

Advances in Environmental Research. Volume 41

https://www.novapublishers.com/catalog/product_info.php?products_id=54917&osCsid=dec2a98da19344b8804ef2eb893f1c0a

Editors: Justin A. Daniels

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This series covers leading-edge research focusing on the environment, including current research data on the impact of forest canopy structure on simulations of atmosphere-biosphere NOX exchange; numerical simulation of CO2 sequestration in saline aquifer influenced by heterogeneous capillary pressure and wettability; the estimation of riverine nutrient fluxes from an urban watershed in New Jersey; a field survey on the Iberian Peninsula; pollution characteristics and potential ecological risk assessment of heavy metals in river sediments based on calculation of pollution indices; rainfall patterns and the relation to atmospheric circulation in Northern Patagonia; a case study of a dry deciduous forest in Kratie, Cambodia; a case study on wastewater management in Nepal; methane interactions with an atmospheric moisture; anthanides and actinides in soils of Khibiny-Lovozero Province; safer irrigation technology adoption under uncertainty perception in Ghana; and nano biomaterial for decontamination of carcinogenic metal from waste water. (Imprint: Nova)



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Series:

Advances in Environmental Research

Binding: Hardcover

Pub. Date: 2015 - 3rd Quarter

Pages: 7x10 - (NBC-R)

ISBN: 978-1-63482-885-7

Status: AP

Chapter

STAKEHOLDER INCLUSION IN DESIGN AND PLANNING - A CASE STUDY ON WASTEWATER MANAGEMENT IN NEPAL

Martina Maria Keitsch¹ and Udhab Nepal²

¹Department of Product Design, Norwegian University of
Science and Technology, Trondheim, Norway

²Civil Engineer at Department of Education, Ministry
of Education, Government of Nepal, Nepal

ABSTRACT

One of the greatest challenges in introducing sustainability solutions lies in their acceptance by stake-holders. History shows numerous failures from not considering local socio-cultural circumstances and practices and new technologies might have a short-term positive impact on people's quality of life, but they will not be used to their full potential if stakeholders have no enduring commitment to their sustenance.

Apart from technical aspects, understanding an appreciation of socio-cultural settings is vital for the planning, design and operation of sustainable technology systems. Planning and implementing sustainable solutions requires first that technologies have practical relevance for people. Second, the sustainability of solutions depends on trust between technology developers and local stakeholders. Relating to these challenges, the following article presents and analyses a case study on wastewater treatment in the Madhyapur Thimi municipality, Nepal.

The case study is a pilot and demonstration project that was initiated as a community-based DEWATS (decentralized wastewater treatment system) by an NGO to tackle the worsening wastewater situation in urban areas of Nepal. Based on this case study, concepts of social acceptance and its role in implementation of community based DEWATS are analyzed. Further, it is discussed how the case study exemplifies challenges with SI. In conclusion, the article provides practical implications for different stakeholders to contribute to resilient wastewater management.

Keywords: Decentralized wastewater treatment system, social acceptance, stakeholder involvement

1. INTRODUCTION

One of the great challenges to implement and operate sustainable solutions over a longer period of time more efficiently lies in their social acceptance. Social acceptance is a prerequisite for the adoption and introduction of new technologies-in particular new public infrastructures (Sauter and Watson, 2007).

Often a project, necessary to improve environmental conditions from a national perspective, also faces local objections as a disturbing nuisance to the local residents. Some authors also stress that moving from global to local, and from general support for technologies and policies to effective positive investment and siting decisions, requires the acknowledgement that there is indeed a problem (Bell et al., 2005 cit. in Wüstenhagen et al., 2007). In the case of waste management and community based project, social acceptance in the form of 'active' acceptance, is more demanding from the local community than 'passive' consent to sustain a system in long run.

Socio-political acceptance is social acceptance on the broadest, most general level. Both, policies and technologies can be subject to social acceptance (or lack thereof). At a general level socio-political acceptance also concerns the acceptance by key stakeholders and policy actors for effective policies. The concept of social acceptance is applied as theoretical basis to analyse this case study. After discussing the settings for the case study in the first section and introducing the project in section two, we present factors affecting social acceptance in a modified form to suit community-based DEWATS in section three. These factors are grouped into four broad categories namely project specific factors, project external environment, community factors and technology related factors (Nepal, 2013).

Some practical implications are conclusively presented in section four. We suggest participatory design as a possible methodology to include stakeholders in planning and implementation processes of wastewater management.

2. THE CONCEPTS

Social Acceptance

The term 'Social acceptance' comprises two different words social and acceptance. 'Social' relates to a group of people having common relationships and interests and 'acceptance' means agreeing to perform any action. Acceptance can range between passive consent and active engagement (Sauter et al. 2007).

Social acceptance includes at least three dimensions: socio-political acceptance, community acceptance and market acceptance (Wüstenhagen et al. 2007). Different authors put emphasis on particular areas e.g. social acceptance as intention to use a technology and measure it through willingness to pay (Mallet, 2007).

Others emphasize distributional justice (how are costs and benefits shared), procedural justice (is there fair decision-making process giving all relevant stakeholders an opportunity to participate) and trust (Gross, 2007: in Wüstenhagen 2007).

A breakdown of trust will almost always result in communities not accepting and adopting the technology intervention (Lewicki et al. 1996).

Participatory Design

User-centred approaches such as participatory design or co-design are supportive tools to generate understanding, negotiation and acceptance in e.g. community based projects. Participatory design addresses diverse audience, non-experts, researchers and practitioners. It is a practice of collective creativity, also known as co-creation/co-design and was established in Norway, Sweden and Denmark as a collective Resource Approach to increase the value of industrial production of a new system for the workplace (Bodker 1996). Van Rijn et al., (2005) argues that users can become part of the design team as 'experts of their experiences'. Participatory design methods have a fourfold effect. First, they generate collaborative communication between planners, designers, users and stakeholders, and requirements and needs can be directly conceptualized with their participation.

Second, they create a continuous conversation between the planners, designer and stakeholders. Third, issues discussed and negotiated facilitate collective learning and expertise of the whole community, while motivation and creativity of stakeholders to contribute is encouraged. Finally, in a participatory design process, co-creation activities minimize possible miss-conceptions between user needs and the end product (Park, J.Y. 2012, Van Rijn et al., 2005). Benefits and challenges of the participatory design approach will be discussed more detailed in section 4.4 of this paper.

Policies and Market Demands

Government policy can promote and facilitate any initiative. Some activities such as cross subsidy, financial incentives, and ecological tax-reforms can be considered promotional activities. For community based projects like DEWATS, policies that insure long term collaboration for operation and maintenance support, and facilitate participation of local stakeholders from the initial stage throughout the whole planning and implementation process are some supportive strategies.

Social acceptance of any innovative technology for improving environment depends on many factors like environment awareness, planning culture – top-down or bottom-up, governance, attitude for change, adaptation of new technology, experiences etc. Warner (2006) states that people's attitude is the combination of cognition (knowledge), perception (feeling), and behavior (action). Changing attitudes is a gradual process, and it takes a very long time. In Nepalese society, still people hesitate to discuss openly about wastewater handling with human excreta due to social stigma, psychological and cultural taboo. In Nepal, handling human excreta is considered as 'filthy' job of the so-called lower caste and lower income people like Chyame, Poda¹, who are still working unsafely for emptying septic tank for removal of sludge, open blocked sewerage (Nepal, 2013). Social acceptance refers to the specific acceptance of siting decisions and the projects by the local stakeholders, particularly residents and local authorities (Wüstenhagen et al., 2007).

¹ Poda, Chyame are lowest occupational castes among an ethnic community Newars. Newars are the indigenous people of Nepal's Kathmandu Valley who speak Newari, an independent language with its own script and literature. Poda, Chyame are considered as 'untouchables' and placed in lower status according to caste hierarchy system prevalent in Nepalese society though caste based discrimination has already lost their legal ground.

This is the arena where the debate around NIMBYism² unfolds, where some argue that the difference between general acceptance and then resistance to specific location can be explained by the fact that people support project as long as it is not in their own backyard, while others argue that this is at least an over-simplification of people's actual motives (e.g. Wolsink, 2006; Bell et al., 2005 cit. in Wustenhagen 2007).

Market acceptance is another important factor to adopt innovative technology including investors, consumers and intra-firm relationships (Wustenhagen 2007). Current DEWATS using local resources for construction and natural process for pollutants removals may not be considered as interesting technology for investors. Urban management strategies and policy adoptions such as 'polluters pay principle', close-loop resource cycles, waste management at the place of generation, enforcement of laws to control and regulate polluting water-bodies and conservation of natural habitat may attract private investors in this sector in coming days. Households presently paying nothing and disposing wastes 'through away' might gradually change their mindset and be convinced for paying due to enforcement of policy measures, that market can be attracted to invest in DEWATS.

3. THE CASE STUDY

Challenges of wastewater management are increasing with rapid population growth in urban areas. In Nepal, rivers get increasingly polluted as more than 90 percent of wastewater is being discharged directly without any treatment which constitutes a particular problem in urban settings. Due to rampant discharge of wastes, during the dry season rivers seem like open sewer within urban areas, especially in Kathmandu valley.

This paper discusses a case of community-based decentralized wastewater treatment system (DEWATS) based on simple plants- reed plants to treat households sewage, which faced first rejection and then acceptance from neighboring communities. It is an NGO initiated project funded by Asian Development Bank initially started in Siddhikali in Madhyapur Thimi municipality to tackle the worsening wastewater situation. Madhyapur Thimi municipality lies in Bhaktapur district of Central Development Region, Nepal around 10 km from Kathmandu Centre. After the plant construction had begun, local people object it by saying that it would pollute the local environment. The implementing agency Environment and Public Health Organization (ENPHO), an NGO, made a lot of effort to convince the local people. They were asked for observation visits to existing treatment plants, but they refused to proceed with the construction (ENPHO, 2005).

Geographically, the construction site was situated unfortunate on the way and near the vicinity of Siddhikali temple. Siddhikali is the main temple of Prajapati³ community of Thimi. Prajapati is a caste among an ethnic community Newars. Prajapatis are potters by caste who make clay products as family enterprises, and are, according to the caste hierarchy system prevalent in Nepalese society, placed in a lower status than Shresthas though all restrictions regarding castes have lost their legal ground.

² NIMBY (an acronym for the phrase "Not In My Back Yard") is a pejorative characterization of opposition to the siting of something perceived as unpleasant or hazardous in their own neighborhood, especially while raising no such objections to similar developments elsewhere.

³ *Prajapati* is a caste among an ethnic community Newars. Prajapatis are potters by caste who make clay products and according to so-called caste hierarchy system of Nepal placed in a lower status.

Religious people of the community frequently use the way while visiting the temple. Relating to the socio-cultural environment there are many religious and cultural events taking place in Thimi. One of the most important cultural events is Bisket Jatra (Chariots festival). A lot of people gather to observe the famous Bisket Jatra which is observed from the open space of Siddhikali where community-based DEWATS was initiated to construct by ENPHO as the implementing agency (IA) to treat wastewater.

Sunga people, nearby of Siddhikali, then requested the construction of the system in their vicinity. The Sunga settlement is located on a higher elevation and the treatment plant is located on the lower level. The site is isolated and there are no ways for public access, the place was formerly used for open defecation and waste dumping. Landslides were frequently observed on this site. The treatment system is designed and built on a steep terrain which is now in operation. The system is treating wastewater from 84 households.

The initiating NGO ENPHO did get an external support to carry out a feasibility study for the community-based DEWATS in 2001 including design and cost estimates to treat wastewater discharge of about 100 m³ per day. After a year ENPHO requested a fund to ADB which was granted for Operational Research on Decentralized Wastewater Management and its Dissemination, which consists a Pilot and Demonstration Activity (PDA) regarding innovative ideas on water management at the local level that include community-based DEWATS in Siddhikali as one of the major component.

Some reasons to select the site in Thimi were Thimi was the worst municipality in sanitation situation within Kathmandu Valley, there was already an outfall of sewer network. The most important reason was that there was a good site already selected for sewage treatment through simple stabilization pond but failed due to inferior construction and sewage spread elsewhere making the place filthy and smelly.

Project Completion Report of ENPHO (2005, p. 3) states “after the signing of the agreement between ADB and the IA, the Mahdyapur Thimi municipality was informed about the PDA program. A program was organized by the IA to give information about the PDA program, representatives from the municipality, local people, local clubs and CBOs attended the program. Several meeting and community consultation programs were also held between municipality, community and the IA. After the submission of Project Inception Report in July 2004, a management committee was formed to support the construction of DEWATS in Siddhikali area. A site office was also established in the Siddhikali area”. Site preparation was initiated using heavy equipment for excavation works to level the ground. Layout of different components of treatment units on the ground was carried out. Procurement of construction materials was done and stored on the site by ENPHO staffs.

Meanwhile some local people started questioning what are they doing? What is the purpose? Will the system that use simple reed plants able to treat the wastewater? What about the foul odor? What about the limited open space used for observing Bisket Jatra and playing for the football. What impact will it create to the religious environment of Siddhikali? Who will take responsibility for operation and management after its completion? Who will maintain if something happen as earlier there was such type of pond but was failed and nobody took care, the bitter impact of past experience (Mallett, 2007).

The chairman of SACDC⁴ said that wastewater is also flowing from the other side which is not proposed for treatment. He continued saying “if the whole of your face is black, what is the sense of making only a small portion white?” This shows ENPHO was unable to clarify the objective of this pilot demonstration project.

According to ENPHO, a lot of efforts were made to convince the local people after objection. Quite a number of discussions and community consultations were carried out to resolve the problem and convince the local community. Design was changed thrice to satisfy. ENPHO arranged an interaction meeting and discussion program with the local community in the presence of former representatives of the Municipality. Local youth and adult seem convinced and construction work resume after two days of the consensus made. But woman, old people and children were sent and again objected threatening to death if continued. According to ENPHO (2005, p. 3) “this development was narrated to ADB and the construction work of DEWATS was suspended till the visit of ADB Review Mission. During the Review Mission, the problems were discussed with the representatives of the Municipality and local community. A decision was made to abandon the construction of the system at Siddhikali area and other suitable locations were considered”.

There seems lacking local people participation to discuss on their priorities and cross cutting issues like financial, technological 'complexity', socio-cultural, political, institutional and environmental in planning DEWATS. Mobilizing local people at grass root level to identify needs and seek their concern for the solution to solve the problems seems absent. This is evident from the fact that most of the people were unknown about the project. Planning DEWATS was carried out in a linear fashion by experts without extensive consultation and engagement of the local community people though the proposal recognized “local people should be involved to sustain the program and also to reduce capital investment”. As stated above, although the proposal has mentioned that stakeholders will be participated in the project from the beginning, in practice it was absent. Project was developed by ENPHO and there was lack of community engagement, ‘Outcome’ dimension was focused in planning community-based DEWATS in Siddhikali ignoring 'process' in the ‘community projects’ as identified by Walker and Devine-Wright (2008). Community-based pilot project was intended to launch without making judgments about the community, their shared expectations, their social networks, their strength and capacity to manage the tasks. ENPHO seems technically very sound but weak in social aspects in this regards. The reason for the selection of the site in Siddhikali was based on confident in its usefulness determined by ENPHO but not by the local people of Siddhikali.

After the local objection to the construction of wastewater treatment plant in Siddhikali, ENPHO was looking another appropriate site somewhere in Bungmati or Khokana in Lalitpur district. But, it became an issue of prestige for the local political leaders of Thimi that their development effort was going to fail, so they proposed a new site for the community-based DEWATS in Sunga, a place adjacent to a school in ward no 14 of Madhyapur Thimi municipality. Also, the local political leaders did not want to lose the aid. Most of the local political leaders, who were involved to convince the local people of Siddhikali saying not to object the wastewater treatment plant construction, were from this area.

⁴ Siddhikali Area Conservation and Development Committee (SACDC) is a community based social organization for the conservation of the Siddhikali temple, and development and management of religious activities close-by.

These local political leaders were also in the management committee of the adjacent school. The Sunga MC Chairperson and one of the members said that the possible objection from school teachers and students can better be managed and convinced as they were in the management committee of the school.

In later site Sunga, mass gathering for community interactions were organized three times before taking the decision to initiate construction: First, to describe the local people about DEWATS and its' functioning, second, a documentary show was arranged in the compound of Balkumari temple to visualize how DEWATS works. Third, an inspection visit was arranged to local political leaders and local people observe DEWATS site. After that, a mass gathering including elected municipal political leaders was organized on a public holiday in the site to discuss the construction of wastewater treatment plant (WWTP) at Sunga Tole. This meeting decided to construct the community-based DEWATS at Sunga.

For this, a management committee (MC) of 17 members, 2 of which were women, was formed representing all sections of society such as representatives from all major parties and local community organization (CBOs, CFUGs, local government etc.) under the chairmanship of a social activist.

Still, some local people disagree to the decision of construction of treatment plant saying that foul odor will pollute the environment. They discussed and local political leaders proposed that the existing sewer line will not be damaged and if foul odor became a continued problem in the future, they will not send wastewater to the treatment unit and will discharge directly to the surface stream as done previously (the zero option?) which Rogers called 'triability' of an innovation in technology adoption model (cited in Mallett, 2007).

Finally, they agreed. Moreover, they were also hoping that after the construction of treatment plant, the landslides can be prevented. The headteacher said that some of his colleagues objected for the proposal to construct treatment plant but he was able to convince them saying that at least their land will be protected from landslides which Rogers called benefits and costs of the innovation (cited in Mallett, 2007).

The next meeting of the MC decided on division of other portfolio of the members. In the same meeting, the MC decided to form an advisory committee of four people under the conveyer-ship of former Mayor of the municipality. Another meeting of MC formed a construction committee having 7 members (only one woman) under the conveyer-ship of MC Chairperson.

The meeting decided to open a bank account in a local saving and credit cooperative in the name of MC. A tripartite MOU between MC, MTM and ENPHO regarding the construction and maintenance of DEWATS was made which solves the problem of 'complexity' in Rogers technology model (cited in Mallett, 2007) that can be regarded as continuous collaboration in technology adoption model (Mallett, 2007).

This management committee was fully responsible for all aspects of construction management including purchasing necessary materials, hiring manpower required for the construction and supervising the construction works. They hired local laborers, procured construction materials and supervise the works. This change of strategy in Sunga might be due to the fact that the approach previously employed by ENPHO in Siddhikali was failure. In the case of Sunga, the construction expenses were reimbursed by ENPHO to the MC. ENPHO provided technical support for the construction. A lot of investment was done for the construction of retaining structures to minimize the potential risk of landslides and filling with soil to make the needed ground level base for different component of treatment units.

4. ANALYSIS OF THE CASE STUDY

Stakeholder Involvement in Planning Community-Based DEWATS

The 'outcome' dimension was overemphasized in the planning of this community-based DEWATS while the 'process' dimension was neglected. Mobilizing local people at grass root level to identify their needs and seek their concern for the solution to solve the wastewater management problems seemed absent as well and while selective participation was achieved while forming the management committee in the former site Siddhikali. The usefulness of the project was determined by the initiating NGO.

There were some fundamental challenges in employing a community-based approach for planning DEWATS in Thimi, which should rely on decentralized and collective decision-making that seeks locally appropriate solutions. For example the focus on 'outcome' dimension, which can be conceived, planned and operated by NGOs and local institutions should have direct benefit for the local community either in terms of creating job opportunities or resources use that can be linked in a way at households' income level.

These direct benefits should be realized by the local community people, but not by the project developer. In Siddhikali, ENPHO hired heavy equipment for excavation work to level the ground. Materials were procured by ENPHO staffs. A contractor was mobilized for construction work but the role of Management Committee (MC) was not clear. The economic authority was not handed over to the MC. Here, the approach taken by ENPHO to initiate construction can be questioned from transparency view point. Local political leaders were agreed to initiate the construction but local inhabitants were disagreeing, some wanted to initiate the project while others were objecting it.

There were various reasons that led to rejection of community based DEWATS in the former site Siddhikali. The main reasons were lack of community involvement from the outset of project planning and selective participation made in the decision-making process ignoring local political dynamics that focus only in product rather than in process among other various reasons. Local people were worried about the impact of possible foul odor to the religious environment.

Traditional uses of the place while selecting the site were ignored. Further, literacy among Siddhikali'sprajapati people was less than municipal average and there were still significant number of households without toilet facilities among them. Environmental awareness was also limited among local Prajapati people. Moreover, there was lacking political commitment from municipality i.e. established supporting mechanism for long term collaboration on future operation and maintenance of the system.

In the lattersite Sunga, NGO and local leaders interact to a greater extended for example through stakeholders' gatherings to discuss pros and contras of DEWATS. Sunga's Shrestha people were more educated, politically more active and the numbers of households having toilet facilities were almost cent percent in Sunga.

It was the management committee to initiate and manage the construction work. MC hires the local labors to carry out the construction works and purchase local construction materials themselves. MC members supervise the works. The construction expenses were reimbursed by ENPHO to the MC. The main cause for the acceptance of community based DEWATS in Sunga was to protect the land from landslides (forced acceptance?).

Further, community preparedness and mobilization that were carried out for selecting the site and forming the management committee including political commitment i.e. tri-party MOU for long term collaboration on future operation and maintenance were among other reasons. These changed strategies employed by ENPHO might be the lessons learnt from the rejection of community-based DEWATS from Siddhikali.

Social Acceptance

Figure 2 illustrates Wüstenhagen's concept that has been slightly modified for community-based DEWATS based on the findings of this study. The aim of this modified version is to contribute to a new understanding on social acceptance of community-based DEWATS. Social acceptance of community-based DEWATS is low, mainly due to matters of handling wastes and associated foul odor problem, among various other factors. These factors can be grouped into four broad categories namely project specific factors, project external environment, community factors and technology related factors (see Figure 2 section b). Project specific factors include location (siting), scale of DEWATS i.e. size of settlement, mode of project planning, implementation and operation (room for local people participation).

Focus on 'process' dimension is vital in planning DEWATS as installing the system within a community do not directly benefit the community.

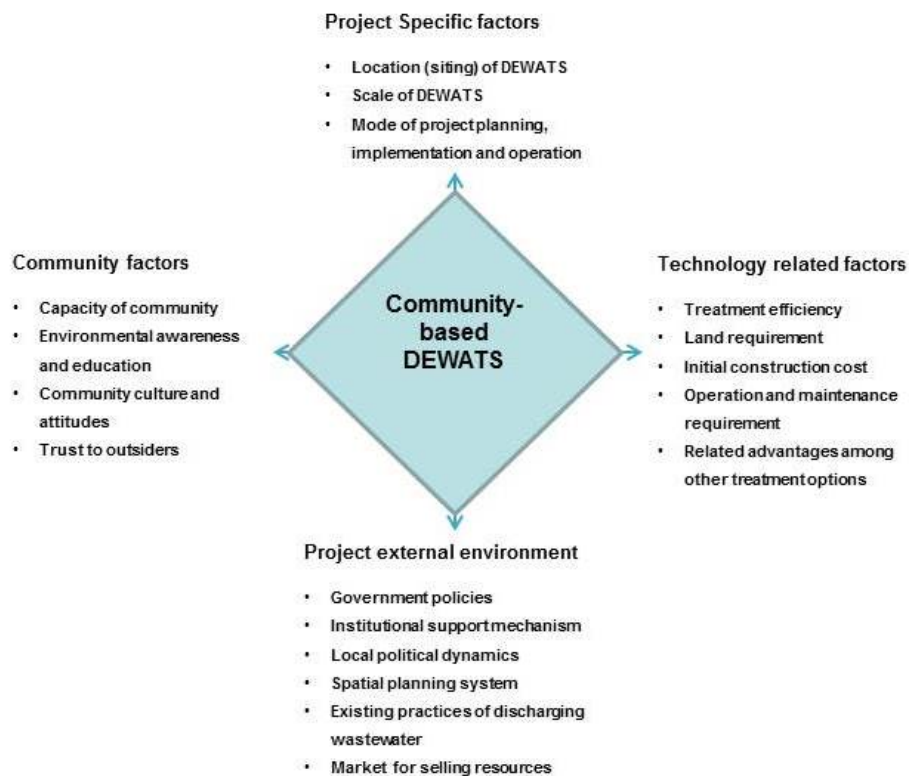


Figure 1. Social Acceptance.

Project external environmental factors are government policies, institutional support mechanisms, local political dynamics, spatial planning system, existing practices of discharging wastewater, market for the resources obtained from DEWATS. Community factors include capacity of the community to own, operate and manage the system; level of environmental awareness and education, community culture and attitudes, trust to the intention of outsiders. Technology related factors are treatment efficiency of the system, land requirement, initial construction cost, operation and maintenance requirement, relative advantages of the selected technology among other treatment options. Among the above envisioned factors sometime one or some of the factors may be decisive than rest others to contribute social acceptance of community-based DEWATS.

Main Challenges

The following overview summarizes the present status and some challenges observed in the community-based DEWATS of Sunga.

- Caretaker has no training and has a little understanding how the system functions. He seems less motivated now due to delayed in salary payment.
- There is no operation and management plan and maintenance manual.
- There is no regular meeting and no reformation of MC.
- There is little understanding about the community-based DEWATS system and no training among MC members. No system maintenance by MC, only dependent on Caretaker and Chairperson. There is a need to build in-house capacity.
- There is no users' contribution in a form of regular tariffs raising to cover the regular operation and management costs. They are dependent on the municipality for financial support and on ENPHO for technical support.
- There is little knowledge regarding DEWATS among municipal technicians. They were saying no capacity building opportunity was available to them.
- The odor problem might be that influent wastewater has a very high concentration of pollutant due to the shortage of flushing water, which demands more hydraulic retention time in ABR for pretreatment before applying in constructed wetlands.
- There is very little resources utilization though potential to resources use such as biogas, wastewater reuse, sludge as fertilizer, reed plants is very high.

From the above one can say that it is a passive consent of Sunga community to accept the community-based DEWATS in Thimi. The following section will draw an abbreviated scenario of a participatory design process including the main DEWATS stakeholders and discuss its benefits and challenges.

Participatory Design - a Contribution to Stakeholder Inclusion?

The World Development Report 2004 states that designing public services frequently fail poor people in terms of access, quantity, and quality.

Pritchett et al. (2002) add, that one source of failure is that many projects are based on the assumption that “inadequate services” are the problem and that top-down uniform public services can provide a solution. Ignoring the interactions among stakeholders, as illustrated in the case, creates however unsatisfactory results and mapping stakeholders’ interactions by before starting a project, deliberately fostering common discussions between diverging socio-cultural groups and including them in the design process is recommendable.

However, the participatory design approach comes with several challenges. It is difficult to know whom to include and who has a stake (and which), so onsets might be based on imperfect information about the stakeholders.

The design process depends on local conditions that are hard to assess, which makes it difficult to monitor whether or not the right decision was taken. One possibility to meet these problems is to clarify before project start if the objective responds to mutual needs of the local stakeholders. If this is the case, local communities will have strong incentives to organize it on their own and the participatory design processes would be more feasible. Given the objective is agreed upon, a participatory design process be feasible.

It would then, among others, include these elements (Kensing 1998):

- 1) Providing stakeholders with access to relevant information, and
- 2) The possibility for taking an independent position on the problems,
- 3) Participation in decision making,
- 4) The availability of appropriate participatory development tools and
- 5) Room for alternative technical and/or organizational arrangements.

5. PRACTICAL IMPLICATIONS

In the following section, we present some practical implications on social acceptance of community-based DEWATS as results of this study and reflections on how to reach a better establishment of the plants in the future.

Walk the Talk

First of all, the government agencies should be pioneer for implementing discharging treated wastewater to set an example according to their policy premises.

Further, enforcing existing rules and regulations against rampant discharge of wastewater from organized sectors viz. the factories, industries, institutions (hospitals, offices, and schools), apartment buildings, and organized housing colonies is the next necessary step.

These efforts can provide the general public with convincing examples towards sustainable wastewater management. Political stability and will power of the government play here a significant role for long term strategic action.

Locational Preferences for Community-Based DEWATS

People naturally want to remain at a distance from wastes. Proximity does have strong influence on local community people to a treatment plant. A close-by wastewater treatment plant creates some nuisance for example because of bad odour and effect the 'value' land and adjacent property. Siting community-based DEWATS can be a contested decision and local residents might be reluctant to initiate it in their vicinity. Thus a system should be installed in a somehow remote location having limited access such as wastelands, wetlands near the bank of rivers. Traditional use and practice of the local people to use the place can support or obstruct the siting decisions for the system.

City-Wide Campaign to Clean Rivers

Community-based DEWATS can be sustained if they are included as a part of a larger comprehensive plan such as city-wide campaigns for depolluting rivers. Making rivers pollution free is a common responsibility of all inhabitants, institutions and communities, who are residing at the watershed (a river basin). A single community cannot take full responsibility to depollute the river. Even if it does, this does not make any significant de-facto difference. Further, a community cannot feel the necessity of establishing community-based DEWATS if industries and private institutions are discharging polluted wastewater directly into rivers.

'Healthy City Standard'

There are fragmented laws and rules against river pollution in Nepal. The National Government can develop a 'healthy city standard' regarding the cleanliness of cities that can also address all the issues against river pollution in a single document. The standard can also be tied-up with national government funds flow mechanism to the local government with reward and punishment provision. 'Clean cities' will get additional grants for promotion of cleanliness while 'non-clean cities' will lose grants and get penance.

Environmental Awareness and Education

Level of environmental awareness among the local people plays a significant role to establish community-based DEWATS. Many people in Nepal are uneducated. The level of environmental awareness among many people is limited. There is a need of persistent environmental awareness programme to motivate, educate and raise environmental awareness among people. NGOs (Non-governmental organizations), CBOs (Community-based Organizations), and public organizations can play an active role in awareness creation and advocacy for environment conservation. The impact of a clean environment should be linked to the individual benefits such as 'waste to wealth' in a way that local people can understand and realize the importance of community-based DEWATS.

More research is needed to explore direct benefits such as savings at medical expenses from good health or saving productive time at household level from a clean environment especially sanitation.

Institutional Support Mechanism

Wastewater treatment requires a significant amount of investment. Not only initial investment, it requires some recurrent expenditure for operation and maintenance although DEWATS is based on low maintenance principle. Community-based DEWATS cannot exist without a support of external institutions and organizations as there are no direct benefits to the local community by installing community-based DEWATS within their vicinity but for overall surroundings spanning over many communities. Long term collaboration with assured operation and maintenance support is also needed for resource constrained communities.

Conclusively, one can say that the level of environmental awareness among the local people plays a significant role to implement community-based DEWATS. Many people in Nepal are however uneducated, which also restrict the level of environmental awareness. There is a need of continuous environmental education and awareness programs to motivate, educate and raise public interest in sustainability issues.

NGOs, CBOs, and civic organizations can play an active role in awareness creation and advocacy for sustainable development. The goal of a clean environment should be linked to the individual benefits in a way that local people can understand and realize e.g. the importance of community-based DEWATS.

More research is needed to explore such direct benefits e.g. saving medical expenses or saving productive time at a household level from a clean environment, especially sanitation.

Also city-wide campaigns to make polluted rivers clean should be launched simultaneously mobilizing different stakeholders.

CONCLUSION

These suggestions above set focus on a greater interaction between different stakeholders, addressing local needs more fully along with national and global priorities, and including individuals and groups systematically in planning and decision-making processes.

Concerning local stakeholders, they can provide basis information on an existing situation and they might have knowledge and professional expertise which is particular valuable for the design and implementation of sustainable solutions.

Finally synergies between stakeholders create dialogues that acknowledge the importance of collective action and shared work, an acknowledgment that ideally contributes to generate discussions and strong civic movements and that democracy needs.

APPENDIX

Time line events of community-based DEWATS in Madhyapur Thimi

2001	With support from Dutch INGO SIMAVI, ENPHO carried out a feasibility study for a community-based decentralized wastewater treatment system based on RBTS (Reed Bed Treatment System)
Oct., 2002	ENPHO requested a fund of US\$ 50,000.00 to ADB for operational research on decentralized wastewater management and its dissemination which consists of pilot and demonstration activity (PDA).
May 2003	ADB (Asian Development Bank) approved grant for the proposal
June 2004	PDA program for water in Nepal was launched (With an implementation period of 12 months) by grant from ADB with an additional support from UN-HABITAT and Water Aid Nepal.
Jul., 2004	Project inception report sent to ADB by ENPHO.
Dec., 2004	RBTS construction started in Siddhikali by clearing the site including procurement of materials but locals interrupted (US\$ 10,960.45 spent out of which materials costing US\$ 7200.95 was procured).
May 28, 2005	Management committee (MC) formed in Sunga.
Jun. 19, 2005	MC formed a Construction Sub-committee of 7 members.
Jun. 25, 2005	Laying of foundation stone of the community-based DEWATS.
Jun. 27, 2005	Time extension granted by ADB up to September, 2005.
Jun. 28, 2005	MOU signed between MC, Municipality and ENPHO regarding construction of the system in Sunga.
Oct., 2005	Construction of the system was completed (in a tight work schedule of four and half months in US\$ 44,000 and PDA completed with an investment of US \$ 70,850).
Jan. 14, 2006	Start of treatment plant operation.

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