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PEOPLE-CENTRED APPROACHES TO WATER AND ENVIRONMENTAL SANITATION

Sustainability Criteria in Sanitation Planning

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This article presents a list of sustainability criteria that might be of importance when assessing different sanitation solutions. The criteria presented are divided into the categories health, environment, economy, socio-culture, and technical function. We strongly recommend the use of sustainability criteria in any strategic sanitation planning and decision-making process whether on a macro or micro project level. Moreover, sanitation sustainability criteria can be used for follow-up and evaluation of sanitation systems. The list of criteria presented in this paper can be used to narrow down and focus discussions among decision-makers and also inspire to the development of context-specific sustainability criteria in the actual planning situation.

Introduction

Recent estimates state that world-wide 2.4 billion people do not have access to improved sanitation (UN, 2004). This global sanitation crisis has been recognised and a concrete Millennium Development Goal have been identified to halve the number of people without access to adequate sanitation by 2015 (UN, 2003). Current legislation and decision making procedures for choosing sanitation systems seems to be based mostly on initial investment costs and operation and maintenance costs of sanitation systems. If the objective is to provide sustainable sanitation services, we find it to be an urgent need to integrate the assessment of sustainability into this process, which will entail the comparison of sanitation systems where more factors than the costs are considered. One way of identifying sanitation solutions that are sustainable both socially as well as economically and environmentally is by using sustainability-oriented criteria for comparing and selecting sanitary systems. Such criteria thinking, or functional requirements thinking, can be used across a huge range of planning and implementation levels. Such criteria could, and we believe should, be used on the macro level by including them in the terms of reference for sanitation projects financed on a national or international level, whilst on the micro level they can also be extremely useful when used by a community to select their sanitary system according to their needs and vision of sustainability. Developing a list of criteria that could indicate the sustainability of system will help narrow down and focus the discussion on the issues of relevance among the different stakeholders. Moreover, it enables sanitation systems to be assessed according to the function of the system rather than the technology itself, thus allowing more room for the implementation of innovative solutions to sanitary problems (Larsen and Gujer, 1997).

Objective

The objective of this article is to present a broad list of criteria that might be of importance to consider in the planning process of sanitation projects, in order to increase the sustainability of the sanitation provisions.

Definition of Sustainability in Relation to Sanitation

The concept sustainable sanitation is often used in the literature, and sometimes without statement what is meant by sustainable sanitation. Therefore we define below our boundary of a sanitation system and what we think is needed for a sanitation system to be sustainable.

A sanitation system encompasses, in our view, the users of the system, the collection, transport, treatment, and management of end products of human excreta, greywater, solid waste, industrial wastewater, and storm water.

A sanitation system that is sustainable, in our view, protects and promotes human health, does not contribute to environmental degradation or depletion of the resource base, is technically and institutionally appropriate, economically viable and socially acceptable.

Criteria for Sustainable Sanitation

Background

The use of criteria in order to assess sustainability of sanitation systems is certainly not new. Larsen and Gujer (1997) underlined the need to focus on functions that the urban water management system shall provide in order to be sustainable. These functions are (1) to guarantee urban hygiene, (2) to assure drinking water of good quality and enough quantities to allow for personal hygiene, (3) to prevent flooding/allow for drainage of urban areas, (4) to integrate urban agriculture into urban water management, and (5) to provide water for pleasure and for recreational aspects of urban culture. Moreover, Larsen and Gujer (1997) underlined the need of carefully identifying the system boundaries when identifying sustainable solutions, in order to avoid exportation of problems in time and space. Different computerized tools have been proposed to assess, by multi-criteria analysis, the sustainability of sanitation systems. One is a toolbox, currently under production, by the Swedish water and sanitation research group Urban Water. The toolbox will include models for, among other things, substance flow analysis, microbial and chemical risk assessment, cost estimates, and user aspects (http://www.urbanwater.org/default_eng.htm). van der Vleuten-Balkema (2003) presented a computer model for assessment of domestic water systems, which included sustainability indicators categorized as functional, economic, environmental or socio-cultural.

The usefulness of sustainability criteria in the planning process

Despite the reports on criteria for sustainable sanitation referred to here, and others not mentioned, we feel there is a lack of recognition and use of criteria for sustainable sanitation in project planning. The use of criteria for sustainable sanitation would be an excellent help in making informed decisions for investment banks and municipal, regional or national authorities when planning for sanitation provision in pipe-less areas. The use of criteria for sustainable sanitation would equally serve very well when planning for sanitation provision to peri-urban areas, where one crucial question to answer could be whether more sustainable sanitation would be provided by local sanitation solutions rather than connection to a central wastewater treatment plant. Sanitation sustainability criteria can also be used for external evaluation of sanitation system compliance to sustainability, and also internally in an organization or company to evaluate existing sanitation systems with regard to their sustainability (Lundin et al., 1999).

Suggestion of criteria for assessment of sustainability of sanitation systems

We present a list of criteria that might be of importance in assessment of sustainability of sanitation systems in Table 1. This list has been developed from criteria/functions/indicators outlined in the literature (van der Vleuten-Balkema, 2003; Hellström et al., 2000; Larsen and Gujer, 1997; Larsen and Lienert, 2003; Lennartsson, 2004, Urban Water, 2004) as well as on meetings held by the German Development Cooperation GTZ in Eschborn 2003, and by the research and development network for ecological sanitation, EcoSanRes, in Stockholm 2004. We have chosen to divide the criteria into five categories; health, environment, economy, socio-culture, and technical function. The categories are further described below.

We are well aware that it is impossible to define a general list of sustainability criteria that will be universally applicable. Our intention with this list is rather to inspire sanitation planners on all levels to include the concept of sustainability criteria for sanitation in their planning process, and to actually define, in a participatory manner with the relevant stakeholders, what criteria their planned sanitation system need to fulfill in their actual situation in order to be sustainable.

Health

The prime objective of sanitation is to protect and promote human health. The entire sanitary system should therefore be hygienically safe, posing as small a risk as possible to infection. This covers the use of the sanitary installation, collection, transport, treatment and end destination of the treated products. The risk of infection from e.g. leaking sewers or pit latrines to the groundwater should also be included, as the risk of being infected when bathing in lakes or the sea nearby an overflow or discharge point from a treatment plant.

Environment

With time, sanitary systems were also developed in such a way so as to protect the environment against possible detrimental effects from sanitation systems. There is a need to consider both emissions to different recipients (water, soil, and air), and also resource use by different sanitation systems both during the construction and operation phase. Moreover it is important to consider the quality of the treatment product for possible reuse in agriculture.

Economy

The capacity to pay for sanitation among the users is an important criteria for sustainability. However in the end it may be their willingness to pay that will define within what range the costs, both construction and O&M costs, can vary and services be sustained financially by the population.

Socio-culture

The prime objectives of sanitation might be to protect human health and the environment. However, sustainability in sanitation cannot be based only on these objectives but need to include social criteria as well as they are most crucial to sustainability in use and services provided by the system. It is possible to distinguish at least three different types of important criteria in this category, namely cultural acceptance, institutional requirements, and perceptions on sanitation. The society is more dynamic than human health and the environment and therefore the socio-cultural criteria, like regulation, perceptions on systems etc might be subject to a more dynamic change with time than criteria considering human health and the environment. How things are seen and their resultant acceptance can change with time. Although improved human health and environment is the main objective to planners and politicians, this might not be enough to sell the sanitation concept to future users. It is also important to recognize that the prime driver for sanitation might be security and status rather than health and environment (Holden, 2004). Another sanitation driver could be the possibility of increased food security if the sanitation solution can provide hygienically safe fertilizers.

Technical function

The technical function of the sanitation system is definitely important for it to be sustainable. One of the more important ones is probably robustness, both within the system (to be able to receive varying loads) and externally (to be able to withstand varying extreme environmental conditions as well as user abuse of the system).

The technical functioning of the system is seen as perhaps the most flexible group of criteria. Technologies can to a large extent be relatively easily adapted to the needs and requirements – easier to adapt the technology to the wider needs than vice versa.

Conclusions

We strongly recommend the use of sustainability criteria in any strategic sanitation planning and decision-making process whether on a macro or micro project level. Moreover, sanitation sustainability criteria can be used for follow-up and evaluation of sanitation systems. The list of criteria presented in this paper can be used to narrow down and focus discussions among decision-makers and also inspire to the development of context-specific sustainability criteria in the actual planning situation.

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Table 1.

Criteria	Indicator	Criteria	Indicator
Health		Hazardous substances: heavy metals, persistent organic compounds, antibiotics/medical residues, hormones	mg/unit
Risk of infection of complete use of system	Risk assessment or qualitative	**Economy**	
Risk of exposure to hazardous substances: heavy metals, medical residues, organic compounds	Risk assessment or qualitative	*Annual costs, including capital and maintenance costs*	Cost/pe/yr
Environment		*Capacity to pay – user (% of available income)*	Disposable income/pe
Use of natural resources, construction and O&M		*Local development*	Qualitative
Land (investment, constr. and O&M)	m^2/pe	**Socio-culture (institutional and user)**	
Energy (constr. and O&M)	MJ/pe	*Willingness to pay (% of available income)*	Reasonable % of income – defined by users
Construction material (constr.)	Type and volume	*Convenience (comfort, personal security, smell, noise, attractiveness, adaptability to different age, gender, and income groups)*	Qualitative
Chemicals (constr. and O&M)	Type and volume	*Institutional requirements*	Qualitative
Fresh water (O&M)		*Responsibility distribution*	Definition of level of organisation
Discharge to water bodies		*Current legal acceptability*	Qualitative
BOD/COD	g/pe/yr	*Appropriateness to current local cultural context (acceptable to use and maintain)*	Qualitative
Impact on eutrophication	g/pe/yr of N and P	*System perception (complexity, compatibility, observability – including aspects of reuse)*	Qualitative
Hazardous substances: heavy metals, persistent organic compounds, antibiotics/medical residues, hormones	mg/pe/yr	*Ability to address awareness and information needs*	Qualitative
Air emissions		**Technical function**	
Contribution to global warming	kg of CO_2 equivalent/yr	*System robustness: risk of failure, effect of failure, structural stability, robustness against extreme conditions*	Qualitative
Odour	Qualitative	*Robustness of use of system: shock loads, abuse of system*	Qualitative
Resources recovered		*Possibility to use local competence for construction and O&M*	Qualitative
Nutrients	% of incoming to the system	*Ease of system monitoring*	Qualitative
Energy	% of the consumption within the system	*Durability / Lifetime*	Qualitative
Organic material	% of incoming to the system	*Complexity of construction and O&M*	Qualitative
Water	% of incoming to the system	*Compatibility with existing systems*	Qualitative
Quality of recycled product (released to soil)		*Flexibility / adaptability (to user needs and existing environmental conditions – high groundwater level, geology etc.)*	Qualitative