

Cultural preferences in designing ecological sanitation systems in North West Frontier Province, Pakistan

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Abstract

Ecological sanitation has been shown to be economically feasible and environmentally sustainable. However, cultural factors affecting the choice of sanitation solutions have not yet been sufficiently investigated, particularly not in Muslim communities. To understand the perceptions of rural Muslim communities regarding alternative sanitation systems, members of households, key informants and women and men's focus groups in Machaki village in the district of Karak, North West Frontier Province (NWFP), were interviewed. A menu of both ecological and conventional sanitation options was put forward for consideration. All respondents were strongly opposed to the urine-separating latrines and in favor of flush toilets. They see any form of latrines as an age-old fashion, backwards and a matter of taboo, while flush toilets are considered prestigious and desirable. Muslim practices of anal cleansing together with the strict religious prohibition of contact with urine and faeces are factors influencing the reluctance towards latrines. The physical appearance of faeces and urine in latrines is repulsive to people. However, the material is less objectionable once it has disappeared in water and relocated to a treatment site. The rural community showed interest in the construction of improved sanitation consisting of flush toilets and an underground sewerage system and recycling of plant nutrients from urine and faeces through treatment in constructed wetlands. The study underlines the importance of incorporating cultural preferences in the planning of improved sanitation, particularly when designing low-cost ecological systems.

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1. Introduction

A little more than half of the world's population has sanitary means of excreta disposal and practice any one or a combination of the following sanitation models; 'flush-and-discharge'; 'flush-and-forget'; 'drop-and-store' and 'sanitize-and-reuse' (Drangert, 1998; Esrey, Andersson, Hillers, & Sawyer, 2001; GTZ, 2003; Winblad, 1997). The first two are regular waterborne flush toilets discharging sewage into the environment with some or without treatment. 'Drop-and-store' refers to dry and flush pit latrines, and 'sanitize-and-reuse' refers to urine-diverting latrines. Although adopting these sanitation models has spared millions of lives, except for 'sanitize-and-reuse', the rest of the models have serious health, economic and environmental consequences (Stoner, 1977; Van der Ryn,

1978; Winblad & Simpson-Herbert, 2004). The first two are costly and lead to wastage of water by using freshwater as a carrier and sink of human excreta and are therefore unsustainable. They are designed on the premise that human excreta is a waste and suitable only for disposal, and that the receiving environment has infinite capacity to assimilate these waste (Esrey et al., 2001). They are therefore often inappropriate for poor people (Dinar, 1998; Loetscher & Keller, 2002; Mara, 2003). The 'drop-and-store' model is comparatively affordable, but it involves the risk of groundwater contamination and keeps nutrients out of the agroecological cycle (Dellstrom Rosenquist, 2005; GTZ, 2003; Wilderer, 2001).

An innovative 'sanitize-and-reuse' or 'ecological sanitation' model is emerging in some parts of the developed world applying the principles of 'don't mix', 'don't flush', and 'don't waste' the human excreta (Winblad, 1997). In this system, urine and faeces are separated, pathogens are killed and nutrients are recycled through composting

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(Van der Ryn, 1978). It is based on an ecosystem approach that reduces health risk, prevents pollution of surface and groundwater and optimizes management of nutrients and water resources (Langergraber & Muellegger, 2005). The model is therefore promoted as an alternative approach to conventional sanitation (Werner, Fall, Schlick, & Mang, 2003). However, despite its many positive aspects, the system also faces a number of challenges. In areas where people have many other pressing needs and the sanitation awareness is low, the adoption of new excreta handling approaches, which may be at odds with the prevailing cultural understanding and practices may not be readily welcomed (Esrey et al., 1998).

Therefore, one has to understand both people's attitudes and behavior and develop feasible strategies for sensitizing and motivating people on the needs for developing appropriate environmental practices. This is important because people look at things through their cultural lenses (Douglas & Wildavsky, 1982). These aspects help to explain the 'why' and 'why not' of denial and acceptability of proposed sanitation approaches. Consequently, to achieve the UN Millennium goal on sanitation, ecological and conventional sanitation technologies must be developed in close collaboration with the users such that they are tailor-made to the different settings. Ecological sanitation, which in most of the literature is synonymous with urine-separating latrines and composting of faeces, needs flexibility to be adapted to different socio-cultural contexts. Likewise, water-based sanitation could easily be made ecological by applying natural treatment processes for recycling nutrients and water. Natural treatment systems are based on much of the same physical, chemical and biological processes as conventional systems, except under natural conditions with a minimum input of materials and energy. The main advantages of natural systems are low construction costs, very low maintenance costs, low demand for skilled operators, and limited needs for institutional structures (Habrel, 1999; Kadlec & Knight, 1996). These systems can totally supplant conventional treatment systems or at least act as supplement to them in developing countries (Kivaisi, 2001). Natural systems are particularly effective in controlling pathogens (Perkins & Hunter, 2000) and are at par with other wastewater treatment processes especially in removing potentially harmful chemical and biological agents, including viruses (Dinges, 1982).

If new approaches to sanitation are to be promoted, we need to understand how to introduce these ideas and motivate people to adopt or adapt them (Jenkins & Curtis, 2005). In this paper we document the process of introducing new ideas of sanitation to a rural Muslim community and how they have adapted these ideas to their culture and environment. The study also shows the importance of choosing an appropriate research methodology that will allow researchers to enter the community and develop a rapport with a rural community not otherwise open to external intervention. The study further aims (a) to gain an

understanding of peoples' perceptions about human excreta and their prevailing sanitary practices, (b) to explore peoples' preferences for sanitation options, and finally, (c) to see how a better understanding of these issues can contribute to the development of sanitation models that can ultimately meet the millennium goal for sanitation.

2. Methodology

Machaki village was selected on the basis of the following criteria: location, size, socio-economic situation, literacy rate, religious and cultural attachments, water availability and sanitation practices, such that it represents a fairly typical rural village in the North West Frontier Province (NWFP), Pakistan. Community needs, desires, preferences and values surrounding human excreta and wastewaters were explored using qualitative research methods comprising individual and group interviews, focus group discussions and participant observation. An actor-oriented approach was adopted, (Long & Long, 1992) including situational analysis, life history analysis and network analysis for in-depth understanding of men and women's roles and interests. Quantitative data about the number of households, demography, literacy rate, numbers of water tanks and pit latrines were also collected.

Since this research involved the practical implementation of a sanitation system, and the introduction of new technologies, the methods used in initiating the study required good skill of communication and understanding of the communities. Before this study, negotiations between the village people and the local government were in their final stages for street pavement to get rid of the stagnant wastewater in the streets. However, contrary to their perceived plan, we thought of a different approach and initiated this study. The principal investigator, in informal individual meetings with 20 male key informants in the village, first raised the issue of sanitation and graywater in the street. The willingness and motivation of those key informants for improved sanitation paved the way for the village elders to meet and discuss village sanitation. In the village elders meeting, which included the local religious leader, the investigator highlighted the adverse health consequences of existing 'lack of sanitation' and the men were asked to brainstorm on remedial measures. After thorough discussion, the men realized the need of immediate action for adopting improved sanitation and agreed on convening another meeting for detailed deliberation and strategy formulation. In the next meeting, the investigator introduced both ecological and conventional sanitation models along with the possibilities of their modification to the prevailing culture and the environment. The options discussed included more conventional systems such as street pavements, pit and flush latrine and toilets with and without treatment, as well as newer, ecological sanitation systems like high-tech urine-separating latrines, low-tech dry latrine with source separation and natural

treatment systems. In Pakistan, high-tech urine-separating commodes are still lacking on the market. Therefore, the investigator presented pictures of urine-separating and old-fashioned dry latrines. The potential positive impacts of newly introduced sanitation options in comparison to the prevailing practices of sanitation were discussed. Once the villagers appreciated the difference between each option and its potential benefits, they were then asked for their preference among the sanitation options. After a few weeks of informal discussion amongst themselves, the villagers came up with a consensus on sanitation. They neither totally rejected nor accepted any of the models but wanted to pick from the two models and combine and adapt it to their culture and environment. The village people unanimously agreed on flush toilet (squatting commode) connected to an underground sewer system, followed by natural treatment systems. Many villagers have used flush toilets on some occasion, while others have only heard of them. Once a consensus on a sanitation model was developed, the village elders formulated a strategy for project initiation. An eight-member village committee (two persons from each of the four sub-clans) was selected for the task. The committee with a local Pashto name of “*Khpal Kaar Po Khpala*” (*help-your-self*) was registered with the local government as a Citizen Community Board (CCB). The committee negotiated with the local government and got approved a PKR 0.5 million project, with 80% and 20% shares of government and the villagers, respectively.

In the village, detailed open-ended interviews of 40 households were conducted, and four separate group discussions, two each with women and men, were held in order to understand their points of view about sanitation. Detailed interviews of 10 key women informants and the Imam of the village’s Mosque were held to explore the issues in more detail from the female and Islamic perspectives. The head of the local government (*Tehsil Nazim*) was interviewed to reflect on the government’s point of view. The changes in physical environment and people’s perceptions in the village were recorded through participant observation and informal discussions.

3. Socio-cultural situation in the study areas

Pakistan is a country of more than 160 million people, 32% of which are living below poverty line. Out of the total population, 65% has access to safe water, 85% of them living in urban and 55% in rural areas. Sanitation facilities, which include sewerage system in urban areas and drainage in rural areas, are available to 42% of population—65% urban and 30% rural areas (Government of Pakistan, 2001). The study village was selected from NWFP, which is one of the four provinces of Pakistan. In NWFP, more than 36% of population lives in poverty, 90% of them live in the rural areas (World Bank, 2002). The province is known for its relatively conservative Muslim population, which does not readily welcome influences from outside the

community. The number of religious Madarsa¹ (1500) is almost equal to the collective number of public high schools, higher secondary schools, colleges and universities (1580) in the province (Government of NWFP, 2002a; World Bank, 2002). The study site, Machaki village, is a typical rural village of NWFP, located in the dry southern district of Karak. The village consists of 49 households with a total of 673 people, having little variation in socio-economic and power relationships. The village has a low literacy rate, only 7 persons have higher education (bachelor’s or master’s degree) and 39 have 12th or 10th grades. The rest of the population is below 10th grade and mostly illiterate. All the old and middle-age women have no school education though most of them can read the Holy Book Quran and hence come under the literate category as prescribed by the government. Although many people now send their girls to public school, the villagers still give high importance to religious education. The village has therefore 4 Muftis,² 8 Moulvis,³ 15 Hafiz-e-Quran⁴ and a number of Madarsa students. Both boys and girls are pursuing religious education.

The village community is religiously conservative and male dominated. Daily life is more driven by tradition, prevailing culture and religion than by state law. In the village, collective decisions are usually made in the Hujra⁵ and the Mosque. Disputes are usually settled in the Jirga.⁶ The Hujra, the Mosque and the Jirga are three strong institutions, however, all are male institutions and women are forbidden both religiously and socially from attending them. The male community spends its free time entertaining guests and sharing daily matters with other villagers in the Hujra. The Mosque is used for praying (five times daily) and discussing religious and other common matters of the village. Religious scholars and the Imam of the Mosque are well respected, and people are willing to listen to them. Women’s activities are mostly restricted to the boundaries of their homes, where they have mostly a reproductive role, which includes child-nurturing, food preparation and cleanliness-related activities. They have little or no direct say in decision-making in daily matters outside the home—at least publicly. However, some women do help the male members of the household with outside activities like in collection of fodder and smallholding farming. NGOs are not welcomed since people are suspicious of their motives and possible hidden agendas.

4. Current trends in water and sanitation

The first community water tank in the village was established in 1970 at the tail end of a 10 km long pipe from the water source. Before that, the villagers were fetching

¹Religious school.

²The highest degree in Islamic Madarsa education.

³Religious scholars.

⁴A person who memorizes the Quran by heart.

⁵Meeting place and guest house for males.

⁶Local institutions where disputes are resolved by the village elders.

water from the same or other sources of almost the same distance using donkeys, camels or carrying on the head. In the late 1980s, the water of the community tank gradually became insufficient due to increased population; however, the villagers succeeded in getting two additional water supply lines from the tube wells in neighboring villages. Later the village got its own tube well along with 20 small-scale underground tanks from the government in 1997. From the water fetching to the first community tank and to the establishment of their own tube well and until today, a supply-driven approach was adopted, and the community did not contribute either in cash or kind. The government did everything for them, as is common practice in the rest of the rural areas in NWFP. The village people adopted different water use and conservation strategies depending on its availability. However, the per capita water consumption increased with the arrival of every new water facility. Presently, almost every household has its own underground water tank, and the per capita water consumption has increased to around 30 L/day. This increase in water use and its discharge to the streets without a proper drainage system have turned the village streets into sewers. The village elderly prefer the old days when they would fetch water from miles compared to today, where there is enough water but mud in the street. The provision of water in the village has definitely brought benefits to the villagers in terms of having enough water, time-saving from fetching water and psychological effect of having enough water. But during the group discussion, it appeared that waterborne diseases have actually increased when the villagers compare the past situation to the present. The village people were able to differentiate between the diseases under the earlier water-scarce and the present water-plenty situation.

The village has clay houses with a room or two made of bricks for those who can afford it. In most of the sleeping rooms, in any one corner, a square elevation of around 4 feet × 4 feet is made from the floor and is specified as an 'open washroom' where members of the household take ablution,⁷ showers and also urinate. The graywater and urine from that open washroom is discharged to the street and gets stagnant there since there is no drainage system in the village. Therefore, unless the rainwater washes the street or the sun dries it, the graywater will stay in the street as a potential health risk, especially for children. The graywater may also contaminate the drinking water by moving into the water pipes under the streets. This is also quite common in other parts of the province, where 40% of the rural population is either discharging their excreta and wastewater into the street drains or pits (Government of NWFP, 2002b). While this poses an apparent health risk, local people are in fact more concerned about the bad smell of stagnant wastewater, dirty mud in the streets and how this might make their clothes impure (*Najas*) for praying.

More than 90% of the village population is practicing open defecation, which is a culturally accepted norm in the area. This is representative of the practices in other rural areas in NWFP where more than 60% of the people have no sanitation facilities and the majority therefore engages in open defecation (ibid). The village is surrounded by vast agricultural land that provides enough space and the 'required privacy' for open defecation. To avoid contact with human excreta, the local people often engage in 'shifting-defecation'. Out of 49 households, only 15 have pit latrines, which are mostly used by the females. People using pit latrines are flushing instead of leaving dry excreta into the deep pits, dug inside their compounds. The rest usually defecate in some designated place inside the home or outside during the early night or dawn in extreme secrecy from the adult males. The darkness of the night prevents them from visiting different places away from home, and as a result, they have a greater chance of contact with excreta.

Surprisingly, what the village streets and defecating places demonstrate is in conflict with the villagers' negative thinking about human excreta and their Islamic-religion teaching of cleanliness and on strictly avoiding contact with urine and faeces. The dirt in the village streets is against their religious reverence and cultural taboo, but still people live with it. The village people have had several meetings and hot discussions on the issue both in the Mosque and in Hujras, but they always resulted in discussions of proving each other guilty rather than strategizing a practical solution. This type of debate is common in the village, where the village people compromise on other values in order not to show weakness to their rivals. This tradition, together with disagreement on who will take the lead and how to organize the resources, prevented joint action and continued to tolerate poor sanitation. A similar paradox was confronted by Van der Geest (1998) in Ghana where people reacted negatively to the human excreta but continued their poor disposal mechanisms, which commonly resulted in close contact with excreta. This is probably because people may get used to the hazard of contact after their continuous exposure to it (Lima, 2004). The 'Tragedy of the Commons' (Hardin, 1968) could be another explanation for such a situation where people in common spaces maximize their own benefits and ignore the needs and feelings of others, and in fact expect others to take responsibility for the areas.

5. Priorities and cultural preferences for sanitation

The village people were initially reluctant to talk about excreta, considering this a private or internal matter, but were comfortable in talking about sanitation, which is considered external. Generally rural people in NWFP do not like to share a household's private matters with outsiders. Excreta and toilets are among these topics. Women talking on excreta with men are still a taboo. To engage them in discussion, we adopted a simple and

⁷Washing hands, face and feet to become spiritually clean in Islamic religion for performing prayers.

indirect approach of discussing the opportunities and challenges associated with the water that enters the home and leaves after use. We found that once the wastewater came out of the home into the street, then even reserved people started talking about it. Speaking of ‘graywater in the street’ can thus be an effective entry point for discussions in the villages without sanitation. The dominance of men and the many religious and cultural taboos on women and youths in NWFP as well as in other Muslim communities, rarely allow a debate within the family or in public places on many vital issues of daily life including human excreta disposal. However, we found the ‘consensus-building model’ of American Bar Association’s Standing Committee on Environmental Law, very productive for incorporating public inputs in decision-making in the village. In this model ‘every affected group participates’ (Bear, 1994) and the local people share their views, and define their responsibilities and capabilities. By brainstorming on the issue, people in Machaki soon realized their ownership of the issue and the urgency in adopting an effective approach for improved sanitation. In their local tradition, people in fact call sensitizing the community or for that matter an individual to a problem which they are otherwise blind to ‘stirring the faeces’. Until this was done, the village people could not properly understand the seriousness of situation arising from the lack of improved sanitation.

The local people’s primary criteria for choosing a sanitation model were prestige, privacy and comfort and had little motivation for health and environment, which is consistent with research findings from other cultures (e.g., Cotton, Franceys, Pickford, & Saywell, 1995; Guzha & Musara, 2003; Holden, Terreblanche, & Muller, 2003). Every household wanted water within the toilet or latrine for anal cleansing, which is common in Muslim cultures. The Islamic religion requires of a person all possible cleaning including anal cleansing as part of purification rituals for praying. The villagers prefer squatting commode, fitted in a north–south direction to avoid facing Mecca. Similar preferences can be found in other Muslim communities following the saying of Prophet Mohammad (peace be upon Him) that “if you go to defecate, do not face the Mecca nor turn your back towards it. Instead you should turn to your left side or right side”⁸ The villagers consider squatting commode helpful for anal cleansing, which cannot easily be followed using urine-separating latrines or common sitting commodes.

The village community was also concerned about the proper disposal and recycling of wastewater after learning about its health, environmental consequences and fertilizer value. Since the local people had no vision or plan for treatment of domestic wastewater, the investigator introduced the idea of a constructed wetland together with other options for wastewater treatment and recycling of nutrients and water. They found the idea of constructed wetland

compatible to their culture and environment once they understood its construction, operation and maintenance process as well as potential benefits.

While the majority of villagers favored flush toilets, there were exceptions. A few men from the older generation have strong sensitivities about excreta and toilet and continue to favor open defecation. For them, in-house latrine or toilet is similar to bringing closer the untouchable and impure human excreta to the home compared to open defecation away from the home and in the field. ‘An in-house toilet’, said an old man, is like ‘*Hum Khori Ow Hum Khari*’⁹—or eating and spitting in the same place, which is true for animals’. ‘Having in-house toilet you get deprived of following the *Summa*¹⁰ of Prophet Mohammad (PBUH), who used to go out and away from the settlement’ said another middle-aged bearded man.¹¹ Learning from the years of daily practices, these people believe that soil is taking good care of the human excreta as the decomposition of soil microorganism also rarely provide them a chance to see their own faeces a week later in the dry hot climate once they properly buried it. This is in line with the finding that burial of excreta breaks the faecal-oral transmission and is almost 100% safe sanitation without construction of latrine (Waterkeyn & Cairncross, 2005). However, older men are not aware—and were not interested to learn—of the excreta decomposition process and the pathogen resistance and life cycle. They feel at ease while defecating under the open sky in nature, where they escape the smell of others and are not conscious of time spent and with no fear of being disturbed by others knocking on their door. They feel that none of those qualities can be availed in a latrine or flush toilet system. This is evident from the routine of a 90-year-old man who goes out for open defecation even during heavy rainfall, on a rough, muddy path, despite having a latrine in his home. Ironically, the man, who was religious and had been the *Moazan*¹² of the Mosque for decades, considered himself too old and weak to walk the comparatively short and straight distance to the Mosque during rain. Although some of the old people were openly criticizing latrines and toilets inside homes, the majority of the villagers wanted to have toilets in their homes and guesthouses.

When the male elders were meeting in the Hujra planning toilets and improved sanitation in the village, the women were literally praying for the success of the plan. Every woman, irrespective of age, wants a toilet inside the home. They were tired of the existing open defecation practices. Due to cultural barriers, however, they could not bring this issue to the male community. Being in the open, women still feared being disturbed even in the darkness and for them defecation is always a

⁹A local proverb.

¹⁰The actions of Prophet Mohammad (PBUH).

¹¹These quotes are based on translations by the principal author.

¹²A man who gives Azan (the call for Muslims to come for praying in the Mosque).

⁸Al-Bukhari (1/146), Muslim (1/507).

troublesome job. Their first priority is privacy. There is little awareness and concern about health, hygiene, and recycling. Therefore, women see open defecation as a problem and strongly favor an in-house flush-toilet arrangement. By having a toilet or latrine inside the premises, they will not need to wait for dark or hide from the male members of the household for defecation inside the home, said an old women. Women also feel that having a toilet in the house would save their time and also relieve them from the disgusting job of throwing their night soil in the designated areas in the village. They feel that it will also help in getting rid of the uncontrolled defecation of children.

The idea of a urine-separating latrine as promoted in ecological sanitation, was absolutely new in the village. They see it quite similar to the age-old dry latrine when night soil is manually removed. Such a latrine is considered a sign of poverty, underdevelopment and low status. When the modus operandi of urine-separating latrine was explained to the villagers, people came with many cultural and religious reservations about its use and the subsequent composting of excreta. For example, the villagers dream of development and a higher standard of living, and thus think of faeces and urine resting in their home or backyards for months as backward, much like their feelings towards the traditional dry latrines. More serious, however, was the importance of water for cleansing. Being Muslims, they prefer water for anal cleansing, which is a bit challenging in urine-separating latrine since one should preferably use toilet paper or other dry matter to keep the faeces dry. The provision of anal cleansing in a separate place within the toilet was rejected since people don't want to move unclean after defecation.

The villagers also feel that urine-separating latrines are costly and complicated. For example, one has to install a specially designed commode to separate urine and faeces, then collect faeces and urine in two separate containers and store and treat it for months. The application of urine and faeces to crops also needs some knowledge and technical expertise. When the village people without even considering the cultural and religious reservation compare these requirements with the flush latrine or open defecation, their immediate response was that they are not ready to sell the freedom they see in flush toilets or open defecation and replace it with a complicated, urine-separating latrine, particularly with their meager resources. The village people are mostly poor, but are proud of having a simple life style and they think that urine-separating latrines do not fit into it. While the villagers of Machaki were aware of the needs to clean flush toilets, they would need to learn new ways to maintain urine-separating latrines to ensure that they remain a facility and not become a health risk. Proper maintenance is necessary particularly in the case of urine-separating latrines, since there is no or limited use of water both in the use of the latrine and in the handling of excreta (Peasey, 2000). Many poor people living in small houses without sanitation, might leave urine-separating latrines

without proper use and maintenance. In Machaki, as in other NWFP's villages, not everyone in the family takes on the responsibilities of use and maintenance—the entire family defecates, but it is the women who have to clean the latrine or toilet. Thus, for urine-separating latrines a whole new setup of culture, behavior and responsibility would be needed, especially for the male. Otherwise the women, already overloaded with undue domestic work, will have to bear yet another unhealthy responsibility.

The villagers also have strong views on the restrictions connected to the direct use of excreta as fertilizer. Although the farmers acknowledge the fertilizer value of excreta by accepting that there are better crops in the defecation sites, the excreta are naturally decomposed in the soil and are not visible and farmer is not involved in its management. Thus, despite the fertilizer value of faeces and lesser-known nutrient richness of urine (Wolgast, 1993), the psychological and religious concern about the impurity of faeces and urine overrule their fertilizer value for the villagers. 'We prefer dying than eating back our own faeces' was the reply of an old farmer while discussing the use of composted faeces and urine from urine-separating latrine. Thus, the village farmers are resistant to direct recycling and re-use of nutrients from faeces and urine due to beliefs and cultural barriers. With little understanding of recycling mechanisms, people prefer to use artificial fertilizer rather than compost.

The repulsion from faeces and urine changes significantly with the change of their physical appearance from excreta into sewage water. Rural people can more easily discuss the attributes of sewage water as opposed to excreta. The reason is that excreta decomposes in the septic tank of water-based sanitation and changes its color, odor and hence has little repulsion. Psychologically, they pretend that the sewage is just dirty water (cf., Sawyer, 2003). For example in Peshawar, the capital city of NWFP, two homeless poor persons washing their dishes in the sewage drains got angry when the investigator asked whether they will touch the faeces of another man, since this was similar to washing dishes in sewage water. For them sewage water was much better and even worth using for washing while faeces was untouchable. This shows how the perception about human excreta changes with the change in its physical composition. Thus, many farmers in NWFP and in the rest of the country who normally are reluctant to use recycled urine and faeces, are nevertheless paying a high price for raw sewage for crop irrigation (Ensink, Mahmood, Van der Hoek, Raschid-Sally, & Amerasinghe, 2004). The same psychology prevails in Machaki village. After thorough discussions of the transformation of faeces and urine into sewage water, they agreed to make their sanitation system ecological by passing the domestic wastewater through a constructed wetland and thus recycling and reusing wastewater and nutrients in agricultural production.

6. Ecological sanitation in Machaki village

In Pakistan and many other developing countries, due to traditional supply-driven subsidized water and sanitation projects, people still expect free services from the government. In Pakistan only 7% of the rural population pays for drinking water (Government of Pakistan, 2002), and most of the water supply schemes are maintained and operated by the government. The government has a fixed rate of PKR 40/month for a household water connection with half-inch pipe in rural areas, but people are not willing to pay that money (pers. comm. with Chief Eng., Work and Services Department). For example, the government of NWFP spends around PKR 800 million annually on the operation and maintenance of the rural water supply schemes and gets only PKR 50 million as revenue from water charges (Government of NWFP, 2003). Sanitation services, if existing, are free as well. Nobody pays for sewage, neither connection nor wastewater treatment. The majority simply cannot afford sanitation charges and the government has not tried pricing the service knowing the community is not willing or able to pay. Since sanitation in rural areas means 'street pavement' paid by the government, rural people use all their influence to get that service for disposing of their wastewater, but for easing their mobility as well. However, the open drains in the paved street often get blocked due to un-controlled solid wastes and refuse such as plastic. The facilities soon become a risk since poor people who cannot afford pits but latrines are discharging both graywater and sewage water into the street drains and hence escalating the health and hygiene problem. On the other hand, urine-separating latrines, which are mostly synonymous with ecological sanitation, are in-house arrangements. Usually the households have to make all the investment from installation to recycling and reuse. Therefore, it is economically less attractive to many of them.

Since the original proposal from Machaki village was in line with the planned technical approach of the government for rural sanitation, the local government agreed to support paving the streets. However, during the research in the village and the open debate on sanitation, the local people learned of the pros and cons of various sanitation models. Once the village people appreciated the link between their local knowledge and scientific methods for disposal of urine and faeces, they were willing to change their behavior and adopt an entirely new approach to sanitation. The conventional approach of street pavement was abandoned, and they reached a consensus of flush toilets along with graywater connected to the sewerage system. The village people also agreed to treat the wastewater and recycle the nutrients through a constructed wetland. In order to convince the local government about this new ecological approach to sanitation they formed a village committee and registered it with the government, renegotiated the agreement to be comprised of a sewage system rather than street pavement, and added to the

agreement the requirement of the construction in each household of at least one toilet and in-house sanitary network for discharging the black and graywater of the house to the underground sewer system at their own cost.

However, before the execution of the project, a conflict on wastewater use rights emerged between two farmers, each one insisting on hosting the treatment plant and hence utilizing the wastewater. This was contrary to the initial response of the village where nobody was ready for land allocation for the treatment plant and considered it a permanent nuisance. The matter was, however, resolved through the local Jirga by giving rights to half of the wastewater to each farmer. This was done by diverting sewage water of some households to the proposed treatment plant in each of the farms. The interest of the farmers in the use of recycled wastewater and nutrients developed during discussions on sanitation and the potential of natural treatment systems. The wastewater use decree¹³ of Council of Leading Islamic Scholars (CLIS) in Saudi Arabia was very instrumental in molding the farmers' perceptions about wastewater use. This shows how rural Muslim people otherwise reluctant to the outside intervention can change their perceptions after religious approval.

Once the project was approved and funds were released, the village committee made the hardware arrangement and hired a local (but not school educated) sanitary expert for 1 week. Within 1 week the villagers got enough technical knowledge from the sanitary expert that they did the rest of the work by themselves. The underground sewer system is now completed. To date, 60% of the households have constructed toilets and connected them and the graywater drain to the system. The wastewater from the village is now discharging by gravity into two different places in almost equal proportion. Land agreements with the two farmers based on water use rights of farmers in return for free land for the subsurface constructed wetland treatment plant has been made. The design of the treatment plant is as per the recommended methods adapted to local conditions. Based on the expected flow of sewage wastewater from the village, two separate subsurface constructed wetlands, each one 15 × 7 m in area, were designed. The system consists of a shallow excavation filled with a 15 cm thick clay layer to minimize seepage. The excavation is further filled with a 0.6 m thick layer of rocks and crushed stones of various sizes. The wetland is surrounded by a clay bund to contain rocks and soil of the system and prevent side seepage. On

¹³ Impure wastewater can be considered as pure water and similar to the original pure water, if its treatment using advanced technical procedures is capable of removing its impurities with regard to taste, color, and smell, as witnessed by honest, specialized and knowledgeable experts. Then it could be used to remove body impurities and for purifying, even for drinking. If there are negative impacts from its direct use on the human health, then it is better to avoid its use, not because it is impure but to avoid harming the human beings. The CLIS prefers to avoid using it for drinking (as possible) to protect health and not to contradict with human habits' (Abderrahman, 2001, pp. 74–75).

top of the rocks and crushed stones, a 15 cm topsoil is spread for supporting roots of the marsh plants grown in the soil media. An inlet zone of coarse gravel ensures effective distribution of sewage water entering through a gravity pipe from a 2 × 2 × 3 m storage tank. A similar outlet zone collects treated liquid diverted to agricultural land. Purification of liquid occurs by combination of physical, chemical and biological processes (Kadlec & Knight, 1996; Srinivasan, Weaver, Lesikar, & Persyn, 2000). This village is thus implementing an ecological sanitation model, which is different from close-loop urine-separating latrines. Water-based sanitation is though not logical and sustainable in the first place but this treatment system recovers the water and nutrient for re-use. This system may thus be appropriate for other communities insisting on water-based sanitation.

In terms of wastewater treatment, the three options discussed with the villagers have different cost and environmental implications. A conventional physical treatment system (aerated lagoon) would cost approximately PKR 235,000 as an initial investment and involve high running and maintenance costs, making it a relatively high investment for the government and villagers. Flushing into pits, on the other hand, is the least expensive option for the village (Table 1), but the environmental risk of ground-water contamination is relatively high, and there is no utilization of wastewater and nutrients from the waste. The current option is both economically within reach of the villagers and is more ecologically sound. In this system, all raw materials for construction of wetland (land and media,

e.g. rocks, soil, clay) as well as local labor are locally available and contributed by the villagers, as part of their 20% share. The transportation of materials, construction and supervision is done from the project as 80% share of the government. It should be noted that this is a one-time investment, with almost no running and maintenance costs. The approximate cost of three wastewater disposal and treatment options is given in Table 1.

7. The prospects of sanitation in Muslim communities

People's value, perception and management of water and sanitation depend on their roots in culture, religious beliefs and taboos about excreta (Amery, 2001; Faruqui, 2001; Kira, 1976). In Muslim cultures in particular, but also in many other cultures, sanitation without water may not be easily welcomed. Islam, like other belief systems, puts a premium on water, and has very specific and detailed rules on water-centered cleanliness including ablution, bathing after sexual intercourse and proper washing after defecation. All these acts need water and are also associated with latrine or toilet and washroom. The Holy Quran mentions the importance and usefulness of the word *Ma'*, meaning 'water' and 'river', 63 and 52 times respectively (Abdul Baqi, 1987), and this has a deep spiritual bearing on Muslim minds. According to Falkenmark (1998) spirituality and ethics is the driving force of influencing human behavior. Therefore, efforts towards sanitation must consider religious, cultural and spiritual values in the design and introduction in any cultural context. Ecological solutions to sanitation are potentially in line with the Islamic way of life based on a life in peace and harmony at individual, social and ecological levels (Amery, 2001). The Islamic religion regulates all aspects of human life including eating, personal hygiene and sanitation (Faruqui, 2001). For example, the Prophet Mohammad (peace be upon Him) was said to have 'forbidden urination in stagnant water'¹⁴ and to have warned people to 'guard against three practices, which invite people's curses: evacuating one's bowels near water sources, by the roadside and in the shade'.¹⁵

The above-mentioned religious and cultural orientation influences the Machaki villagers in preferring water-based sanitation and to minimize contact with faeces and urine, which are considered *Najas* (impure) in the Muslim culture. For example, Islam advocates adopting all necessary measures to restrict a body or clothing to come in contact with urine and faeces, as this would disqualify a person from praying. There is a 14-century old religious dimension to Muslim peoples' repulsion of human excreta, and likewise the preference for anal cleansing and sitting for defecation and urination. In the Muslim culture, learning and practicing these things from childhood produces a sense of disgust about human excreta, which, Winblad and

Table 1
Approximate costs of sewage treatment options in Machaki village

Cost item	Cost of wastewater treatment option (in PKR)		
	Conventional physical treatment (aerated lagoon)	Deep pit	Subsurface constructed wetland
Land cost	30,000	3000	30,000
Site cleaning excavation	5000	6000	4000
Liner	0	0	2000
Soil planting media	0	0	3000
Plant and planting	0	0	1000
Subtotal	35,000	9000	40,000
Materials (cement, bricks, stones etc)	150,000	10,000	30,000
Equipments (aeration pump)	10,000	0	0
Engineering, construction and supervision	50,000	6000	10,000
Total capital cost	245,000	25,000	80,000
Operation and maintenance (annual)	15,000	0	0

¹⁴Muslim 553 (The Book of Hadeeth).

¹⁵Abu-Dawood 24, in Hadeeth Encyclopedia.

Simpson-Hebert (2004) described as a faecophobic culture. They still consider excreta as a waste and less as a resource. Therefore, people prefer not to see or think about excreta, as they would have to in the case of urine-separating latrines. The faecophilic culture (Winblad & Kalima, 1985) of China and other South East Asian countries, however, have been using human excreta as fertilizers for thousands of years (Dellstrom Rosenquist, 2005; King, 1911; Van der Ryn, 1978). They consider the human excreta as a valuable product and could be more receptive to urine-diverting latrines. These cultures have also influenced the Muslim communities of northern areas of Pakistan bordering China, where the farmers are still mixing faeces with soil and used it as manure. The existence of this culture in the Muslim communities could probably be attributed to their centuries-old roots in the Tibetan and Chinese culture, the ecological conditions under which these practices developed, and their relative remoteness from cultural influences from the rest of Pakistan. This shows that cultural norms, values and local taboos could have equally strong influence as religious values on the way people manage their excreta.

The reason for sanitation not being a top priority of the poor and middle-income people could also be understood by Dellstrom Rosenquist (2005) work of 'A Psychosocial Analysis of Human-Sanitation Nexus' and Maslow's theory of 'hierarchy of needs' (Maslow, 1970). According to Dellstrom Rosenquist, humans invent ways to deny some needs and natural processes like death and excretions. He explains that the denial of need may be due both to overestimation of risk associated with sanitation at a personal level, and therefore people avoid talking about excreta, and underestimation of risk at society level where people do not worry about pollution from excrement (Dellstrom Rosenquist, 2005, p. 342). According to Maslow theory 'physiological needs' at the lower level of the hierarchy dominate the individual motivation. Unless these needs are fully or partially fulfilled, other needs higher up in the hierarchy like 'safety needs,' 'interpersonal needs,' 'status needs' and 'self-actualisation needs' will not come true. Most of the people not having access to improved sanitation in developing countries may be engaged and worried about meeting 'physiological needs' and seldom think about other needs higher up in the Maslow's hierarchy. In Machaki, people were much more concerned about meeting the food, water, shelter and security needs. Sanitation for them is quite at the top of the Maslow's hierarchy and thus at the bottom of the list of their own priorities. However, as Maslow also pointed out the 'reversal of the hierarchy' can occur. There were, for example, exceptional cases in Machaki village. We found nine household members who had cell phones but not latrines. A similar situation was confirmed in Mumbai, India where the slum-dwellers and street vendors prefer to keep cell phones, TV and not latrine facilities (UN-habitat, 2003; Pers. Comm. with Sudhir Thakare). In Machaki, another 30 households in the village keep weapons for safety but have no latrine. Most of the households having

weapons for self-defense prefer taking loans for meeting the 'physiological needs' rather than swapping or selling the weapons. In most developing countries, a reasonable latrine can be built for the price of a cell phone or, for that matter, weapons, which the village people of Machaki are keeping. But they choose cell phones and weapons instead of latrines. Here the 'safety needs' and 'status needs' are preferred to the 'physiological needs.' Thus, there seems to be different hierarchies of needs for different people, and these are likely to be gendered as well. These preferences and value judgments might be due to the anticipation of risk. They cannot easily link the same level of risk caused by lack of improved sanitation as by lack of safety or from crimes (Douglas & Wildavsky, 1982). The consequences of poor sanitation (diseases and death) in most cases are attributed to 'the will of God' where they find themselves helpless. Hygiene education, empowering the local people and effective government policies could help change the place of sanitation in the hierarchy of needs.

It is also important to consider the all components of sanitation when evaluating its relevance. Conventional ecological sanitation (urine-separating latrine), does not contribute to the disposal and treatment of graywater, rather it only complements it through the recycling of nutrients and excreta (Johansson & Nykvist, 2001). The stagnant graywater in the streets, which is a major sanitation problem in Machaki and other rural villages of NWFP, will remain until properly disposed of and treated. The handling of two separate systems is expensive and may not be within the reach of many people and countries. The Machaki villagers, for example, argued that they could not afford two separate sanitation systems. Economic considerations are, therefore, an important factor in developing appropriate systems.

In many developing countries the phrase 'development' means acquiring western science and technology and standard of living. Developing countries are therefore stuck in the 'catching-up syndrome', i.e., acquiring western technology including water-borne sanitation (Iqbal, 2002). Poor people see urine-separating latrines as an obstacle in 'catching up', as the majority of western societies are following the 'flush-and-discharge' sanitation model. Therefore, if the new approach of ecological sanitation is to be promoted for the billions of people without improved sanitation, the poor people must see similar trends in societies they admire. A culture practicing flush toilets may not be heard when advocating urine-separating latrines.

8. Conclusions

Ecological sanitation will no doubt help improve health, water availability and food production. It is logical, sustainable, and cost effective both in theory and in practice. The technology can be equally pro-poor and pro-rich, for men and for women and for water-scarce and water-rich areas. However, despite its many positive

aspects, this approach will be of little use unless the target people are willing to adopt it. In urine-separating latrines, for example, the focus is on recycling, health and environment, whereas the majority of people without access to sanitation hardly share any of these concerns. Their prime priorities are privacy, dignity and security. People use cultural lenses for evaluating any intervention, including sanitation. Therefore, for new solutions to sanitation to flourish in rural communities, one has to understand the prevailing cultures, preferences and practices. One has to tailor-make sanitation technology to the local cultural environment. To tackle this challenge, more open discussions around sanitation need to be undertaken in the villages such that people can relate their cultural and religious knowledge and perceptions with scientific knowledge on sanitation, health hygiene and recycling.

Poor and illiterate people have the potential and capability to make good choices if they are given the opportunity to be involved from inception to completion of sanitation projects. Suitable methodology is needed to include the community, learn about preferences and knowledge and maintain their confidence through the development of consensus and motivation. Once they realize the importance of proper sanitation and the problems associated with not having it, people will be motivated to take charge themselves in the development of appropriate technologies as seen in the case of Machaki village. This will help the people by allowing them to choose for themselves among a menu of sanitation options and will also relieve experts from their duty of doing the job for them.

One must also recognize the limitations of certain types of ecological technologies. The urine-separating latrine, for example, can only complement other systems by recycling plant nutrients. Stagnant graywater in the streets will remain until properly disposed of and treated. The arguments made by villagers that they cannot afford two different sanitation projects, one for blackwater and one for graywater in the same settlement, is probably true in all developing countries where the demand for sanitation is low.

Thus, urine-separating latrines, while theoretically sound, are not appropriate in Machaki, and may not at this time be a practical and attractive option in other Muslim communities due to prevalent socio-cultural and religious influences. There are, however, alternative ecological sanitation systems, which, with careful discussions with the community, could have a good chance of successful implementation. In Machaki village, a constructed wetland was successfully introduced and adapted to local conditions after consensus building in the community. Thus, the present case shows that it is important that the general principles of ecological sanitation models are adapted to local conditions, rather than introducing universal, specific technologies developed under different conditions.

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