Title of full paper: Ecological sanitation, a scalable model for Rwanda

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Beatrice Mukasine – Biography

Beatrice Mukasine is a water, sanitation, and hygiene expert with 14 years' experience in designing, implementing, managing, tracking, and assessing WASH projects in Rwanda. She has worked for SNV since 2001 in the areas of Gender, Youth and currently as the Water, Sanitation and Hygiene/Governance Advisor. In this role, she oversees quality control and supervision of local implementers of the Ecological sanitation project, leads and manages the project. She also maintains strategic partnerships and is charged with promoting dialogue for increased access to safe water and improved sanitation, and promoting participation at the local level. Beatrice holds a Master's degree in Business Administration.

Abstract

An ecosan pilot project is being run in Rwanda by The Netherlands Development Organization (SNV Rwanda). The project aims to increase hygienic sanitation and contribute to a "Green Economy" by improving environmental management, reducing water pollution and increasing local agricultural production through access to ecological sanitation (Ecosan) technologies. This will increase poverty reduction, build climate resilience and green economic growth with positive effects on human health (reduced incidences of water-borne diseases). The project targets two districts in the volcanic region (North-West Rwanda); namely Burera and Nyabihu (2 Sectors in each district) – 2000 families in 10 communities - 3600 students in 20 Schools.

SNV's support focuses on improving access to rural water supply and improved sanitation through 3 sub-programmes: Functionality of Rural Water Supply Services; Sustainable Sanitation and Hygiene for All; and Water and Sanitation Services in Schools. SNV Rwanda has been working on these WASH-related issues since 2007 in the region. SNV introduced the Ecosan project in the volcanic regions because dry sanitation solutions are considered more appropriate for rocky terrain that is prone to flooding. Traditional pit latrines tend to be shallow, hardly deeper than a metre. Combined with a high water table, this increases the pollution of ground and surface water sources. Frequent floods especially in Nyabihu make pit latrines unusable and expose surface and ground water systems to biological pollution.

The Ecosan project has the following specific objectives: improved awareness on benefits of ecological sanitation for health and agricultural production, improved local capacities in construction, and operation and maintenance of Ecosan, awareness through demonstrative Ecosan models in schools and households, action research and social learning implemented on Ecosan and lessons learned used to inform policy development.
The project approach is centred on ***s***trengthening local capacities (Local Capacity Builders (LCBs) and Local masons), involvement of beneficiaries, rehabilitation of existing infrastructures, building a scalable model, documentation of experiences, evidence-based advocacy for replication, and building Public Private Partnerships around public toilets.
The key results attributed to the Ecosan project in Rwanda include:

- 10 villages mobilized for Ecosan with more than 400 Households willing to construct Dry toilets;
- 20 school representatives, 30 community mobilizers and 30 masons trained,
- 4 cooperatives trained in Operation and Maintenance and business oriented Ecosan;
- 40 Households trained and supported to construct Ecosan model latrines;
- 4 new blocks of Ecosan constructed in schools,
- 2 blocks of toilets rehabilitated in public places;
- 1 district-wide forum has been organized.

The project is expected to improve sanitation and hygiene practices in schools and villages. During the first phase of the project, there is need to boost awareness on the benefits of Ecosan for health and agricultural production. The construction phase has recently been completed. The next phase will involve follow up visits to beneficiary households to support them in the operation and maintenance of their toilets while training them on the use of urine and recycled faeces in agriculture. So far, Ecosan technology is revolutionising environmental care and reducing open defecation in Burera and Nyabihu districts. SNV is hopeful that the new model can be replicated across Rwanda once the initial project phase is complete.

Key words: urine diversion, Ecosan, reuse of nutrients, health, reducing water pollution, ecological sanitation

Ecological sanitation, a scalable model for Rwanda

1. Introduction

The Ecosan Project in Rwanda is a pilot funded by The Netherlands Development Organisation (SNV Rwanda) aimed at increasing hygienic sanitation and contributing to a Green Economy by improving environmental management, reducing water pollution and increasing local agricultural production through access to ecological sanitation (Ecosan) technologies. This will contribute to poverty reduction, build climate resilience and green economic growth with positive effects on human health (reduced incidences of water-borne diseases). The project targets two volcanic region districts in the North-West of Rwanda; Burera and Nyabihu (2 Sectors in each district) – 2000 families in 10 communities and 3600 students in 20 schools.

1.1 Problem analysis: The context of rural sanitation in Rwanda

Rwanda has made remarkable progress in access to improved sanitation in households. As a result, almost all households claim to have toilets and open defection was as minor as 6% in 2009 (Government of Rwanda, 2010). The National survey EICV3 (2010/2011) showed that access to improved sanitation in rural areas is 73.1%.

According to the 2013/UNICEF WASH project Sustainability Check report, within the four districts of the volcanic region, namely Burera, Musanze, Nyabihu and Rubavu, sanitation efforts have focused on the building of latrines in schools, hospitals and public places for the benefit of the general population. These efforts have also involved advocacy and education, where households are encouraged to build latrines in their homes. Findings from this survey show that 93.4% of the respondents' households have latrines while about 6% do not have latrines but they share a latrine with another household.

Though access to latrines seems not to be a challenge, observations on the ground progressively raise the unsanitary situation of existing latrines, stressing the need to clearly define improved[1] and unimproved sanitation. The construction standards and hygiene conditions of household latrines need to be addressed through community education (Ref. Sustainability check report 2013/UNICEF WASH project).

For instance, while in 2011 the EICV3 reported access to improved sanitation at 70.4% in Nyabihu district, the district health report filed in May 2014 reported that the proportion of households with improved hygienic latrines stands at 51%.

[1] According to WHO / UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, Improved sanitation includes Flush toilet, Piped sewer system, Septic tank, Flush/pour flush to pit latrine, Ventilated improved pit latrine (VIP), Pit latrine with slab, Composting toilet. Unimproved sanitation: Flush/pour flush to elsewhere, Pit latrine without slab, Bucket , Hanging toilet or hanging latrine, No facilities or bush or field

1.2 Rationale

The most common type of latrine used in rural Rwanda is the pit latrine. The latter is perceived widely as an easy solution and one of the most affordable technologies. Nevertheless, concerns are being raised about the limitations of this technology in relation to poor conditions of emptying, handling and disposing of waste when the cistern fills up, difficulties related to the user interface such as bad odour and flies and the risk of ground and surface water pollution in some particular geological contexts.

The latter challenge is real in the volcanic region of Rwanda. The rocky soil makes digging deep pits difficult. As a consequence, pits are usually shallow and fill up quickly, nullifying efforts of local communities in their quest for sustainable solutions with their scarce resources. Environmentally, the shallow pits in the flood-prone areas regularly pollute the water streams during major rain episodes. Therefore there is a pressing need to develop alternatives that are context-specific while providing the required benefits of sustainable sanitation such as ecological sanitation (Winblad and Simpson-Hebert, 2004).

The idea of ecological sanitation is neither new in Rwanda nor in the Northern and Western regions. Ecological sanitation is even presented in the 2010 water and sanitation policy and strategy as a suitable solution for Rwanda. While it is seen as a viable solution conceptually, the operationalization seems to have produced less than ideal results so far.

As described in Rosemarin et al., (2008) Ecosan is contributing to a Green Economy in several ways: 1) Valuing human waste contributes to agricultural productivity; 2) improved health standards lead to a more productive population 3) Reducing pollution increases environmental resilience.

1.3 Valuing Human Waste: Erosion, soil fertility and food security

Deforestation, erosion and overexploitation of arable soils together cause degradation of natural resilience. According to FAO, the Earth is losing 25 billion tonnes of topsoil per year because of erosion. Topsoil contains humus (carbon fibres, phosphorus and potassium), and micro-organisms necessary for healthy plant growth, and which are not found in chemical fertilizers. The need to find innovative solutions to tackle these environmental problems in Rwanda is particularly urgent given the growing population (population density is 522 persons/Km^2 in Burera and 556 persons/Km^2 in Nyabihu, according to the National Population Census, 2012) and the growing trend towards urbanisation. Overall poor health conditions impact negatively on income generation and poverty reduction rates. Especially in Burera and Nyabihu districts, the local population is vulnerable to climate change due to their high dependence on rain-fed agriculture, the high population density and continued poverty. These two districts in particular are prone to floods and landslides due to the steep hilly terrain and increasingly erratic rainfall patterns occasioned by climate shifts which adversely impact on crop yields and rural livelihoods. Promoting the sustainable intensification of small-scale farming and resource recovery and reuse is a key development path identified in the Government's Green Growth and Climate Resilience Strategy.

1.4 Improved health standards and more productive population.

Access to improved sanitation and clean drinking water are considered an important priority for poverty eradication and economic transformation in Rwanda, particularly considering that Water, Sanitation and Hygiene (WASH) related ailments account for more than 80% of total morbidity. It is in this respect that the Government of Rwanda (GoR) aims, under the Second Economic Development and Poverty Reduction Strategy II (Government of Rwanda, 2013), to realise 100% access to sanitation and to clean drinking water by 2018. Water services are increasingly affected by environmental and other factors – such as pollution, infrastructure destruction due to erosion and poor hygiene practices at water points. Investing in innovative approaches and infrastructures that reduce these effects is therefore key.

1.5 Greening Economy: tackling water pollution and water scarcity

The concept of 'more crop per drop' is today more relevant than ever. We have to develop and promote wise crop husbandry practices. Communities and economies will only be sustainable if there is water of sufficient quality and quantity. Modern agricultural practices are threatening the quality of water, while climate change is affecting the availability of water. Water pollution in Rwanda is expected to increase as a result of economic development, demographic growth and rapid urbanization. Many important water bodies already contain high levels of pollutants and contaminants, posing serious threats to humans and ecosystems. The main causes of pollution in Burera and Nyabihu districts include poor sanitation practices and release of untreated sewerage, despite the steps made towards universal access to improved sanitation (78.4% and 70.4% for Burera and Nyabihu districts respectively[2]). A recent baseline water quality assessment across all 30 districts found that 28% of samples represented improved water sources, 80% unimproved water sources and 58% from stored water in homes exceeding the microbiological limits imposed by the national standards. This indicates that even people with access to improved water sources are exposed to pollution.

Sanitation challenges are compounded by use of traditional pit latrines that tend to be hardly deeper than a metre, which combined with high water tables, facilitates rather than reduces the pollution of ground and surface water sources. Frequent floods especially in Nyabihu make latrines unusable and expose surface and ground water systems to biological pollution. Thus, it is important to consider more innovative sanitation technologies, such as dry toilets, which are considered more appropriate for such an environment. The District Development Plans (DDPs) of the 2 districts clearly state expansion of holistic sanitation solutions as a priority, hence lending relevance and timeliness to the project.

In terms of quantities, water resources have to be used wisely, making sure that every drops counts. At the moment, efficiency in water use is low. Measures to improve water use efficiency are therefore clearly justified in the context of rampant climate change. They also make economic sense. This involves a wide range of interventions, including changing the behaviour of consumers and disseminating water-efficient technologies. In order to build a developed Rwanda, adopting waterless technologies and growing a common sense of the environmental benefit of such technology is crucial. The new Rwandan policy on Integrated Water Resource Management (Government of Rwanda, 2011) intends to improve the efficient use of water resources.

2. Project Methodology

To address the above issues in this project, SNV introduced the dry toilet Ecosan solution in the two districts of Burera and Nyabihu. The project objectives are being achieved through the combination of two key components: i) demand creation for Ecosan as a sustainable solution to environmental sanitation and resilience to climate change, ii) Effective governance at local authority level for quality implementation and safe use of the promoted technology.

2.1 Demand Creation

The overall approach started by creating a consistent demand for Ecosan toilets through awareness campaigns, mobilisation of trained local champions and practice-based learning of the benefits of using Ecosan by-products in agriculture. Long-term promotion is essential to ensure sustainability and long term health and environmental benefits.

Sanitation and hygiene promotion can learn from advertising and other persuasive communication. However, at local level, most sanitation and hygiene promotion is still characterised as "material

[2] District Development Plans for Burera and Nyabihu districts.

centred" rather than "behaviour centred." For instance the most commonly used motivator for hygiene promotion is still "health", which rarely triggers behavioural change. Another challenge is that many hygiene promotion programmes aim to address too many behaviours at once, for example hand washing with soap, food hygiene, safe water handling, bed nets etc. There is a need for innovation of environmental sanitation and promotion practices and to translate international insights into local contexts for better quality results.

The approach of the Ecosan project consists of a definition of priority behaviours and incentives for change based on survey data, formative research, development of Behaviour Change Communication (BCC) strategies, and consequently design of messages, campaigns and monitoring effectiveness. An essential component is the involvement of local and national agencies.

We have learned that local formative research involving stakeholders contributes to a much better understanding of behaviour change. This gives rise to enhanced trust, builds support for further research activities and begets endorsement of the research and its results. Formative research helps answer SMART questions about demand and improves the outcome of interventions.

Care will be taken to customise the messages to the target communities. Campaigns and hygiene behavioural change communication will not be a standalone intervention but will be embedded into local sanitation plans. Implementation of demand creation requires strong community facilitation skills and a good knowledge of sanitation and local context. SNV leverages a solid knowledge of the local context and engagement of different stakeholders, local organisations and authorities in getting local buy-in and setting benchmarks. The Ecosan project engages demand creation facilitators to act while taking into account differences between households in terms of income and leaderships.

More attention must be paid to ensure informed choice of the technologies. Facilitators should not just offer one-off training, but should incorporate regular moments of reflection and learning through practice for improvements. Inevitably, there are unresponsive villages or households within any district, which may require unique demand creation approaches.

Promotion of Ecosan begins with awareness raising among local leaders and community mobilisers on the cost and benefits of the technology. Visits to other areas within or outside the country featuring communities that have adopted the approach are crucial. Once the leaders are convinced, they will lead and steer the demand creation activities. Demonstration units have to be built so that households can see what is coming and touch the reality of the promoted approach. Demand creation looks at construction of demonstrative standard latrines that can be replicated by the targeted communities; mobilization, support and follow up local communities in constructing their own improved latrines and strengthening capacities of local masons in building improved latrines adapted to the volcanic region.

2.2 Governance

Local authorities have been engaged in ensuring quality control towards implementing a safe and environmentally friendly technology.

Technologies promoted without the buy-in of local authorities often end with poor service delivery from poorly skilled artisans, incomplete installation of the technology which ends up not serving the intended purpose, and misuse among households leading to pollution of natural resources. SNV supports local governments to take the lead in planning and for everyone to take pride in incremental progress made in their district through monitoring. The joint district sanitation planning process involves: discussing the needs and approaches to reach different geographical areas and how to reach poorer households, discussing the best use of resources, setting clear standards and eliminating contradictions to ensure proper technology implementation and further checking of proper use.

Officers responsible for sanitation and environmental issues at district and sector level have been trained in the required technology, operation and maintenance. Tools such as guidelines and standard have been developed in consultation with them so that they master the opportunities and risks related to management of ecological sanitation. This way they are able to play a key role, not only in promotion but also in the quality of the facilities built.

In this pilot project, SNV has partnered primarily with two experienced local Organisations COFORWA *(Les Compagnons Fontainiers du Rwanda*), and REC (Rwanda Environment Care). The partnership builds on strengthening local capacities (Ecosan Community Mobilisers, household and school health club representatives, local masons, as well as for local technicians), involvement of beneficiaries, focus on rehabilitation of existing infrastructures, building a scalable model, experience documentation, evidence-based advocacy for replication, and building Public Private Partnerships (PPP) around public toilets.

In addition, SNV Rwanda and Stockholm Environment Institute (SEI) have entered into a partnership agreement. The latter specialises in Capacity Building Services for Ecological Sanitation. On its part, SEI has developed training material on Ecosan including Behaviour Change Communication (BCC) and school curricula; Advice on Ecosan technologies, and organised meetings on ecological sanitation with stakeholders at national level, action research and social learning.

3. Results

The key results attributed to the Ecosan project in Rwanda include 10 villages mobilized for Ecosan with more than 400 Households willing to construct Dry toilets; 20 schools' representatives, 30 community mobilizers, 30 masons, 4 cooperatives trained in Operation and Maintenance and business oriented Ecosan; 40 Households trained and supported to construct Ecosan model latrines; 4 new blocks of Ecosan constructed in schools, 3 blocks rehabilitated in public places (Business center Shaba, Cyanika Sector Office, Kagitega school); and 1 district-wide forum has been organised.

Around 71,780 people in Burera and Nyabihu districts have been reached by messages on benefits of ecological sanitation for health and for agricultural production through: Community meetings, Sanitation stakeholders' forums and Awareness campaigns (community work and radio spots).

In 2014, the project implemented a set of activities, summarized as follows:

- A baseline study to improve the understanding of the context and inform better planning during the implementation.
- Training of trainers: Ecosan O&M, use of recycle products in agriculture.
- Training of 30 community mobilizers to promote the technology and assist the community members in the use of their facilities.
- Training of 21 school leaders to guide the process of introducing ecological sanitation in schools.
- Introduction of the Ecosan concept in 10 villages through informative communities meetings led by trained mobilizers and local organisation.
- Training of 30 masons on construction of dry toilets for families and Business Development.

Figure 1: Household dry toilets in Burera district

- Construction of 40 demo dry toilets in households using trained masons.
- Construction of 4 blocks of dry toilets in schools.
- Rehabilitation of 3 blocks of dry toilets in schools and public places.

Figure 2: Toilet block in a school in Burera Distict

- Organisation of a learning event gathering more than 50 local leaders to share knowledge and vision for ecological sanitation in the volcanic region

For 2015, the following activities are planned:

- behaviour change awareness campaigns on Ecosan,
- Design and implement innovative activities for demand creation and marketing of Ecosan latrine,
- Facilitate and inform local cooperatives on management, operation and maintenance and marketing of Ecosan by-products,
- Regular visits and accompaniment of schools on operation and maintenance and reuse of Ecosan by-products,
- Training household on basic Operation and Maintainance and reuse of by-products as fertilizers,
- Advise masons in marketing their skills and provision of Ecosan construction services,
- Facilitate districts WASH stakeholders meeting for sharing lessons learnt on Ecosan for scaling up,
- And development of case studies and articles on the project outputs and outcomes.

The project will improve climate resilience by boosting local agricultural productivity, preserving soil fertility and safeguarding long-term local food security, while minimising the consumption and pollution of water resources and reducing the incidence of water-borne diseases. The proposed interventions will also promote green growth in the target areas by stimulating the demand for green WASH technology. This represents an opportunity to scale up the intervention since the project can trigger countrywide uptake of Ecosan toilets, ensuring that the targeted schools and households are

seen as models. Overall the project aligns well with Rwanda's 2020 vision: to become a developed climate-resilient country and low carbon economy by 2050.

4. Lessons learned and conclusions

The project will improve sanitation and hygiene practices in schools and villages. During the first phase of the project, in order to better harness the benefits of Ecosan toilets, we have established a need to boost awareness on the benefits of Ecosan for health and agricultural production to improve local capacity in construction and operation of dry toilets as well as promotion through stakeholder platform meetings.

While Ecosan appears to be a suitable solution for the volcanic region, the knowledge gap around the concept, principle and implementation of dry toilets technology is still an issue at local level. Furthermore poor understanding is often encountered. The cost of dry toilets came out regularly as a challenge hampering the uptake of the technology. A standard dry toilet costs about 350 US Dollars, an amount that is prohibitive to most rural Rwandan households.

Use of urine as fertiliser is a key driver for uptake of dry toilets. This concept appeared to be new to more novel to most farmers in the region compared to the use of faecal matters from pit latrines. However it is gaining acceptance due to the permanent need for alternative fertilizer in the region that decries unaffordable cost of commercial fertiliser such as NPK.

The learning must be continuous. Now that the construction phase is over, follow up visits will be organised in 2015 to beneficiary households to support them in the operation and maintenance of their toilets while training them on the use of urine and recycled faeces in agriculture. In the meantime, the facilitators will continue to demonstrate to the remaining households in the community how they can build their own durable latrines using local resources with the support of trained masons.

Action research led that innovations will reduce the cost of the urine diversion toilet depending on the combinations of materials used and location, as follows:

1. Use of mud and wood for the super structure will be much cheaper than using cement-based wall material.
2. Use of bambou sheet as superstructure will reduce the cost
3. Use of 28-gauge iron sheet instead of the costly steel sheet.
4. Use of stones for the vaults and using cement for plastering the vaults only, to enable waterproofing.
5. Use of thatch or other local roofing material is cheaper than iron sheets.
6. Use of logs as the foundation for the floor instead of a concrete slab that involves use of iron bars and cement

We have also learned that Ecosan technology is revolutionising environmental care and reducing open defecation in Burera and Nyabihu districts. SNV is hopeful that the new model can be replicated across Rwanda once the initial project phase is complete.

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