("TEA WORM") IN PLASTIC CONTAINERS.





Photography: Biodigester for treatment of cattle manure. Biogas production and biol.

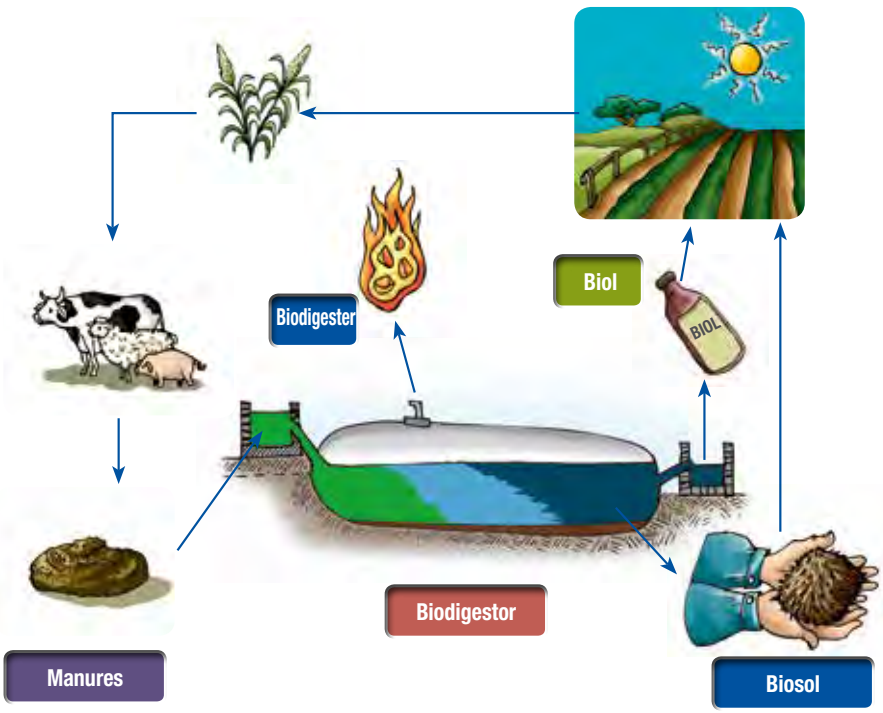
Biodigester

Biodigesters are structures in which methane gas is produced through anaerobic fermentation (without oxygen) of organic waste. The UPEA has a biodigester built with flexible material (PVC) (Taiwanese model), appropriate technology to optimize the management of livestock excreta, thereby reducing their pollution potential.

Biodigester is fed with cattle manure fresh or "green" but, together with the SNV, we have also planned to implement biodigester intended to treatment of solid waste, wastewater and human urine from ecological toilets for the purpose of reuse.

Photography: Visit to UPEA area.

NUTRIENT CYCLING IN BIOPROCESS ANAEROBIC DIGESTION.

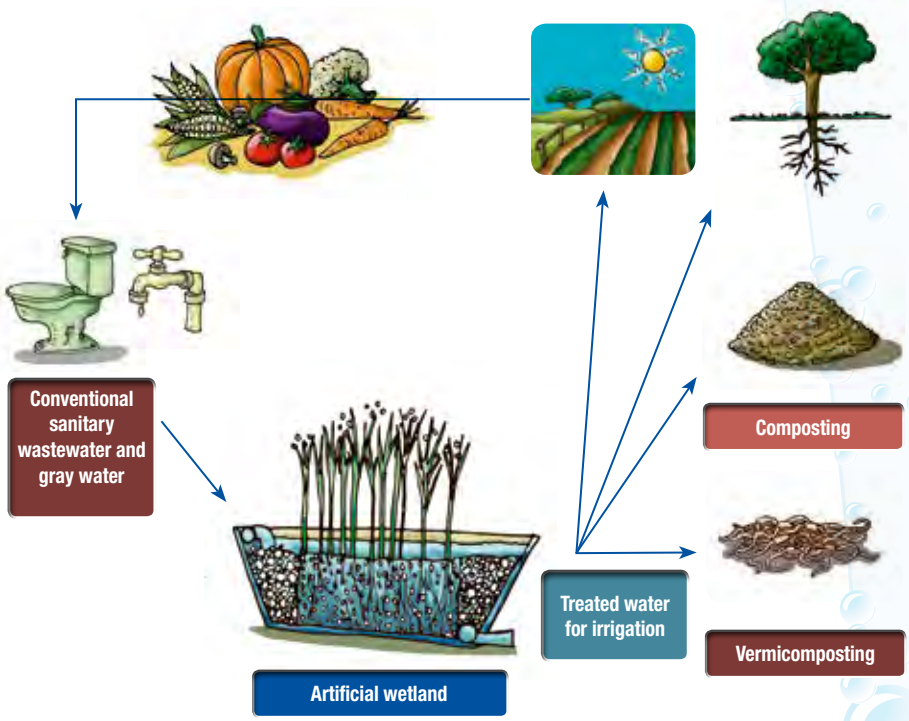


Artificial wetlands

Treatment of wastewater generated in conventional toilets, showers, sinks, kitchens and others, is done by artificial wetlands installed in the UPEA, thanks to the collaboration of Swiss Foundation for Technical Development Cooperation (Swisscontact).

It is a decentralized system that uses as a functional principle self-purification biological processes that occur in natural systems (wetlands). This media constitutes a filter medium helps reduce the degree of water pollution.

NUTRIENT CYCLING ON THE BIOPROCESS OF ARTIFICIAL WETLANDS RHIZOFILTRATION



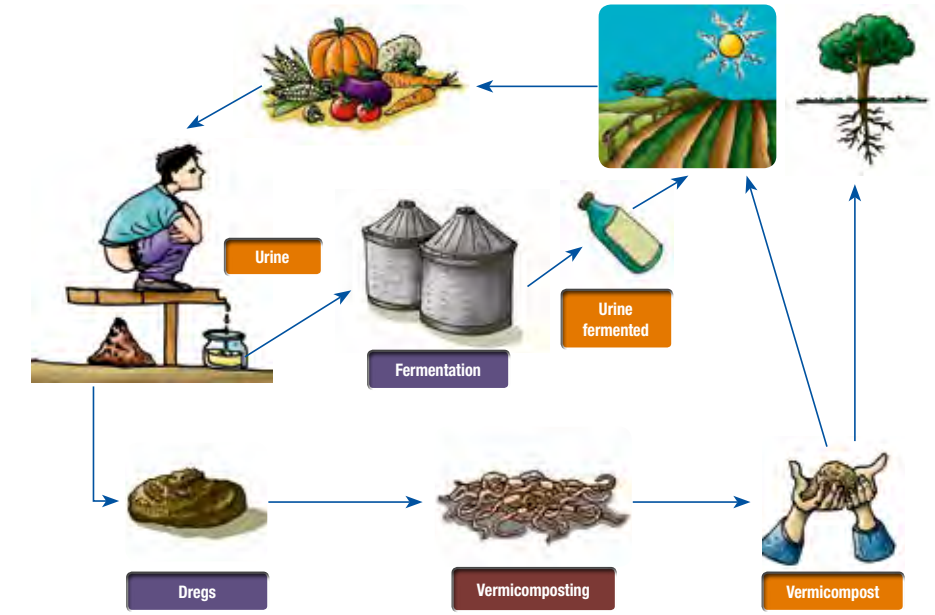
Photography: Artificial wetlands to treat wastewater generated in the Kallutaca Experimental Station.

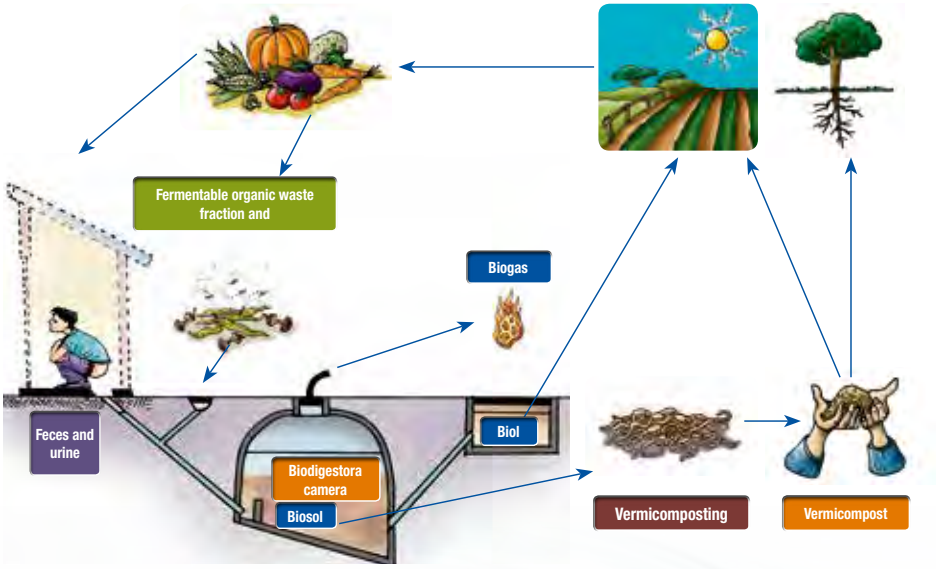
Ecological toilets: proposal

Given that the region has no connection to a sewage system, ecological toilets have become appropriate systems for management of human excreta. Implemented in areas surrounding the UPEA (District 7 of the city of El Alto) by Sumaj Huasi Foundation.

UPEA is being implementing ecological sanitation of septic tank, where feces will be gathered in a barrel, with urine separation. A viable proposal in the context of the UPEA is biodigestion process of human excreta together with other waste, in a digester chamber whose products would be an effluent (biological), sludge (biosol) and biogas.

"UPEA aims to become a research and social interaction organization par excellence, as well as having a key role in transformation and technological innovation in the country"





Destination of bioprocessed materials

"Compost" and "vermicompost" produced from organic waste are used as amendment, both in agricultural soils of Kallutaka Experimental Station itself, as in vegetable production areas (greenhouses) and gardening.

The vermicompost of human excreta will be primarily used for fertilizing of forest species. It will also possible to use (prior micro-biological analysis) to fertilize agricultural crops, except leaf vegetables for the risk of containing pathogens that could not be destroyed in the process of vermicomposting

The biodigester effluent called "Biol" is used as foliar fertilizer, diluted in water or applied directly to the soil. The solid residue called "Biosol" can be used as fertilizer or substrate for vermicomposting.

Destination of treated wastewater

Treated wastewaters in the system of wetlands are used to irrigate compost piles and vermicomposting berths. It can also be applied (previous analysis) for irrigation of crops and forages. On the other hand, treated water recirculates in wetlands in a system of "Bio-filter" with worms to complete and improve the efficiency of treatment.

Photography: Field visit to UPEA premises.

Final considerations

UPEA as a public university serving the most disadvantaged sectors of the society aims to become a research and social interaction organization par excellence, as well as having a key role in the transformation and technological innovation in the country.

The trends that are driving the relationship among innovation, security and food sovereignty also depends on other factors such as an integrated approach to sustainable management of the productive system, the preservation and promotion of biodiversity, the primacy of food security and sovereignty.

As it was mentioned, described actions, are considered a form of incentive for students and teachers who are interested in research, with emphasis on the development of research projects, participative action or development research, especially in the field of food security, agro-ecology and sanitation.

In this sense, implementation of treatment per bioprocesses should be understood as a strategy whose scope goes beyond related to waste management and that means an input for the development of a more ecologically sustainable organic agriculture than conventional.

Photography: Visit to Hölö, Decentralized wastewater treatment plant by humid composting- Sweden

VISIT TO SWEDEN: KNOWLEDGE SHARING ON WATER AND SANITATION

Liliana Gonzáles Alé.
SNV Water and Sanitation Advisor

Acquire and share knowledge in water and sanitation are activities which capitalize information, promote innovative actions based on proven experiences, generating inputs to exchange with other related stakeholders, and support making good decisions. Many social, private, public or development organizations include in their agendas issues related to water and sanitation, collaborating with the development of an institutional culture and promote the ability to optimize results and increase the value of their interventions.

Thereby, as part of the promotion strategy of Sweden, knowledge sharing was held from 1 to May 8, 2015 in Stockholm, with the support of the Embassy of Sweden.

This event contributed to intensify the knowledge of the participating organizations and, above all, it generated integrated policy proposals, with the purpose that practical changes occur in the future as a contribution to achieving national sectorial goals, related to the management and quality of water.

Knowledge sharing was successfully achieved with the participation of representatives of public, social, academic, development institutions and the Embassy of Sweden that formed the Bolivian delegation, including Vice-minister of Potable Water and Sanitation, Vice-minister of Water Resources and Irrigation, University of San Francisco Xavier de Chuquisaca, AGUA-TUYA and Sumaj Huasi foundations, UNICEF and SNV, who attended as international organizations with collaborative strategies prioritized in water and sanitation sector.

The objective was to exchange and present issues related to the situation in natural resources, water and sanitation sector for different stakeholders and public-private Swedish institutions. Also study visits to municipal authorities, companies and institutions were conducted.

During the visits to different Swedish institutions, the Bolivian delegation had the opportunity to know technological innovations, management models for water, nutrients, research, new approaches and concepts related to management. Also, they acceded to experiences on the reuse of treated water as well as nutrient application in production cycles. Water and sanitation treatments that strengthen public management and development actions.

"Meeting with organizations with similar features, and the presence of private companies working in the water and sanitation sector in Sweden, constituted the core of the meeting, as they were able to establish links between Bolivia and Sweden to continue the cooperation in this sector, regarding research, innovations and experiences."

The agenda was developed according to expected format, holding meetings with the Municipality of Södertälje; Swedish Association of Water and Wastewater; Swedish University of Agricultural Sciences (SLU); SIDA thematic seminar and workshop at the Institute of Stockholm Environment (SEI).

Also, there were meetings with representatives of Stockholm International Water Institute (SIWI); Sweco; CompostEra Swedish Technical Institute (SP), Toilets Without Borders, among others. Field visits to the wastewater treatment and wet composting plants at Hölö ; the biogas plant of the University of Agriculture of Sweden and Hammarby Sjöstad water recycling plant and recycling center in urban areas were held.

Bolivian delegation prepared information about the national situation on water, sanitation and treatment aspects of biogas, and presented aspects of solid waste management as a priority to address by public sector.

Each participating organization collaborated with preparation and submission of information on progress of projects funded by the Government of Sweden, as well as on the situation and challenges of the country in terms of water, sanitation and solid waste. Results of the concept of technological transformation were shown and how they may impact to the future; common democratic values within the institutions and solidity of partnership developed in the water instances for the protection of the common good.

Progress was highlighted, but at the same time, the need to continue working hard to achieve the goals of Agenda 2025 and the national policy of universal right to water and sanitation.

Meetings with organizations with similar features, attended by private companies working in the water and sanitation sector in Sweden as well, constituted the core of the gathering, as they were able to establish links between Bolivia and Sweden to continue the cooperation in this sector in regards to research, innovations and experience. Potentially, also aspects of a trade.

Bolivian delegation appreciated as positive the visit and promised to contribute to monitoring knowledge sharing activities. It was also achieved, identifying landmarks and commitments made in short term. For example, those related to coordinated meetings to promote initiatives related to management and water quality. Exchange of information and collaboration among implementing partners of SNV/NODE and some participants in Stockholm entities as well.

hotography: Hölö - Decentralized wastewater plant - Telge Nät, Suecia.

Additionally, AGUATUYA Foundation proposed as a challenge to work in a national proposal based on the experience known in Hölö plant. SNV/NODE and SLU University proposed to work on ecological sanitation research issues, as well as the adoption of Separett technology. Also among the Sumaj Huasi Foundation, the Global Water Partnership (GWP) and the SLU University will work on separators toilets technologies and mass treatment of liquid.

Photography: Seminar at the Institute of Stockholm Environment (SEI), Sweden.

> *To strengthen competitiveness, resilience and sustainability of water and sanitation management will be necessary to maintain a continuous exchange of processes and research outcomes among public, social and private organizations, as well as participation of experts in social policies, development and technical, inter alia.*

To strengthen competitiveness, resilience and sustainability of water and sanitation management will be necessary to maintain a continuous exchange of processes and research outcomes among public, social and private organizations, as well as participation of experts in social policies, development and technical, inter alia.

SNV will analyze and propose the best mechanism for this implementation in coordination with Swedish Embassy. Additionally it will train and exchange information with institutions within the Decentralized Program for Sustainable Sanitation and externally with working counterparts.

EFFLUENT RECOVERY PROMOTES SUSTAINABLE DEVELOPMENT IN THE REGION

Miguel Bohrt
Environmental engineer

Currently, a great pressure is exerted on water resources globally, mainly because water is an essential good of society and for the production of goods and services. Their excessive use and poor management can lead, by 2030, a water shortage in the world of 40% (WWAP, 2015). Furthermore, according to the World Health Organization by 2025 "... about 2,000 million people will live in countries or regions where water scarcity will be absolute".

Under this trend, the activity that uses more water worldwide is agriculture, with 70% of freshwater withdrawals and over 90% for consumption (water used in manufacturing, food preparation, etc.) (FAO, 2013). Putting in evidence the need to change agricultural practices and replace the fresh water as the main source of irrigation for agriculture.

That is why, thanks to its status of waste, we can take advantage of treated wastewaters in different activities that do not require drinking water quality as a way to protect the precious

resource, such as in recharging aquifers, reuse in industry, recreation activities, agriculture, firefighting, irrigation of green areas, etc. (MMAyA, 2013).

It is essential to recover the residual water by treatment processes for reuse effluent safely.

In turn, the reuse of treated wastewater or recovered not only prevents unnecessary wear on fresh water, but rather it has a number of benefits in use. As is the case of biodegradable organic material in the waste water, which by treatment mainly from biological nature, it becomes mineralized by obtaining nutrients concentrations (phosphorus and nitrogen) usable by plants, representing a natural fertilizer and becoming valuable raw material.

According to the World Health Organization (WHO), with an irrigation rate of de 1,5 m3 /m2 per year for a regularly semiarid climate, wastewater can supply 225 kg of nitrogen and 45 kg of phosphorus per hectare (WHO, 2006).

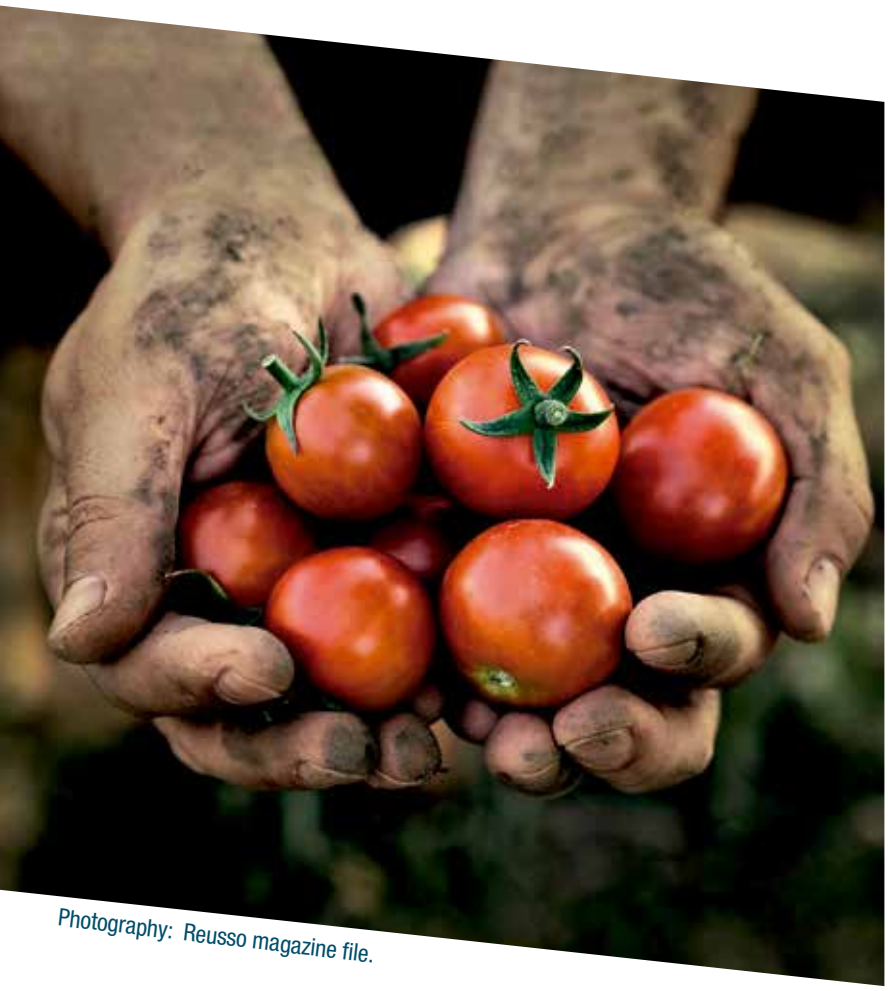
Furthermore, there are indirect benefits to the environment related to the use of treated wastewater in agriculture, such as reducing impacts with the extraction and production of fertilizers. Also wastewater reuse implies recycle nutrients to be absorbed by plants, and return them to the cycles in nature, avoiding its liberation (WHO, 2006).

Implementation of a project for the reuse of urban effluent usually is very large and expensive, mainly because the treated water quality must meet a specific quality.

That is why there are many aspects to consider when planning the recovery and reuse of wastewater, of them the specific objective of the project highlights since this will primarily determine a standard for setting the required water quality.

For example, water to irrigate green areas or reuse in fires will be different and certainly lower quality than water for other activities, as there are plants that recover waste water to be injected into groundwater wells to provide potable water. In the latter case, it is vitally important to pay attention the presence of three types of contaminants:

"According to the World Health Organization by 2025 about 2,000 million people will live in countries or regions where water scarcity will be absolute."



Photography: Reusso magazine file.

Wastewater recovery can be considered a measure to safeguard water resources through their efficient and safe use, as it prevents water bodies like rivers, lakes, wetlands and even oceans would be the destination of the waste water from cities and communities.

1) pathogenic agents mainly viruses, 2) organic substances, including pesticides and 3) heavy metals. The required quality can only be obtained after a recovery advanced high cost process.

Another case is that of irrigation in agriculture with recovered wastewater, where it is necessary to analyze the concentration of: salts, toxic ions, sodium, nutrients and pathogens, among others, since mentioned contaminant levels can damage the soil used in crops, although harvests may be affected by high concentrations of such substances. But interaction among soil, crop and irrigation water will be closely linked to climatic features of the site, soil properties and raw wastewater to recover.

However, not only wastewater can be recovered through large projects, or which cover a large demand, it is an increasingly common practice to recover effluent in the same place of its generation and at small-scale.

The most common practice is to separate the black of gray wastewater and exploit the latter after conditioning to water plants, as a source of water for toilets or any other use.

Even, there are facilities in households for the integrated treatment of all generated, gray and black wastewater, in a way that there is no release into the environment or sanitary sewer connection. Treatment of wastewater may vary from septic tanks, until avoid its generation using composting toilets that treat human excreta for composting.

Photography: Quinoa fields by Daniel Martínez Núñez

"It is an increasingly common practice to recover effluent in the same place of its generation and at small-scale. For instance separate the black of gray wastewater and exploit the latter after conditioning to water plants, as a source of water for toilets, etc."

Benefits from this kind of recovery are: reduction of fresh water consumption and its respective monetary savings, less generation of municipal wastewater, environmental protection, improved water availability in arid climates, economic benefits of users, among others.

However, small-scale recovery is more common in suburban and rural areas, which brings some limitations to their environmental benefits. Since the largest concentration of people is found in urban areas and therefore greater wastewater generation, being very limited positive environmental impacts

By poor rural people. Still, the benefits counted are many.

Wastewater recovery can be considered a measure to protect water resources through efficient and safe use, not only because enablement wastewater water as an alternative, but for the environmental benefits generated not only because wastewater enablement as an alternative, but for the environmental benefits generated to prevent water bodies like rivers, lakes, wetlands and even oceans would be destination of the waste water from cities and communities.

In addition, positive impacts to recover the wastewater and reinsert in the cycle of human activities are economic and social issues, with the aim of promoting sustainable development.

TREVERIS FOUNDATION
AND ITS GOOD PRACTICES IN ECOLOGICAL SANITATION

> *Children and youth in poverty and marginalization in communities Luje (Poroma) and Laja Tambillos and Laja Kasa (San Lucas), have the opportunity to access to this new sanitation technology friendly to the environment.*

Henry Morales M.
SNV-NODE Project Consultant

Undoubtedly Decentralized Sustainable Sanitation is a new approach inspired by the concept of ecological sanitation with a holistic view of the natural cycles, in which the wastewater and treated excreta are not considered as waste but, on the contrary, are employed as reusable resources. Chuquisaca Solidarity and Friendship Foundation, known as TREVERIS Foundation is developing in different municipalities of the department of Chuquisaca sanitation experiences with this approach.

Children and youth in poverty and marginalization in communities Luje (Poroma) and Laja Tambillos and Laja Kasa (San Lucas), have the opportunity to access to this new sanitation technology friendly to the environment that returns nutrients to the soil, and it is a clear and obvious example of a development in balance with Mother Earth.

Photography: Children from the Department of Chuquisaca on a crop of lettuce.

Photography: Monitoring visit to the municipalities of the Department of Chuquisaca.

Construction and use of new Ecological Dry Toilets, integrated into modules of six units, provide students opportunities of school clusters to strengthen their knowledge, skills and humanistic, technical and production abilities in community, through the reality of their own socio-educational centers, and encourage their integration from harvest of rainfall in tanks with 10,000 liters.

This vital resource feds an irrigation system provided under the system of terracing, since it is very useful for the production of lettuce, tomatoes, beets and other root crops that are part of the socio-educational projects, which show good ecological practices, adapt to climate change and food security, contributing to healthy eating for boys and girls and staff of school.

The development of this successful experience in construction, training in the management and use of Dry Ecological Toilets, and application of urine and feces in forest-fruit agricultural production, is implemented within the framework of SNV/NODE Project and its various strategic partners, as TREVERIS Foundation in the rural area of Chuquisaca.

Such experience is aimed at the student population awareness about the effect of climate change and water management in combination of three components:

a) Collection and storage of rainwater; b) Irrigation and vegetable production for food security and c) ecological sanitation and waste management (Ecological Dry Toilets construction).

Photographs: Monitoring visit to the municipalities of the Department of Chuquisaca

The main beneficiaries are teachers and students. Community authorities say diffusion of this new technology is important in rural areas to prevent contamination of the environment and above all, to build a healthy community. As evidence of these words is that to date (April 2015) they have on its own initiative the construction of new modules of Ecological Dry Toilets in other communities of Chuquisaca, and it is planned to build six new demonstrative works in coordination with the municipal governments of San Lucas and Poroma, in order to generate demand in the community and spread this new technology, to explain that it is possible to carry out good ecological practices related to education.

Photography: Ecological Dry Toilets at school shelters built by the Foundation TRÉVERIS.

"Undoubtedly Decentralized Sustainable Sanitation is a new approach inspired by the concept of ecological sanitation with a holistic view of the natural cycles, in which the wastewater and treated excreta are not considered as waste but, on the contrary, are employed as reusable resources."

The success of this technology is clearly settled in the constant process of training starting with the socialization of work developed by the SNV/NODE Project, through its social strategy that complements the construction processes of Ecological Dry Toilets (use, management and reuse of urine and feces covered in productive activities), since at time of the monitoring it has been proven that students and teachers understand the importance of preserving the environment through the appropriation of the concept of reusing treated urine and feces.

SNV

50 años

Saneamiento Sostenible, Soluciones Ecológicas

MODEL OF SUSTAINABILITY
FOR OF DRY ECOLOGICAL SANITATION PLANNING SYSTEMS

Photography: Monitoring visit to ecological dry toilets, constructed by Water for People in Riberalta.

Horacio Barrancos
SNV advisor

Sustainability and decentralized sanitation management have become an integral approach to undertaking ecological sanitation projects reaching several purposes: provide access to sanitation to families who do not have it, improve the quality of life of the population, promoting environmental protection and contribute to productivity.

Decentralized Sustainable Sanitation Node Project as Knowledge Platform and Impact Generation on Sustainable Solutions, through the Netherlands Development Organisation (SNV), develops and implements models of sustainable sanitation solutions, with decentralized approach (Decentralized Sustainable Sanitation DSS) and in this perspective, it promotes management of integral and sustainable systems that make use of Dry Ecological Toilets.

In this framework the SNV-NODE has developed an operational tool, as a conceptual and methodological contribution to the planning and implementation along the entire value chain of

sanitation, management systems of ecological sanitation using Ecological Dry Toilets.

Through various experiences in the framework of SNV/NODE Project, it has been found that the functionality of the integrated approach to household sanitation not only involves installing the toilet, but all other accessories that complete a modular concept of sanitation (shower, laundry sinks, tiles, and even bio gardens). It also contributes to the beneficiaries take ownership of the concept and technology, and to accept it as an option rather than a temporary alternative. In this way it contributes to its operation and maintenance in the best conditions.

Providing services to people of safe and sustainable sanitation means more than providing a latrine or toilet. For its size and manner of operation, sanitation modules allow the population that does not have sanitation services in the core networks, access to safe management of human excreta, giving both social and economic viability, and a favorable impact on the environment.

In this sense, the integral vision of this sanitation solution, has involved the development of a process that not only refers to the construction but to a set of connected activities, either sequential or simultaneously to form the vision of a management system along the "sanitation value chain".

"A value chain is a system of people, organizations and activities required to create, process, and deliver a product or service"

Value chain in sanitation

Decentralized Sustainable Sanitation includes understanding of contexts in which people live and how different local, departmental institutions and central government care about and engage in developing opportunities along several elements of a process which it is a whole vision that, as stated, has been called "sanitation value chain."

The value chain approach on sanitation provides a useful tool to study and design specific interventions to strengthen the operation of a system providing basic services so sensitive to human development as sanitation is.

"A value chain is a system of people, organizations and activities required to create, process, and deliver a product or service. Stakeholders included in the value chain can be producers, processors, traders and service providers. The value chain concept is based on the "organization" of different stakeholders and how they "interact" in its institutional environment."[1]

This approach allows us to identify opportunities for inclusive development. The strengthening of opportunities along the chain should seek the goal of self-sustainability of the systems, therefore, it is vital to promote effective dialogue between stakeholders, which facilitates and promotes partnerships at different levels.

Also, this vision of addressing institutional and governance aspects of the system, with the aim of promoting a favorable environment for development.

Then the sanitation value chain provides a useful tool to study and design punctual interventionsstrengthening the operation of a system providing basic services so sensitive to human development, as sanitation is. Decentralized Sustainable Sanitation (DSS), analyzed from the chain approach, is configured as

1 SNV-NODE Project. 2014. Strategic tools for Ecological Dry Toilets. Parameterization scenarios in sanitation chain. La Paz. p.5

Photography: Monitoring visit to ecological dry sanitation systems implemented by SNV in Montero.

Photography: Monitoring visit to ecological dry sanitation systems implemented by SNV in Montero

a system of multiple stakeholders, tasks, services and –therefore- links that, by their nature, require a vision that not only assess the integrity of the system, but also that can be studied at each stage, sustainability and growth, both from the perspective of access to basic services, as well as from the perspective of sustainable solution of ecological sanitation[2].

The proposed chain approach, promotes these systems would be economically sustainable, which commit the actions of the institutions directly related, either by some sort of sectorial interest or calls by law, because the latter will provide sustainability in all (legal sustainability, economic and administrative) fields. Implementation of such sanitation solutions poses different stages; hence the string does not begin with the collection and storage of human excreta, but much earlier with a (non-economic) social process of self-belief in the need to transform traditional practices of using latrines, septic tanks or open field (all of which are harmful to health and the environment) for more efficient, sustainable and innovative ecological field.

The importance of the chain lies in the product or service that the DSS provides to society and thus in the stakeholders who should provide funding in fundraising and in its intervention.

Count on systematizing the Sustainable Sanitation value chain enables the SNV-NODE Project establish conditions in which the SSD model can be replicable and scalable sustainably. This tool has the following objectives:

2 DSS, as ecological sanitation, is an integral view of natural cycles in which wastewater and human excreta are not regarded as waste, but as reusable resources. Sustainable Sanitation uses the basic principles of nature seeking to close water cycles and nutrients using modern, safe and sustainable technologies.

i) make a systematic analysis to identify the value that this type of system contributes to society or beneficiaries of the service, and for which they should be willing to pay ii) the separation of the value chain by groups of activities (processes) that add value to verify the needs and contributions of each link.

With these considerations DSS value chain is described below which develops in Bolivia in recent years, with ecological of Dry Technology Toilets integrated to gathering, transportation, treatment and reuse of waste systems.

The following tables outline the chain in its various links and, above all, the general strategy of intervention.

Stages interact throughout the whole process of implementation; separation of the value chain by links or groups of activities (processes) that add value (This allows to verify the need and contribution of each link, but, even more, allows to look where an opportunity for improvement is possible).

Sanitation value	Intervention
Promotion of demand and user identification	Outreach campaign on sanitation
	Social mobilization, activation of demand
Provision of materials and DSS construction systems, for instance Ecological Dry Toilets (EDT)	Development of markets for the provision of materials and supplies for the construction of EDT
	Build sanitation facilities
User access to system service	Implementation of the family, public or community toilets
Collection and Transport	Collecting and transporting waste to transfer stations or waste processing sites in organic resources
Processing or waste treatment	Build, maintain and operate plants in sewage treatment
Final reuse	Subsystems derived using organic resources in a productive way

Source: Compiled based on information from the study strategic planning tools for ecological dry sanitation systems. SNV. 2015

As a result of experience, we have worked on a methodological proposal for the planning of ecological sanitation systems, from the perspective of its design and implementation along the entire chain of sanitation technology of Ecological Dry Toilets, reuse and closing of nutrient cycle. Tool that is aimed at instances with making decision capacity (public and private) and at specialized in sanitation technicians

Source: Compiled based on information from the study strategic planning tools for ecological dry sanitation systems. SNV. 2015

Count on systematizing the Sustainable Sanitation value chain enables the SNV-NODE Project establish conditions in which the SSD model can be replicable and scalable sustainably.

The tool

With the aim of assess the economic and financial sustainability and the implications of implementing a sanitation solution of this nature in suburban areas and municipalities that are still lacking of sanitation systems with conventional technologies, such as the sewerage system, it was developed a computer tool[3] based on algorithms that consider aspects such as the dimensioning of services components and essential resources that are directly or indirectly associated with a system of decentralized sanitation technology of Ecological Dry Toilets in the implementation of complete modules (shower, sink, laundry, etc.).

The tool developed shows strategic proposals for the planning and implementation of ecological dry sanitation modules along the chain of sanitation

The proposal includes conceptualizing the DSS value chain; information on perceptions of urban and suburban users about this model of sanitation; the explanation of the use of a software tool that allows, from an economic and financial sustainability approach, modeling various scenarios along the entire chain of sanitation; that is, from demand generation, construction, feces and urine collection and transportation, its treatment and obtaining of earthworm humus.

3 This tool was originally developed based on the experience of Sumaj Huasi Foundation, but then incorporated innovations on the basis of several other implemented experiences inside and outside Bolivia, so the information contained in the tool supported in this experience is only a reference made to understand the operational logic of the software tool and it does not constitute, under any point of view, an assessment for the work of Sumaj Huasi, or a market benchmark for the industry.

This modeling is complemented by two important analyzes: institutional roles and funding alternatives for the sustainability of the chain and conceptual guidelines on social and environmental studies required.

As expected, in parallel, it has developed a user guide for understanding and application of the software tool. This second part of the document is submitted extensive conceptual and operational detail, whose main objective is to allow the construction of different scenarios to design the best possible strategy, for the nature of the population to be address.

Photography: Monitoring visit to ecological dry sanitation systems implemented by SNV in Montero.

The tool shows the parameterized model itself, developed a software application that already has its version 2.0. This application allows a friendly use and very high degree of parameterization, in order to give the operator the ability to create and recreate infinite possible scenarios.

This model is the one that allows the user from the introduction of some data that are required by the system itself, get results in terms of cost, investment, technical and operational resources, among others, and from this, determining revenue requirements and funding structure for the sustainability of each exercised scenario.

Finally, it should be noted that the tool developed is an effort in the field of ecological sanitation; opens the way for additional studies SNV plans to continue doing to have greater quantitative elements in order to encourage the participation of State agencies including mainly the municipalities, as well as sector policy makers and implementation instruments and also the regulators.

The value chain approach provides a useful tool to study and design specific interventions to strengthen the operation of a system for providing basic services so sensitive to human development such as sanitation is. In particular, the Decentralized Sustainable Sanitation Decentralized (DSS), analyzed from the chain approach, is configured as a system of multiple stakeholders, tasks, services and therefore links.

The tool can be operated locally or online form via the World Wide Web (www); it is in the NODE project Web Platform (http//anesbvi-nssd-bolivia.org/mssd/), and is being released along different training events for professionals and officials involved in the field of sanitation.

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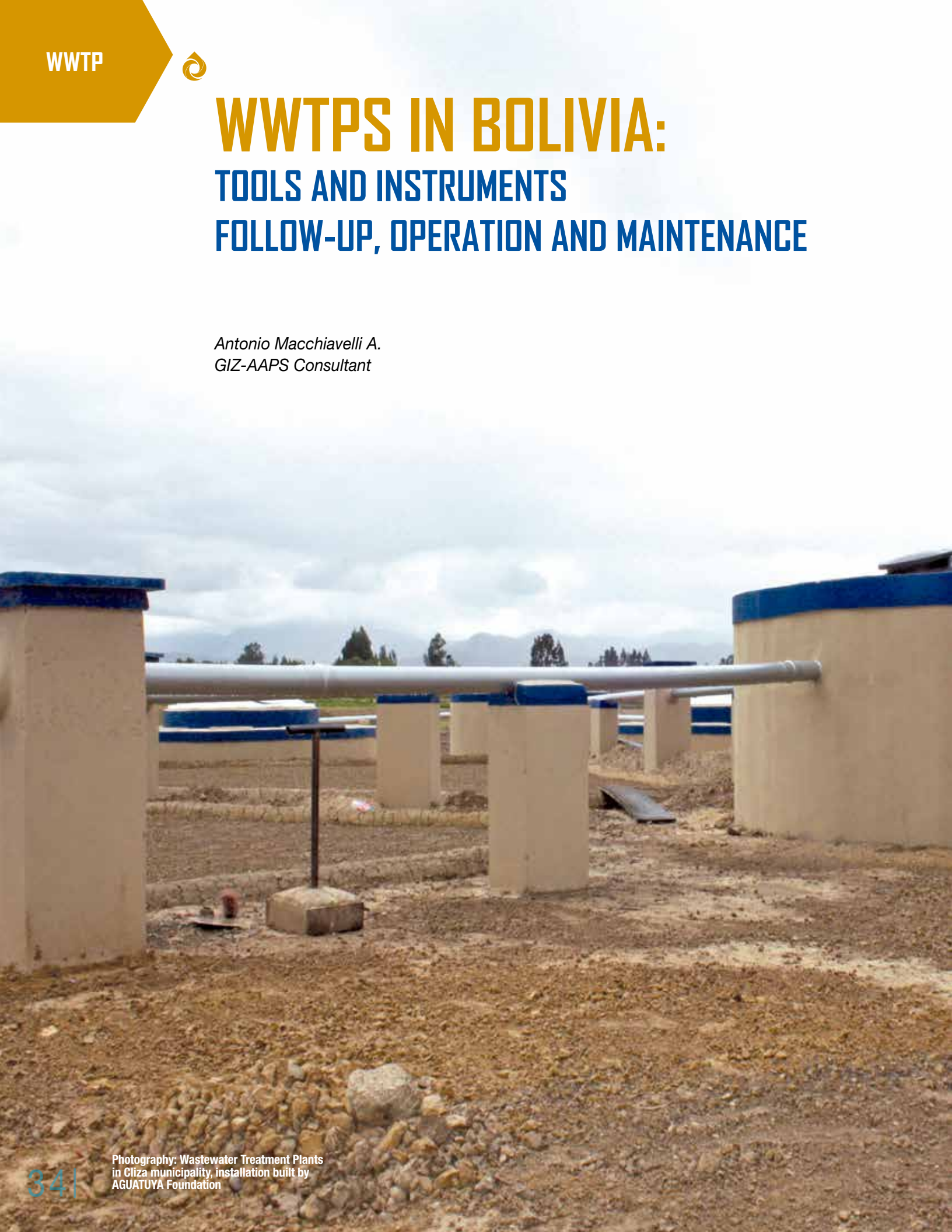
WWTPS IN BOLIVIA:
TOOLS AND INSTRUMENTS FOLLOW-UP, OPERATION AND MAINTENANCE

Antonio Macchiavelli A.
GIZ-AAPS Consultant



Photography: Wastewater Treatment Plants in Cliza municipality, installation built by AGUATUYA Foundation

According to data from the PWSA (2015), 57% of the population has sewage services, but only 14% of municipalities have WWTPs, and of these, 60% are functioning poorly.*

One of the most important challenges of water management in Bolivia is reaching the closure of the ecological cycle of the use and utilization of water resources through the implementation of Wastewater Treatment Plants (WWTP) to allow optimum and continuous operation.

Authority of Supervision and Social Control of Potable Water and Basic Sanitation (PWSA), heading by its Executive Director Lic. Benecio Quispe Gutiérrez, has taken with a special relevance these requirements and the need to develop tools which allow control and monitoring of the facilities currently available, so through its Department of Environmental Regulation on Water Resources has implemented indicators for operation and maintenance of WWTP in the country, achieving the product described briefly below.

Diagnosis of Treatment Plants in Bolivia

In 2012, the Ministry of Environment and Water (MMAyA) and the German Development Cooperation (GIZ)

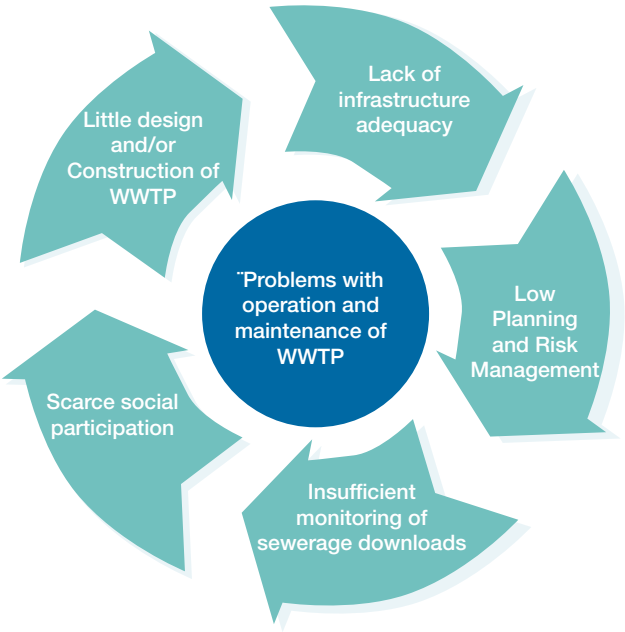
performed the "systematization of treatment and reuse of wastewater in Bolivia" a research in 111 populated areas nationwide.

Among the results it was established that only 84 of these centers have WWTP, but 31 of them (37%) do not work. According to data from the PWSA (2015), 57% of the population has sewerage services but only 14% of municipalities have WWTPs, and of these 60% are functioning poorly.

This self-criticism perception for reflecting in making decisions about the relevance of sustainability affects treatment facilities.

Significant investments, either through the State, international cooperation or as a result of loans from various sources, have been affected on many levels and in many cases by irreparably situations summarized in the following diagram:

Problems identified in operation and maintenance of WWTPs



Source: A. Macchiavelli, GIZ-AAPS Consultant. March, 2015

* PWSA: Authority of Supervision and Social Control of Potable Water and Basic Sanitation.

Categorization of Wastewater Treatment Plants

With the goal to establish specific criteria for the operation and maintenance indicators, two criteria for the categorization of WWTP apply:

1. Criterion of "Equivalent Population"

The size of the population must provide a value consistent with reality and not with a theoretical design; the best measure is obtained from the organic load measured in the influent to the WWTP.

The equivalent population corresponds to the gross load of organic pollution contained in the wastewater produced by domestic loads and economic activities in the inhabited center. An "equivalent population" represents "the biodegradable organic load with biochemical the oxygen demand of 5 days (BOD5), 54 g of oxygen per capita per day[1]. The concept therefore allows recording pollutant loads regardless of their origin and nature:

WWTP categories as decided by Equivalent Population Equivalent

Categories	Criteria	
	Equivalent Population	Reference of territoriality
A	Higher to 500.000	Trunk line of the country
B	Between 50,000 and 5000,000	Capital cities capitals
C	Between 10.000 and 50.000	Intermediate cities
D	Between 2.000 and 10.000	Municipalities

NOTE: If the equivalent population corresponds to the sum of actions of two or more WWTP, all WWTP comprising the system will be considered in the same category.

Source: A. Macchiavelli, GIZ-AAPS Consultant. March, 2015

1 By: NB-03 688 (P.. 52); Titirico, 2008 and UNEP's report "Study of Wastewater Characterization Affluent to Puckukollo Treatment System", 2011.

2. Criterion for "Treatment System"

The method allows to represent algorithmically and simple the type of treatment that have the WWTP, both in water treatment and solid management. To this end applies:

WWTP categorization according to their levels of treatment

Description	According to water treatment line			
	Preliminary	Primary	Secondary	Advanced
According to waterline				
A. Basic pretreatment	1	0	0	0
B. Pretreatment and primary treatment	1	1	0	0
C. Pretreatment, primary and biological treatment	1	1	1	0
D. Primary, biological and advanced pretreatment	1	1	1	1
E. Simple primary treatment with pretreatment	0	1	0	0
F. Primary and secondary treatment without pretreatment	0	1	1	0
G. Secondary or unconventional natural functioning treatment without pretreatment biological	0	0	1	0
H. Unconventional treatment of biological or natural functioning (including pretreatment)	1	0	1	0
I. Unconventional natural biological and advanced treatment (including pretreatment)	1	0	1	1

Description	According to solid line
	Category acc. / Level of treatment
According to solid line	
a) Assessment for reuse (vermiculture, stabilization microorganisms ...)	P=Perfecto
b) Thickening, Stabilization, Conditioning and Dehydration	C=Complete
c) Basic stabilization with lime and dried beds.	B=Basic
d) Only dried beds	M=Minimum
e) Ningún tratamiento en línea de sólidos.	N=Ninguno

Source: A. Macchiavelli, GIZ-AAPS Consultant. March, 2015

Thus, it is possible to perform coding of each WWTP that provides summarized their particular characteristics.

Operating and maintenance indicators

An indicator is a fact quantified measuring the effectiveness and / or efficiency of all or part of a process or system, with reference to a regulation, plan or purpose, determined or accepted in a strategic box. This definition puts the accent on the "measurement" of the indicator.

Any system that lacks a subsystem efficiency indicators or feedback, it will likely have a very short operational life (Source: Espinosa Fuentes, Chile, s/a).

"The Environmental Regulation on Water Resources of the PWSA consider critical closing the ecological cycle, through initiatives that contribute to the care and preservation of environment."

Photography: WWTP Maria Auxiliadora, D9, CBBA Municipality. Presentation of key factors to managing a decentralized WWTP, Gustavo Heredia.

Actual operating capacity of Wastewater Treatment Plant

In most cases, the actual capacity of the water treatment WWTP in Bolivia is not in accordance with the design capacity or the last enlargement. Also, the capacity of the WWTP in terms of flow, population and sometimes organic loads tends to be superior to projected, either because the number of non-domestic connections, due to unplanned growth or because the WWTP would have served their useful life.

It is important to consider these aspects, because although they do not relate directly to operating activities and maintenance affect the achievement of an efficient water treatment. Operators continuously have to face this kind of problems.

Basic conditions for the operation and maintenance of WWTP

Basic conditions for the operation and maintenance of wastewater treatment plants are grouped in criteria concerning the adequacy of infrastructure. Namely:

1. 1. Maintenance Management of Wastewater Treatment Plant

Evaluation of specific maintenance activities of each plant depends on the systems used, of environment features and other random factors. Obeys to multiple criteria.

However, one key criterion is the time that operator allocate to preventive maintenance, which must be efficient enough to reduce the chances of requiring corrective maintenance (maintenance efficiency).

Photography: Lomas del Pagador. Presentation of key factors to managing a decentralized WWTP, Gustavo Heredia factors.

Furthermore, while corrective maintenance is unavoidable, it must have timely and according response to the capacity and scope of the operator (maintenance efficiency.

2. Operational continuity of Wastewater Treatment Plant

A general criterion was taken into account based on the operational continuity of the WWTP. If the percentage of operating hours decreases in any month, it means that the system has stopped, and since then it can be affected at different levels.

Furthermore, this criterion is simple to monitoring by the regulatory body, in case of an inspection conducted at any time of its operation

3. Valuation and reuse of solids from Wastewater Treatment Plants

Solids handling of WWTP are very basic even in our country, but it is an indisputable challenge. The indicator aims to assess the efforts made by some operators to reuse generated waste. Also, the Board of Environmental Regulation on Water Resources of the PWSA, consider critically important closing the ecological cycle, through initiatives that contribute to the care and preservation of the environment.

These indicators would be applied in WSPEs that have WWTPs nationally regulated by the PWSA, both for generating a measurable baseline of information to monitor, regulation and prioritization of actions for the sustainability of them.

CURIOUS FACTS

By 2014, coverage of potable water in rural areas reached 63% and sanitation coverage to 30% nationally.

The main advantages of Decentralized Sustainable Sanitation are:

- Rational use of water resources, combating the adverse effects of climate change
- positive impact on human health
- It helps prevent environmental degradation.

In ancient Rome there was a public urinal system operating separately from the toilets. Because of its high level of ammonia, urine was a priced raw material to sell in factories and laundries in order to remove oil and dirt, and to clean and whiten woolen robes.

Already in the seventh century. BC, we have the first background in the city of Erbil (Northern Iraq) where tunnels known as qanats were dug to channel groundwater in greater distances.

LIVE STREAMING
AND ON REAL TIME BY INTERNET

Photography: Reusso magazine file.

Cristian Cadena L.
SNV-NODE Project Consultant

> *Transmission of information over the Internet in real time has two different modes, video conferencing and Web seminar (webinar)*

Live broadcasts and online real-time facilitate the dissemination of knowledge in the field of water and sanitation, achieving massive coverage to the different stakeholders and users of water and sanitation services.

One of the main features of online, and one of its most significant characteristics in relation to the Web technology today, It is the transmission of content or content streaming. Through a review of concepts

and, trying to put more simply the definition of this methodology, we can conclude that is the way to see and hear files (audio or video) without having to download them in full.

Decentralized Knowledge on Sustainable Sanitation Node has on its website (www.anesbvi-nssd-bolivia.org) computer tools such as forums, videos, Wiki SSD, virtual room and virtual classroom, aimed at disseminating content and further training in sanitation.

Previously, to watch a video or listen to an audio webcast, it was needed to fully discharge the file and then run or play it completely. This streaming methodology allows to check content without having to download by 100% to computer equipment, thus, it also saves space on hard drives.

Reviewing a little on history, streaming was born as the first boom of Web applications. Although the history of audio and video on computer comes from mid-twentieth century, It was not until the 80s when computing really began to reach the common Internet user

In those years, computers were not powerful, also Internet speed was very low and play a video or audio with high quality was only available to users with computer equipment of last generation and with the best internet connection to that time.

Photography: Reusso magazine file.

A few more years were taken to reach troubleshoot accessibility to cheaper and better technology equipment, since in the 90s, most people had conventional computers enjoying audio and video files. These files are basically on their own computers stored on their hard drives, which already have the ability to read the information at the speed required for the processor might interpret and play.

In 1997, broadband Internet was released to the public. Domestic high-speed network was presented with the cable modem DSL (Digital Subscribers Line), being exposed two years later. By 2001, subscriptions to cable and DSL quickly surpassed those with dial-up, due to the speed offered to users to implement the new functional characteristics of new Internet technologies.

This milestone was essential to make way for more effective use of methodologies such as streaming and its variations.

After having put this issue in context, we need to speak more emphatically of a variation of this method of information transmission, and this is the webcast in real time. This way of transmitting information has two different modes, video conferencing and Web seminar (webinar).

"Transmitting or streaming contents is the way to see and hear files (audio or video) without having to download them in full."

Web Video Conference

Web video conferences are basically virtual meetings using the Internet as the transmission means. The different participants of this meeting work from their own computer, creating a virtual environment interaction for the time of the meeting.

This tool is daily used by the various areas of SNV / NODE both for national and international conferences.

The main feature is that this communication takes the form of "many to many", that is, that at some point in the meeting all the people who are in the same video conference have the role of facilitators, share their desktops, they share files, can talk and be heard by all participants at the same time.

This type of communication also has the characteristic being a collaborative environment; it means all members of the video conference have the role of moderator and participant at some point of the activity, also have either a the facility to provide data and ideas to the treated topic, and other users in video feeds with that information to complete and validate their own knowledge.

Photography: Reusso magazine file

For this mode of transmission we count on devoted and specialized programs for Web video conferences.

Currently the most commercial and used software is the Skype; this software allow up to ten people connected at the same time for the virtual activity (the free version), but it's possible to increase the number of participants with a paid package (Skype Premium account).

Web Seminars (webinar)

This modality is one of the most used on issues of training and information dissemination over Internet at this time, because it works very well (depending on the operating platform) for mass communication and also allows interaction with the lecturer, also among the users themselves who participate as listeners in the virtual event.

SNV/NODE enhanced the use of the tool several times, but one of the most important moments was during the "Meeting of Experiences in Decentralized Sustainable Sanitation" held in the city of La Paz in 2014, achieving expansion of older users participation in real time and with lower costs.

The main feature of this method is that it runs on a concept of "one to many", it means, there is a user who operates as a moderator or speaker, and the rest of the participants hear and see live and in real time. Depending on the technological tool, didactic elements can be used to support the contribution of knowledge or information of moderator. These elements can be PowerPoint presentations, videos, shared files, links to Web pages, shared desktop, etc.

To participate in this type of experience four major elements are needed: a computer, an Internet connection, any audio device (for example headphones or speakers) and microphone (if the tool allows communication by voice). It is important to point out that currently and in our midst we already have technical support (computer equipment and Internet access) that allows participation in such virtual events more effectively.

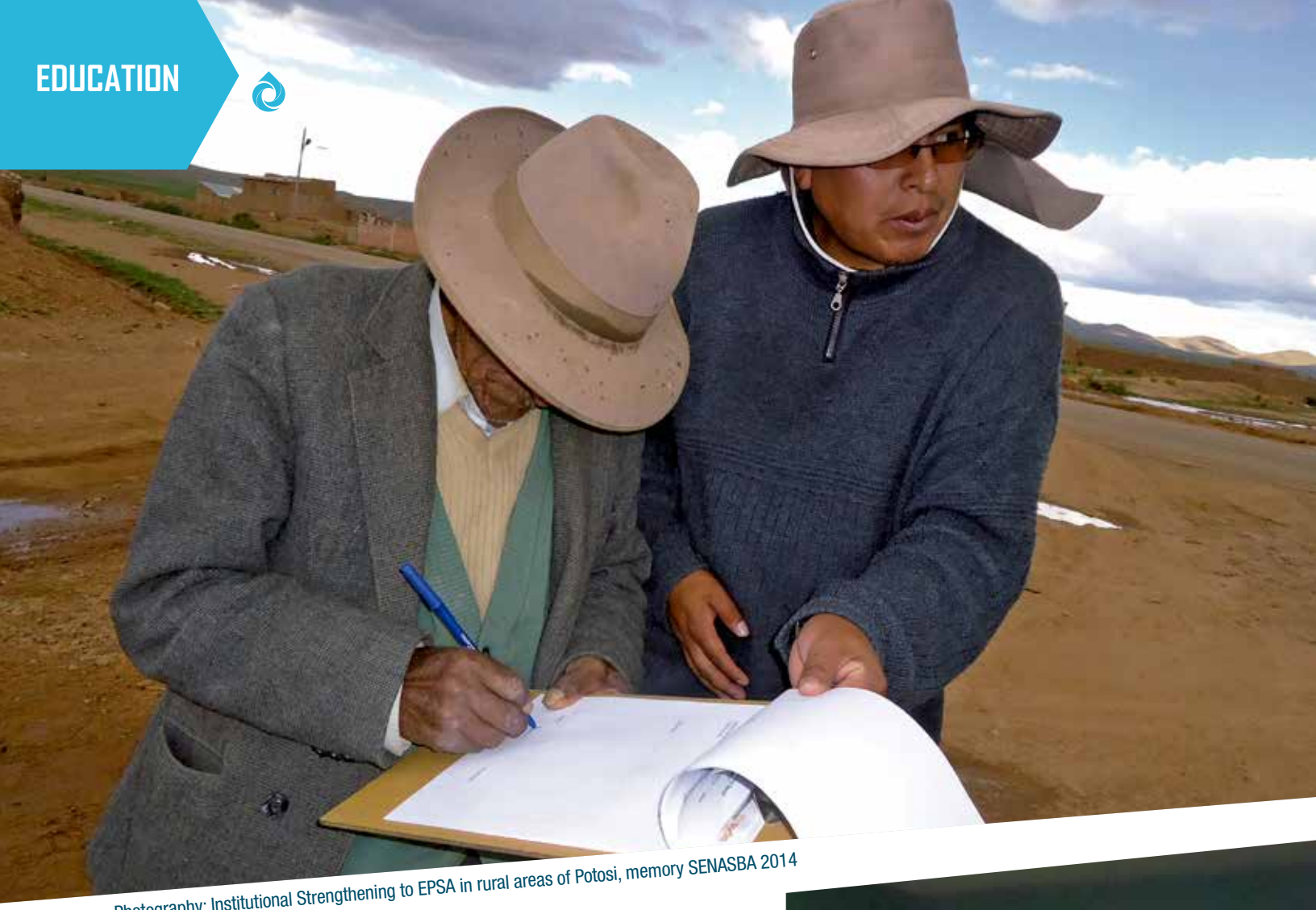
The (webinar software) systems, which are used as a means of communication in virtual seminars, have a tendency to be developed with emphasis on speed and compatibility of technologies, in this way it's possibly to participate with almost any type of operating system and Internet moderate speed connection.

Los This allows to change the participation of the common Internet user to this kind of virtual events.

During 2014 the SNV/NODE train virtually approx. 100 students of the Military Academy of Engineering (EMI La Paz) through courses: 1) DSS: Focus, Institutions and Application in Bolivia and 2) Technology in decentralized sustainable sanitation, ecological dry toilets.

It is recommended to seek virtual events and participate in them, as the global trend in real-time communication and training is marked by the recurrent use of such technologies; on the Web you can find a lot of events of this type, from free of charge up to pay, with the opportunity to learn something new, no matter who offer topics for discussion and learning.

Photography: Reusso magazine file



Photography: Institutional Strengthening to EPSA in rural areas of Potosi, memory SENASBA 2014

WHAT DOES THE MULTINATIONAL WATER SCHOOL DO?

Antonio Mullisaca
SENASBA Knowledge Management Manager

Photography: A graduate of the Multinational Water School.

State investment in its three levels, water and sanitation, in the last 10 years has been remarkable and has succeeded in increasing coverage rates of these services nationwide in interesting percentages. But progress in infrastructure was not accompanied by a similar pace in improving capabilities so we can talk about sustainable service expansion. The latter is presented as a scenario enabling to implement programs urgently.

Situation of investment in water and sanitation

In the last 10 years we have invested nearly 1,500 million in the implementation of water and sanitation systems, to increase the coverage of these services in the country. Thanks to the efforts to achieve the Millennium Development Goals and the implementation of new human right to water and sewer, It was reached the following indexes during 2014:

> *"The Multinational Water School is developing the academic development process for implementing technical training at national level, in order to grant titles to current empirical operators managing existing systems."*

Potable water coverage in urban areas: 85%

Potable water coverage in rural areas: 63%

Basic sanitation coverage in urban areas: 71%

Basic sanitation coverage in rural areas: 30%

45% of waste generated is disposed in a final disposal site.

Source: SENASBA

Photography: Participation of women in water management and sanitation, Memory SENASBA 2014.

"In the last 10 years we have invested nearly 1,500 million in the implementation of water and sanitation systems, to increase the coverage of these services in the country."

Status of capacity building

Infrastructure has increased the level of coverage and in turn has been accompanied by a process of capacity building, in order that this investment becomes a sustainable service. Potable water systems, sewer systems, the water treatment plants and landfills implemented need trained personnel to conduct operation and maintenance. The companies providing Water Services (EPSA) need attention of technical staff trained, that from the municipality, supports the sustainability of services. Designs of the various projects to be financed must have the quantity and quality of professionals that develop, execute, monitor or oversee. A panoramic look at the specific needs indicates insufficient trained technical staff and above all, professionals to ensure both project and services management.

For reference, a study by the German Cooperation indicates the need for 10,900 technicians for service management, as well as training 122 specialists per year for project management.

Multinational Water School Action

The offer for training at a technical level, university or postgraduate level careers referring to a concrete demand is very low. Thus, the Multinational Water School, as SENASBA training strategy, is developing the academic development process to implement technical training at national level, in order to grant diplomas to existing empirical operators managing existing systems and also to prepare operators (senior and media technicians in the operation and maintenance of water systems, sanitation and waste) of the planned investment to meet the goals of Agenda 2025, on strategic alliances with renowned technical institutes.

At the same time, it is being developing a postgraduate academic program (graduate level) under an agreement with universities, linked to cooperation agencies to train specialized professionals in specific requirements of the water sector and sanitation, including innovation and research. The second half of this year and the first of 2016 will consolidate the complete offer covering Specialization on Community Development, Institutional Strengthening, Formulation, Monitoring and Control of Water Projects, Sanitation (with attention to ecological sanitation) and Solid Waste.

Photography: "Sewer workers" women make effective the human right to services, Memory SENASBA 2014.

Photography: Virtual mode the Multinational Water School.

SANITARY AND ENVIRONMENTAL ENGINEERING A WAY TO THE UNIVERSAL ACCESS SANITATION

Ing. Gonzalo Ortega D.
President of ABIS- Tarija subsidiary

> *"Is worth a pound of cure" because once the waste water reaches the river or body of water, is much more costly decontamination.*

The Bolivian Association of Sanitary and Environmental Engineering (ABIS-Tarija subsidiary), organized the XIII National Congress of Sanitary and Environmental Engineering on May 2015 in Tarija (Bolivia), in the courtyard of the City Council, located in the environs of the Main Plaza of the city.

The event was attended by local, national and international exhibitors; Also, university students and professionals from across the country, with a total of 400 participants. The theme was *"The Sanitary Engineering and Environmental*

Photography: XIII National Congress of Sanitary and Environmental Engineering in Tarija

Photography: XIII National Congress of Sanitary and Environmental Engineering in Tarija

Towards Universal Access to Water and Zero Discharge of Wastewater", the main objective was to raise the "zero discharge" with a meaning that "every sewer project must necessarily have a treatment plant and agricultural irrigation (reuse)", through compliance with international standards and without letting the waste water reaches the river, in this way, pollution of water resources, environment and agricultural crops is decelerated.

It's said that "Is worth a pound of cure" because once the waste water reaches the river or body of water, is much more costly decontamination

The event was held in a masterly technical room and three classrooms with field trips on the last day to Lake San Jacinto and power generation, Rincon de la Victoria and Drinking Water Plant and Reservoir Huacata.

Among the most important results of the Congress was the positioning of ABIS-Subsidiary Tarija in the national context of ABIS-BOLIVIA, and local such as within the College and the Society of Engineers of Bolivia (SIB), and that was a challenge that the organizers have taken taken, to hit the "spotlight" before the ABIS Tarija subsidiary Congress it barely existed. Another result was the technical knowledge and dissemination among professionals and students from Tarija of current issues in sanitary and environmental engineering.

"Every sewer project must necessarily have a treatment plant and agricultural irrigation (reuse)", through compliance with international standards and without letting the waste water reaches the river, in this way, pollution of water resources, environment and agricultural crops is decelerated."

GOVERNABILITY AND GOVERNANCE

IN THE SYSTEMS OF DECENTRALIZED SUSTAINABLE SANITATION

Guido Meruvia
Expert on Water and Sanitation

Photography: WastewaterTreatment Systems for Reuse.

Decentralized Sustainable sanitation systems Decentralized (SSD) constitute a new model of sanitation. Its implementation, if it fulfills the closing of the hydrological cycle, has more advantages over traditional models. Among the main advantages are: i) the rational use of water resources, combating the adverse effects of climate change; ii) The positive impact on human health, avoiding environmental degradation. Moreover, this approach has as its premise return nutrients to Mother Earth, with the possibility of generating economic alternatives for many users, supporting in this way to poverty reduction. Also, its implementation is not only confined to rural areas, there successful examples of interventions in the suburban areas.

The two technologies most widespread in our country are: Ecological Dry Toilets (EDT) and Decentralized Wastewater Treatment

The analysis of governance should help to study whether, for example, the management model chosen fits the sociocultural context of the intervention area; if the rules are met effectively designed; know what the existing institutional arrangements and mechanisms of interaction and generation of collective action among public and private actors are.

Plants (WWTP-D). both systems[1]. They do not qualify as Common Property Resources[2], being the most appropriate definition of the common pool resources "CUR".

CUR are characterized by the difficulty of excluding potential beneficiaries when the system is built, but also, there is a high produced resource appropriation, making it necessary the construction of institutional arrangements and the creation of collective action between public-private stakeholders to solve two main problems: y) The provision of service and ii) the appropriation of the produced resources. In this context it is that the analysis of governability and governance becomes relevant[3].

Investigate whether the operator is responding to the needs of the population over time, checking whether it fulfills the mandate for which it was created, is fundamental. It involves analyze how legitimate, efficient and effective it is under the current rules, what lies with governance.

1 A public good is characterized as non-rival and non-excludable. The non-competition would imply that the enjoyment of it by an additional user does not pose a limitation for another user while no exclusion means that all users can enjoy without any discrimination. Moreover, a private good is the exact opposite, that is to say it is opponent (enjoyment of user generates a constraint to another user) and excludable.

2 They are resources to which everyone has free access. Air is a typical example of this type of resource.

3 DSS systems are built by men seeking to preserve a scarce and vulnerable natural resource system such as water. When it is used properly it generates positive externalities (environmental, health, economic development), benefiting the population as a whole. In this regard, the provision is made jointly, generating multiple benefits to society. Regarding the produced resources, they are characterized for high appropriation by use. For example, the compost produced and used by a family or producer is the compost that another family or producer stop using. Similarly, the treated water used for irrigation is treated water is left to use in another irrigation system

However, determining whether one operator has or does not have governance implies, in turn, explore additional factors. Among the main we can mention: the kind of management model chosen, articulation between public and private actors, the type of existing rules, the degree of implementation and complementarity with the local context. One way of government can be very successful in a given area, but have completely different results in other contexts. These elements make reference to governance.

The analysis of governance must allow identifying what the main weakness faced by operators.

"The two technologies most widespread in our country are: Ecological Dry Toilets (EDT) and Decentralized Wastewater Treatment Plants (WWTP-D). Both systems have a special feature as it does not qualify as exclusively private or exclusively public property. They are commonly used resources "CUR"

The analysis of governance must allow to identify what the main weakness faced by operators, which are the alerts to take care to establish the best strategies to correct or reverse a particular situation. For its part, the analysis of governance should help to consider whether, for example, the management model chosen adapts to the sociocultural context of the intervention area; if the rules are met effectively designed; know what the existing institutional arrangements are and the mechanisms of interaction and generation of collective action among public and private stakeholders. As shown, both elements are permanently getting feedback.

If the system does not have legitimacy, it is not efficient or effective; it can hardly meet the purposes for which it has been established. This could generate great social, health and/or environmental

Photography: Ecological Dry Toilet - SNV Bolivia.

troubles. Determine that the operator effectively meets the demands of the population over time and within the framework of established rules, It implies the need to assess and continuously monitor weak areas and components. The ultimate goal is to contribute to the development of strategies to reverse any negative situation.

Moreover, if the model of government does not respond to the socio-cultural conditions of their surroundings, it can hardly meet the needs of users over time. By the nature of Decentralized Sustainable Sanitation the handling and management of these services cannot be built exclusively from an external agent, without taking into account the direct and active participation of users. In that sense, Governance cannot be seen from a vertical perspective, exclusive to the State or someone private.

On the contrary, the operator's ability to meet the needs of users should consider a governance structure to facilitate a non-hierarchical interaction, building collective action and the generation of public-private institutional arrangements. This implies that the design and implementation of rules should not only consider the local context, but also must be linked to the formal rules established by the State.

Legitimacy, efficiency and effectiveness in providing must be built from the local context itself, with the participation of users as central stakeholders , and not imposed from outside party to the beneficiaries themselves.

Each of these aspects involves the search for mechanisms to promote the *"governance building from local"*.

However, to corroborate such claims must be made multiple studies yet in different scenarios with different contexts and situations, and to complement and deepen the investigation. This is a job that SNV has started and is expected to be replicated on a larger scale to assist, in this way, sector, national and sub-national institutions in fulfilling of Agenda 2025.

CENTER FOR AGRO-TECHNOLOGICAL INNOVATION LA BARRANCA:

RESEARCH AND PRODUCTION IN CLAY SOILS AND HEAVY SOILS

Based on an interview with Fritz Hamel, technical manager of Agro Innovation Center - Technology La Barranca

Science and agriculture are fused in favor of organic production, since it is considered as a worldwide innovation, because it prevents food from coming into contact with chemicals. In Chuquisaca, students and teachers of Agronomy Career provide an option to tell at home with ecologically grown products and genetically conserved species through cloning.

Agro-Technological Research Center La Barranca is one of the experimental fields belonging to the Faculty of Agricultural Sciences of Career Agronomy, Superior Technician of San Francisco Xavier de Chuquisaca University.

Center conducts essays in different areas, such as livestock, agriculture and horticulture; also assists in the students in their training practices as well as sixth semester students conduct their internships.

Photography: Production Agro-Technological innovation La Barranca center - Sucre.

The Center promotes ecological management in the production part, recovery of degraded soils, as well as water conservation, it means rainwater harvesting.

One of the features of La Barranca is that it is located 2,960 meters above sea level. It's quite windy and cold area, with clayey and heavy soils; thus there are great challenges in the productive part and the adaptation of other species such as olive trees, peaches and apples and along with the students the best suited to the area are being tested, since in the Centre does not a single transgenic product, nor any transgenic seed hybrid seed is used. All seeds are natural and open.

Research and production takes place throughout the year, from the moment that the provision of water and rainwater harvesting basins in the drilling of a deep well is done. Being a research center, La Barranca uses three irrigation systems: the traditional, produced by flooding in different plots, the sprinkler system in some research plots, and the drip system is installed in most of the tents, to take better care of the water and also prevent the spread of some bacteria. Each tent is devoted to different stages of plants, from the consolidation of roots in cuttings[1] for subsequent sale or transfer for growth and production.

1 Cuttings or gores are fragments of separated plants by a reproductive purpose. Fragments [stalk] can be cut and introduced into the land to produce roots.

"The Center for Agro-Technological Innovation La Barranca formed an alliance with SNV and the Municipal Government of Sucre for the construction of dry ecological sanitary systems and a treatment plant for composting organic material from these sanitary systems, promoting a secure closing cycle"

Photography: Production Center La Barranca.

Everything produced is transferred to a marketing center which has the Faculty of Agricultural Sciences (street Calvo-Chuquisaca), where products are exposed to be sold, and offer even lower prices with the aim of achieving the consumption of these foods produced ecologically.

Techniques also show that the new plants may be formed in a time of 15 to 30 days, when elsewhere are formed up to 60 days. That is, we talk about a process of cloning plants, as all new policies are genetically identical to high quality seeds imported from other countries.

The Center has two production fields: horticulture, which is the most exploited and, also seeds production. The Centre is registered as a producer of seeds to the INIAF because it is a strategic partner, in agreement with vegetables nationwide.

Research work and production are being carried in three species that have been prioritized: garlic, tomato and onion, in Potosi, Tarija and Chuquisaca.

So far we have many achievements. In addition to the 70 trainees who graduated from career and now they are entitled, it also has intensive tomato production. In the last campaign, it was to generate 2,100

kilos of production, averaging about 3.5 kilos per square meter, it means a ratio of 35,000 kilos per hectare is made. This is within the normal range in the country and abroad, but organic production is still done, we do not use chemicals, we do not force the crop to the fullest.

A plant of seed processing is being constructing. It is in process of construction; it has all the equipment and may make their own certification of seed that produces the Centre and the producers, always based on the rule of INIAF.

Photography: Premises cultivation and research center La Barranca.

Photography: Solar tent for La Barranca Center product experimentation.

Photography: Solar tent for La Barranca Center product experimentation.

The great new is that a building will be built of the career in the Center, with the entire academic and administrative portion. Also there will be a residential school for students, as we want to replicate the model in school Zamorano in Honduras, with the purpose that our professionals are better trained.

Similarly, the Innovation Centre has new projects to be implemented in door, one of them is in alliance with SNV and the Municipal Government of Sucre for the construction of dry ecological sanitation systems and treatment plants composting of organic material from these sanitary systems, promoting a safe closing cycle. In La Barranca will experience by investigating the use of compost as natural fertilizer allowed in certain crops. The aim is to study different assays to ensure their use without a negative impact on health.

Additionally, the University of Chuquisaca, through La Barranca, counts with the collaboration of the University of Almeria (Spain) for vegetable production. With this support 3,000 meters of tents are achieved for organic production.

A hard work with lot of patience is carried out every day at the Center, it expects to expand production in local markets and also share its experiences with producers from other municipalities and departments.

SANATION IN THE HISTORY

Photography: Ancient Roman toilet, http://journals.worldnomads.com/keera/photo/639/12558/Turkey/old-roman-toilets-at-ephesus.

Mónica Ayala S.
SNV – NODE Project Consultant

In the course of history, for the inhabitants of the first cities, getting water was a challenge to overcome as part of the benefits of urban life. Although water is the main element of life, supply and distribution and excreta disposal, through sanitation options, they constitute the main elements of civilization.

The following is a report based on different historical texts on water and sanitation in the ancient cities seeking to arouse the interest of professionals of the sector about issues like sanitation and its main solutions over the years found that many of the innovations already were, in some way, raised as well by other sectoralists in the antiquity and reflect the statement from Solomon *"What was it? The same will be. What has been done? The same will be done; there is nothing new under the sun*

Photography: Ancient Rome, http://www.pilloledistoria.it/2792/storia-antica/i-bag- ni-pubblici-dellantica-roma-come-funzionavano?lang=es

Is there anything that one can say: Here is this new? It was in the centuries that have gone before us "(Eclesiastés1: 9-10, 1960)

In principle it is easy to imagine the way in the first inhabitants had access to the liquid element, placing their homes in close proximity to rivers, lakes and lagoons. Access complication arose with the growth of cities that moved away increasingly from sources and demanded water importation. Already in the seventh century. BC, we have the first backgrounds in the city of Erbil (Northern Iraq) where tunnels known as qanats[1] were dug (Pavón Maldonado, 1990: 185), to channel groundwater from greater distances. Similarly, the Greeks dug canals to distribute water in Troya and Athens from the springs of the nearby hills.

"Just in the first half of the seventeenth century physicians and scientists had to deal with cholera outbreaks, and demonstrated the role of contaminated water in the transmission of the disease."

1 La The Arabic voice qanat is used in Arab countries to designate galleries or underground tunnels built by the hand of man, to capture rain water stored in permeable sand layers that rest on other impermeable. All along its route, the qanat has a series of properly spaced pits whose depths were marked by different levels of the ground (...).

The population growth also requires over time water evacuation systems, especially rain to prevent floods, developing sewers systems and covered channels developed to direct the accumulated water.

While these were efforts demonstrating technological solutions to water supply and sanitation, credit for the development of a complete system of water importation and distribution through public pipes, and intend to return used water to the environment goes back to ancient Rome (Sedlak, 2014).

Ancient Rome

During the third century BC, the average population of the Roman cities reached half a million people that in addition of consumption, practiced forms of aquatic recreation including toilets as forums for social meetings. In his epic, Rome did not have enough water for the uses to which the Romans were accustomed; the Tiber became small, so that the

Photography: Cleaning an ancient Roman toilet, http://www.pilloledistoria.it/2792/storia-antica/i-bagni-pubblici-dellantica-roma-come-funzionavano?lang=es

> *In Rome, the sewers and sewage were born, and, as for all, get rid of the wastewater meant a big commitment that fell under a Goddess: Cloacina.*

Roman engineers they had to expand the hydraulic borders of the empire through importing water from different sources, building systems that met the needs of endowment in the Empire.

A curious fact about the engineering works in the Roman Empire means that despite the grandstanding structures and soaring arches of the aqueducts crossing the city, meaning only 5% of the length of the Roman water transportation system. Moreover, "Romans tried not to build for their cost and their tendency to fail" (Beckett, 2014). Most aqueducts consisted of pipe underground channels and tunnels made of concrete. Since much of the imported water was hidden from view, elevated structures were important to make people aware of their achievements.

The knowledge accumulated by the Romans on their buildings made them became the first multinational building systems, bringing water to different places in Rome.

Notwithstanding, technological advances since these times, also health problems related to sanitation were evident, since most piping systems were made of lead, whose

Photographs: Cloacina, goddess of main sewer, http://www.vroma.org/~jruebel/cloacina.html

consistency was ideal because of its flexibility for different shapes and diameters. One of his most important architects, Vitruvius[2], knew very well the problem of toxicity, but nevertheless decided to continue using for at convenient for works Some authors appeal to the huge amount of lead consumed as one of the reasons for the decline and fall of the Empire[3] (Creces, 1984). This provides strong support the hypothesis that lead poisoning contributed to the decline of the Roman Empire (Blogecologista, 2014).

During its heyday slaves simulate naval battles in huge pools built just for this type of event. One of the aqueduct was built to fill these artificial pools. In this sense, Rome had a sophisticated system of public bath with hot water, provided through a system of heaters and pipes, Therefore, the water used had to be properly drained to prevent flooding. To do this they had the highest sewer drainage system. A channel reinforced with concrete walls built to remove water from some low areas adjacent to rivers. Slowly, sewers and sewage were born, and as for everything to get rid of wastewater meant a big commitment that fell under a Goddess: Cloacina[4].

From the Main Sewer, they had the idea of making a series of holes in the ground on the sewer, being born this way the first public toilets that in principle did not have isolated divisions, but they were a better choice than hauling buckets to wells.

2 Author oldest treaty architecture which is preserved and the only classical antiquity. De Architectura. In 10 books. It's about orders, materials, decorative techniques, construction, types of buildings, hydraulics, colors, mechanical and gnomonic.

3 Researchers found that the water during the heyday of the Roman Empire dramatically increased its lead content, up to 100 times than natural spring water. Researchers were able to determine that the isotopes of lead present came from the mines exploited by Romans in different provinces of the empire such as Italy, England, France and Spain and the contamination occurred because the water flowed through these fistulas or lead pipes, for no other cause.

4 According to mythology, Cloacina not only guarded the main sewer, but also ensures the hygiene of city residents, driving dirt through its drainage system to the ends of the city.

Photography: Paris Sewer Museum, http://www.paris.es/museo-alcantarillado.

Also in Rome there was a public urinal system operating separately from the toilets. Because of its high level of ammonia, urine was a priced raw material to sell in factories and laundries in order to remove oil and dirt, and to clean and whiten woolen robes. Therefore it was decided to establish a tax on urine poured into latrines and was used by different businesses in the empire[5].

After Rome

Despite his fall, systems built by Roman engineers spread the concept of importing water and provision of water across Europe and Minor Asia.

In Europe, the houses were small and narrow streets, and the waste accumulated in the courtyards was poured into the alleyways at night, places that became the focus of infection for the first medieval towns. Over time, we were establishing informal systems developed to dispose waste to farms. These became known as manure collectors, people walking the alleyways at night. This material became marketed as fertilizer for peasant farms.

5 This occurred during the reign of Vespasianto to whom the phrase "Money does not smell (Pecunia non olet)" is attributed.

However, this collection activity was short-lived because it was an intensive and uncompetitive labor, as farmers also had a large supply of animal manure from their own farms. In this way the streets and alleys became dirtier as far as the population grew, and they had to find other solutions to eradicate all the accumulated waste.

The perspective of reuse in history

In Asia an efficient approach on waste was developed with a vision on recycling. In Japan and China, especially the reuse of organic waste was highly successful because Asian farmers have fewer animals, factor that increases the value of human rights, in addition to the amount of population.

In Japan, human wastes are separated before recycling. Fecal material was the most valuable product, because the solids were easier to transport.

China, in turn, designed a sealed clay jars to store waste for a long time. Such practices, although resulting in cleaner water sources, reducing odors. Gastrointestinal diseases were endemic among farmers and their families.

In the late nineteenth century, these systems, lost its economic attractiveness, to discover and popularize other synthetic fertilizers

> *In Europe, the houses were small and narrow streets, and the waste accumulated in the courtyards was poured into the alleyways at night, places that became the focus of infection for the first medieval towns.*

Health and sanitation

Until the arrival of the bubonic plague of the fourteenth century, began to relate the unsanitary conditions of the population to health. In principle it was considered that the toxic waste steam was the cause of the disease, so they do not yet relate to human waste in the streets and alleys[6]. The link between cholera and contaminated water was established when the London physician John Snow developed a mapping of cholera victims who lived on the same

Photography: Sewer System
http://www.paris.es/museo alcantarillado.

6 As we know cholera is transmitted when water or food contaminated with infected feces by the bacterium Vibrio cholera. The disease spread in London because the water of the Thames and numerous shallow wells are often contaminated with feces.

street *"Broad Street"*[7], and they had consumed all the water in the same shallow well. Only then remove human waste from the streets was seen as an important aspect of public health protection, and forcing people to seek water sources uncontaminated.

Sanitation solutions

While the discovery of Snow century revolutionized thinking in health, its influence did not reach infrastructure problems that needed solving on a large scale, as eliminate shallow wells for intake was one thing, but pollution of a river was a much bigger problem.

The challenge that European cities began to address now was referred to transfer wastewater to places far from the source. In this perspective, Europe began to develop systems to transport the waste to farmers' fields, in order to contribute with crops. In Paris the idea of reuse of waste was accepted, which began in late 1800, building of agricultural pipelines (Vera, 1995) increasing every year farms took advantage this system. The problem was the pathogens in food; however, the purpose of this type of transfer was not because of doubts about the safety of vegetables, but by the population growth of cities and therefore their waste, questioning the ability of farms to receive this quantity of recycled water.

In this perspective, late nineteenth century, London and Paris, two of the most important cities in Europe, despite the attempts of wastewater debug with productive approaches or recycling, decided, for public health, to continue pouring water into the Seine and Thames and explore water intakes in the upper parts of rivers upstream.

Certainly each of those paragraphs, would deserve a more detailed analysis of all its connotations in the history of sanitation. However, this brief overview rescues the importance through the centuries has had both water and excreta disposal, creating and recreating processes, innovations and setbacks in the work of humanity. But where it is believed that everything has been said, history returns lessons and in the sector in question Victor Hugo already said: "The history of men is reflected in the history of the sewers."[8]

7 The story of Jon Snow is an excellent introduction to the science of epidemiology and public health

Photography: The Sacred Cloacina found in August 2012. The upper part of the chapel is seen at ground level. Its base is several meters below the surface.
https://en.wikipedia.org/wiki/Shrine_of_Venus_Cloacina

8 Victor Hugo, Les Miserables, Ed. Plus Ultra, Spain, 1893, Chapter IV, p. 220

SI TOMAMOS EN CUENTA QUE SÓLO EL 3% DEL AGUA DE NUESTRO PLANETA ES COMESTIBLE

¿CUÁL ES LA IMPORTANCIA REAL QUE LE DAMOS?

SANEAMIENTO ECOLÓGICO SOSTENIBLE

ALTITUDE MILK:
BLOSSOM OF MILK, BLOSSOM OF COMPANY

Por Brenda Pardo
REUSSO – SNV magazine editor

> *Flor de Leche is a factory with responsibility for treating their production waste, with environmental principles in the development of artisan cheeses inspired by European traditions.*

Stanislas Gillès de Pélichy, a Belgian entrepreneur, lover of nature and ecological life found a home to live in Bolivia with the conditions he wanted since 1979. Surrounded by farmers who live with the motherland working with respect and affection, animals, vegetation, good climate and tranquility

Since 1998, Stanislas opted for Achocalla to create there the cheese factory "Flor de Leche", a production with responsibility for treating their production waste, environmental principles in the development of artisan cheeses inspired by European traditions.

The name "Flor de Leche" is an inspiration of an expression of the countries in South America, in order to highlight something outstanding such as "blossom of country"or "blossom of people".

On the other hand, says Don Stanislas blossom is the most beautiful of a plant and sustains: *"I saw that in Achocalla produce milk, then why not do something with added value and beauty."*

After 17 years of work, with 35 workers (80% women), a restaurant open to public visits on Saturdays and Sundays. Flor de Leche is one of the most successful companies of the city of La Paz with social and environmental responsibility.

Photography: Edam cheese ripening room.

Photography: Refinement room, Flor de Leche.

REUSSO Magazine made a site visit and invites you to read the successful work performed by Flor de Leche.

The work dynamics of Flor de Leche is through service groups, that is, each area has something to prepare and collaborate so that the next area does its work effectively.

SEPRO - Production Services

At Flor de Leche entire manufacturing process of the artisanal cheeses begins in SEPRO (Production Services), where Lourdes Escobar, Achocalla neighbor and a staff member of the plant, says that in this area the cow milk is received. Flor de Leche works with about 180 producers who deliver milk daily from 8 am; that is to say working with 2,500 liters per day that caters to two main processes (around 1,400 liters) and a small process (about 300 liters). Is worth to emphasize that the payment to producers is done through a categorization of milk per quality (A, B or C).

This is an incentive for farmers to take care of the quality of their milk, thus they receive a better price for their product.

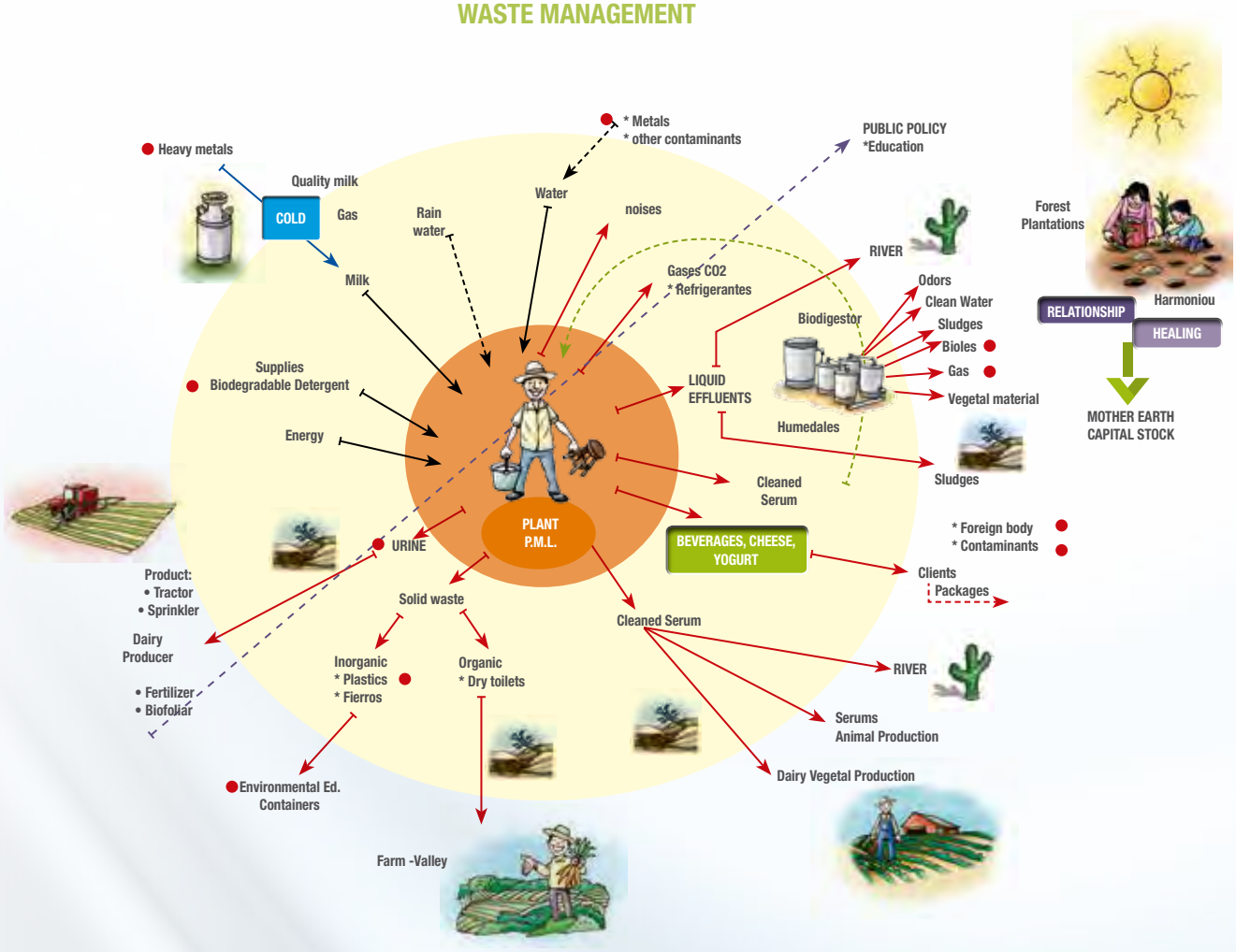
Once all the quality controls both fat percentage, density, temperature, acidity, etc., all milk received is used in the day and serves the process of

cheese making. The production can be classified into the following groups: ripened, cooked and pressed and cleaned cheeses, ripened, pressed and uncooked chesses, ripened cheeses pressed with mushrooms, fresh cheeses, yogurts and fermented milks.

Also, Rosa Jimenez says that once it receives the milk is very important to keep it cold (4th), for it the product is transferred to the cooling tanks, subsequently, when the milk is at an

Photography: Packaging room, Flor de Leche.

OUTLINE OF PRODUCTION MANAGEMENT AND WASTE MANAGEMENT



optimal temperature, It takes the pasteurization area where milk is pasteurized at 74 ° C for 15 seconds

Production

The production area is where the varieties of artisanal cheeses are made, it proceeds as follows:

First, there is the reception of milk into tubs previously disinfected by the responsible for process cheese; then adding calcium chloride ferment and when the quantity of milk is complete we must add the rennet at a temperature of 32 ° C for 30 minutes. After this process, it starts with the first cut that is manual with lyres; subsequently, the second cut is made faster and the tub mechanical arm is used, and then the final cut to give the appropriate size of the cheese grains is carried out.

Finally, the draining of the cheese (product sent tanks to feed the animals of the neighbors is conducted) with water addition. After this last step, comes molding.

Molds containing the cheese grains are taken to the press for finished agglomerate and compact suitably in the desired shape of cheese.

It should be noted that this area is the most important, because this is where the processing of milk to cheese is made.

Refining

After pressing cheese, they pass to brines (large tubs with serum and salt) where cheese is left for a few hours for salting. After this time, are refined (washed with water and salt to prevent drying) for the appropriate time to maturity.

Packaging

After completing the appropriate time to maturity of the types of cheese, they are packed every Thursday to be distributed at points of sale, either stores or supermarkets.

Flor de Leche is characterized as an ecological plant that is, besides

artisanal cheeses made, they also carry out the treatment of effluents discharged. For this, Stanislas shows the course of the natural treatment.

Effluent treatment

From cleaning milk cans, followed by the pasteurization process and even the waters resulting from all units, all milk wastewater are collected through circuits of pipes and different inspection chambers.

Serum, the result of manufacturing cheese process, is recovered by separate circuits and it is offered at no cost to the residents of Achocalla to feed their pig, beef and other cattle.

All effluents are stored in a reservoir 12 thousand liters which are constantly removed to facilitate the homogenization with different natural additives (such as lime, potassium and nitrogen sources), to facilitate the formation and working of bacterial complexes proteolytic and lipolytic which initiate degradation

Photography: Pressing of cheese, Flor de Leche.

Photography: Tilsit cheese.

"Flor de Leche is characterized as an ecological plant that is, besides artisanal cheeses made, they also carry out the treatment of effluents discharged."

Photography: Wastewater from milk reservoir, Flor de Leche.

Photography: Artificial Wetland with geomembrane, Flor de Leche

of proteins, fats and oils in the equalizer these waters, once removed, reduced fats, oils, proteins and stabilized pH, is pumped upl to reach a feed tank, followed by an effluent heater stabilized to finally lead to a series of biodigesters of 30,000 liters, placed in series, in order to ensure optimal working methanogenic bacteria.

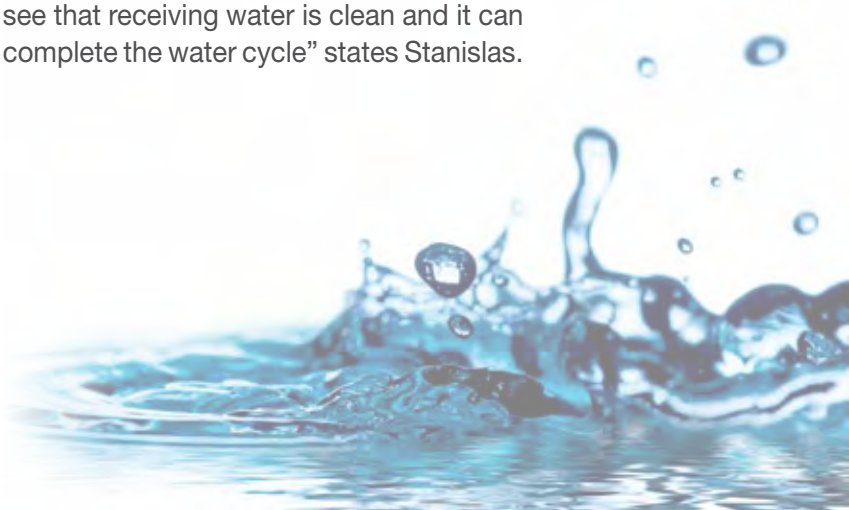
Everything is a process of applied research for several years by Stanislas together with different professors, physicians and ten postgraduate students of the career of Chemistry, Food and Environment, as well as the IIDEPROQ, both under the University of San Andrés (UMSA), together with the support and coaching of SwissContact foundation.

All effluents pass through the equalizer, then biodigesters and finally to artificial wetlands to return to earth as irrigation water.

Artificial wetlands

Artificial wetlands are biological systems, isolated with geomembrane having a sprinkling input and an output. In artificial wetlands live bacteria that are agglomerated in the sands and serve to filter and finish of decomposing balances organic load of effluents and eventually produce water that meets the conditions and regulations to be used as irrigation and forestry crops water.

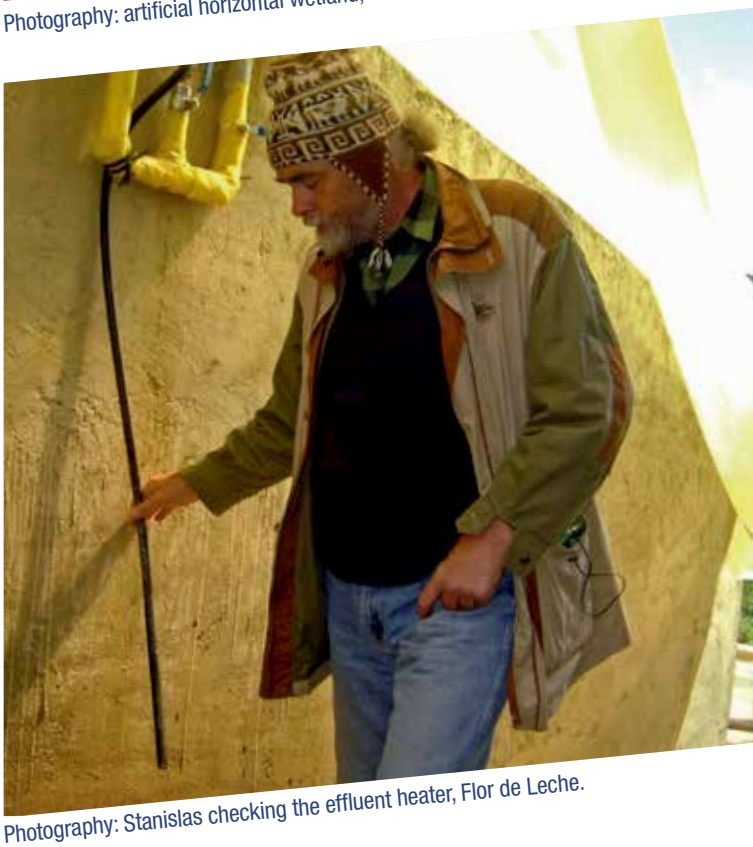
The facility has two types of subsurface flow artificial wetlands: Two are vertical flow and the latter with horizontal flow. Both are installed in series and carried out complementary functions. The horizontal flow ends in a kind of lagoon where fish will be reared soon “This is to let people see that receiving water is clean and it can complete the water cycle” states Stanislas.



This whole system is called water treatment naturally and ecological.

At the end of the tour Stanislas , states that working with ecological principles and social responsibility is very important, because of the way you treat well others, they treat you well, and this is no exception when working with the earth "as a country and as a inhabitants that we are in this great garden which is the Earth, we must be aware that we are doing tremendous harm in different ways, it can be seen the global warming, pollution of water, air, land, by different means and by the greed of certain people that all they care about is accumulating money meaningless (...) it is true that the economic sustainability of our production organization is essential to sell a product, but it should and be possible to be an entrepreneur without harming Mother Earth (...) rather now, it touches us to collaborate and influencing cure ".

Photography: artificial horizontal wetland, Flor de Leche.



Photography: Stanislas checking the effluent heater, Flor de Leche.

Photography: Artificial Vertical Wetland, Flor de Leche.

SOCIAL MANAGEMENT,
A NEW DIMENSION OF ORGANIZATIONAL DEVELOPMENT IN A WSPE

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> *It is not the strongest species that survive, nor the most intelligent, but the one responds best to change.*
>
> *Charles Darwin*

Social management is a key dimension in the functioning and operation of a WSPE. This is the people-centered strategy that promotes the participation of women and men in all project activities with the objective of improving their living conditions, according to their socio-cultural, economic and environmental context. Also contribute to the sustainability of investments based on the synergy of local and sector capacities, enabling impact on the health and environmental protection.

Although this approach has a strong presence in project management, the challenge in recent years is to formalize the Social Management in plans, programs and the formal organizational structure of a Water Services Providing Entity (WSPE).

The importance of institutionalization is that this strategy would be visible to achieve adequate continuity of projects and services from WSPE, as to conventional services (water and sewage) and non-conventional (ecological sanitation).

It is important to think about the creation of an organizational unit of Social Management in the WSPE that has direct dependence on general management, since the creation of a unit in isolation, out of an organizational development approach may be weak, undervalued and disintegrated to other areas of the institutional development of the WSPE.

The development of the five dimensions of organizational development in a WSPE and their integration allow them to achieve entities with greater sustainability.

That is, it is important to incorporate this concept as an extra dimension of organizational development, where their contribution is significant and allows for integration with other areas of a Water and Sanitation Services Provider Entity.

This process requires a vision of organizational development with five dimensions:

- Dimension of people.
- Dimension of the organizational structure.
- Dimension of technology.
- Dimension of physical environment (work environment).
- Dimension of social management (new)

This figure expresses the new model of organizational development for WSPE.

Social Management is the strategy that focuses on people, it must promote the participation of women, men, adolescents and children in all the activities of projects (…) with the aim of improving their living conditions, according to their socio-cultural, economic and environmental context

Each dimension shows a high degree of specialization, being the ideal location of this unit per administered specialties, reporting directly to the General Manager of the WSPE, as a support unit

1. People, being the most important element in the WSPE or any organization, they are considered agents of change. Its importance lies in the interpersonal relationships within the organization, through a harmonious conduct aimed at supporting the goals of the organization.

It should develop in people skills and competences that enable professional performance conducive to achieving a good labor climate as part of the implementation of an adaptive organizational culture to the entity, which is achieved to reach the established objectives, based on a strong involvement and greater job satisfaction of people, through programs of development of knowledge management for training of teams of high performance and support from the managerial staff to permanent motivation at all levels and areas of organizational structure.

2. Organizational structure, it includes the design and implementation of a structure, the organization, chart, which comes into operation through the implementation of an organization manual. It describes the responsibilities of each organizational unit and also the implementation of a manual of processes and procedures where all operations are detailed.

It is essential to consider all manuals, operating instructions and regulations that allow the dynamics of organizational structure.

3. Technology, It refers to knowledge which an organization transform inputs into outputs. Every organization has at least one technology to convert financial, human and physical resources into products or services

"The importance of the institutionalization of social management is a visible strategy for proper continuity of projects and services from WSPE, in terms of conventional services, (water and sewage) and to nonconventional ones (ecological sanitation)."

5. Physical environment, it includes installations where labor relations are developed. The physical arrangement of the workplace directly affects employee productivity.

Managers who spare resources to create pleasant and harmonious working environments create barriers to employee productivity.

Within the development of the physical environment should be taken into account ergonomic and user-friendly designs. In the workplace should provide quality spaces, encouraging employees to develop a sense of belonging in the workplace

6. Social management, social management for WSPE is related to the services provided.

The Social Management is defined as the interaction of users, organizations and other social and institutional stakeholders involved in the use and management of services provided by WSPE, for decision making accepted and consistent implementation of measures regarding access and distribution, multiple use and conservation of water and other resources, seeking an equitable participation of the different stakeholders and to pay attention and respect for different interests.

The development of the five dimensions of organizational development in the WSPE and the integration among them will allow achieving entities with greater sustainability.

Also, track through indicators of each of the dimensions of specialized and integrated manner with the others will enable the evidence of the entity development.

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