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A revised sanitation approach framework to identify improved sanitation strategies:
A case study of agrarian communities in Ungra (Karnataka, India)

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ABSTRACT

An effort to identify appropriate sanitation strategies for communities should encompass the perception, feelings and practices involved in satisfying the basic urge to defecate and urinate, along with their disposal. An existing Sanitation-Approach framework permits an understanding into the nature of psycho-socio-economic influences that determine societal approach to sanitation. This framework facilitates the identification and provision of improved sanitation facilities taking into account suitable resource allocation, environmental protection, usability, acceptability and sustainability for a specific community. In the present study, agrarian communities in five village clusters located in Ungra (Karnataka, India) were chosen to evaluate the robustness and applicability of this framework. Solid-waste disposal practices and access to education, hitherto not integrated in the framework, was found to strongly influence the community’s awareness and approach to sanitation. Accordingly, a revised sanitation-approach framework incorporating these factors has been proposed, and appropriate strategies for each of the village clusters have been identified.

Key words: improved sanitation, rural agrarian community, sanitation assessment, sanitation-approach framework, Ungra (Karnataka, India).

INTRODUCTION

Sanitation is a term primarily used to characterize the safe handling and disposal of human excreta (urine and faeces). The main objective here is to avoid faecal-oral transmission (Penn 2005) and water-borne diseases. The approach of a community to sanitation includes factors such as the perception, feelings and practices involved in defecation and urination, and the disposal of this waste. Their attitude is a result of interconnected factors of cognition (knowledge), perception (feeling) and behaviour (action) (Krech et al 1962). To understand the various factors that determine a community’s sanitation approach, a systems structure was
developed by Avvannavar et al (2008). Such frameworks are important in providing ‘improved sanitation’ solutions, to alleviate the suffering of people due to ill health, income-loss, and distress attributed to inconvenience and indignity (WHO/UNICEF 2010a). Sanitation solutions such as flush toilet, piped sewer system, ventilated pit latrines, etc., that prevent direct contact with human excrements are considered ‘improved’, while others such as bucket latrines, hanging toilets, and open defecation are not (WHO/UNICEF 2010a).

Even though target 3 of the Millennium Development Goal (MDG) number 7 has made possible the provision of improved sanitation for many, a redoubling of efforts is necessary if the target is to be met (WHO/UNICEF 2010b). The aim is to reduce the number of people without sustainable access to basic sanitation by half, by the year 2015 (UN 2011). Assisting the MDG and International Year of Sanitation 2008, is the Total Sanitation Campaign (TSC) in India. This is a successor to the Central Rural Sanitation Programme (launched in 1986). It is demand-driven and gives importance to the empowerment and participation of local communities in the implementation of sanitation schemes (MoEF, 2004).

To test the robustness and applicability of the sanitation-approach framework, five village clusters in Ungra (Karnataka, India) were chosen to evaluate the impact of each factor under the four categories of human settlement, natural environment, religion/culture and society on the sanitation approach of the community. It also enables identification of other significant influencing factors that are not part of the present structure. The methodology adopted comprises a field study including a comprehensive survey, evolved based on the Sanitation-Approach framework, into the sanitation practices for each of the village clusters, data-analysis and interaction with local health-officials and doctors, NGO’s and administrative officials. An overview of the study methodology is illustrated in Figure 1.
Figure 1. Methodology to provide improved sanitation to the community.
STUDY METHODOLOGY

This study is part of an on-going project on Total Sanitation, at the Centre for Sustainable Technologies, Indian Institute of Science (CST-IISc) to identify appropriate sanitation for agrarian communities. Five village clusters namely Yadavanne, Ungra, New Colony, Old Colony and Pura were identified based on proximity to IISc’s rural extension centre at Ungra (Kunigal Taluk, Karnataka, India). This centre is an extension of CST-IISc located 100 km, by road, west of Bangalore. It is a semi-arid agrarian settlement under Yedavanne Grama Panchayat (Figure 2) comprising of hutment clusters (250 households; average family size of 5 members per household). The main occupation is agriculture and domestication of animals with an average monthly income is less than Rs 2500 (Rs 50~1 US$).

![Figure 2. Aerial map of Ungra Panchayat.](image-url)
Aim of the study

The study in Ungra aims to evaluate the community’s sanitation approach by adopting the framework, establish the needs of the community, and identify and design appropriate sanitation strategies, particularly for women.

Preliminary investigation

The preliminary investigation comprises a visual survey (including a photographic survey of the living environment) and interaction with community members to assess the current status of sanitation of the community under study, including sanitation habits and type and state of existing (if any) sanitation facilities. Direct interaction was conducted in the form of door-to-door survey. Each village cluster represents a conglomerate settlement either in terms of nature of occupation, caste, age and represents a typical administrative unit. The survey included nearly 12% of the households, and was conducted for a randomly selected household for every street and can be classified as stratified-random survey.

Identification of beneficiaries

The governing criteria in the needs assessment include the practice of open defecation, high incidence of diseases attributed to faecal-oral transmission, high school-dropouts among girls, insecure and unhygienic living environments, limited or no access to sanitation facilities and marginalisation (gender/caste/income). Participatory community workshops or informal gatherings act as platforms for the community to voice their opinions/preferences.

Detailed investigation

The objective here is to arrive at an integrated sanitation design that is likely to be both effective and accepted by the community. A comprehensive study of the present/past
sanitation facilities/programmes is imperative to assess the reasons for their effectiveness or non-usage, viz. private toilets or community toilets. Field investigations aid in discerning open defecation and hygiene practices and also in identifying potential sites for provision of sanitation facilities. Interaction with the local authorities (governing bodies, health centres, Total Sanitation Campaign, Integrated Child Development Scheme, *anganwadi* (kindergarten) and school teachers) provide information on the demography, geomorphology of the living environment, and the health of the community. The working constraints under which the proposed sanitation solution is to operate were also identified, following which an appropriate sanitation design can be evolved. Figure 3 illustrates the method adopted to evaluate and organise factors adopting the Sanitation-Approach framework proposed by Avvannavar et al., (2008).

Figure 3. Method to ascertain factors in the sanitation-approach structure.
RESULTS AND DISCUSSIONS

The significance of relevant factors in the sanitation-approach structure is explained in this section. The data collected was analysed adopting the statistical analysis package SPSS. Estimated marginal means were arrived at for each of the pertinent factors influencing the community’s access/preference to sanitation. This permits the comparison amongst means of unequal sample sizes, and reveal the mean response for each factor, adjusted for another variable of concern (in this case access to sanitation). The Sanitation-Approach framework derived for Ungra is illustrated in Figure 4.

![Figure 4. Sanitation-approach structure for Ungra.](image)

**Human settlement**

The main *human-settlement* factors comprise settlement density, urban/rural settings and the immediate natural settings/surrounds, particularly to discern practices of open defecation. Ungra comprises cluster of houses with defined agricultural boundaries. Figures 5 (a, b, c)
illustrate hamlet-wise sanitation habits with regards access to private facilities and practices of open defecation. Proximity/accessibility to agricultural fields and thick bushes provided a compelling impetus to open defecation, particularly pronounced in Old Colony. Though not conclusive, the close proximity of the Community Health Centre and Panchayat office in Yadavanne resulted in a relatively lower open defecation practices.

Figure 5. Hamlet-wise influence of proximal natural terrain and sanitation facilities on sanitation habits of (a) men, (b) women and (c) children.

**Natural environment**

Natural environment covers the terrain, water sources and climatic conditions. The houses in the five hamlets are clustered amidst agricultural fields. The main source of water in the five hamlets are community taps connected to community bore wells or individual pipes
connected to private bore wells (depths of 450–600 feet). Sanitation facilities which aim at non-pollution of soil and ground water such as the waterless composting toilets assume importance here.

The relation between the availability of water on the usage of sanitation facilities in each hamlet is displayed in Figure 6. In Old Colony, most people were satisfied with the quantity of water available; however, other factors such as settlement density, fear/superstitions and wealth also strongly influence sanitation practices. Intermittent water supply in Ungra and New Colony were likely reasons for the community being accustomed to open defecation.

These hamlets are semi-arid and receive most rainfall during the monsoon; water logging during the rains is common. The proposed sanitation design must accommodate such occurrences.
**Religion/culture**

Religion and culture have a significant psychological bearing on an individual’s perception of defecation and personal health and includes caste based social order, fear and superstitions. Most people in New Colony belong to migrated scheduled castes and tribes and receive benefits from the government, while Old Colony comprises original residents belonging to higher castes. Caste based skirmishes are still evident.

Fear and superstition based beliefs include: (a) bathing frequently washes away the money/income at home; (b) defecation, and consequently toilets, should be far away from homes. This belief was found to be a deep-rooted amongst the older generation, particularly in the case of Old Colony. Men and children defecate along open fields while women prefer bushes, in the wee morning hours (seeking privacy).

While implementing suitable toilet designs, awareness campaigns must be conducted to ensure that people are not hesitant in using the new toilet designs. However, in orthodox families men prevented women from attending awareness classes which would be a constraint in spreading proper awareness on sanitation and hygiene.

**Society**

Societal considerations include behavioural and attitudinal responses at the individual and group levels and influenced by health, wealth, technology, gender and personal safety. Sanitation practices and community health are intertwined. Inappropriate sanitation results in water contamination, leading to water borne diseases such as malaria, dengue, and diarrhoea.
Awareness amongst children in schools and *anganwadis* has had little influence in convincing adults to take any mitigating action.

However, as in Figure 7, the influence of sanitation levels on disease incidence levels is not clearly evident except in the case of New Colony where the lowest disease incidence levels (reported), in light of high sanitation level. Despite Yadavanne having the lowest sanitation level, access to a Community Health Centre may have resulted in a lower disease incidence level than other hamlets. The generally prevalent practice of open-defecation, particularly Old Colony (see Fig. 8) may have a greater bearing on the disease incidence levels.

The state of sanitation is generally dependent on the income/wealth of families. However, it was observed that expenditure on improved sanitation is influenced by spending priorities. For instance, while most families in these hamlets possess mobile phones, colour televisions with satellite-dish networks and DVD players, many of them expressed inability to construct latrines. Families exposed to city-life were keen on constructing toilets primarily from a...
desire to showcase improved lifestyle/luxury and not in response to a basic necessity. Most of such toilets constructed are detached from the main dwelling and remain locked most of the time. Its usage was found primarily for visiting relatives from the city. However, the only available toilets in all the hamlets are poorly-constructed septic tank based models.

Despite wide disparity in the needs and priorities among men and women in all five hamlets, all were in agreement with prevalent defecation habits (due to inadequate awareness). Most men opted for open defecation at any time, while women preferred open defecation in groups amidst bushes, very early in the morning. They displayed insecurity and embarrassment in discussing their sanitation habits. There are no public toilets in any of these hamlets. Possible impacts of inadequate sanitation include school dropouts, women refraining from consuming adequate amounts of water to reduce the need to urinate.

As illustrated in Fig 8, the proximity to sanitation was rated as far more number of times than near. Despite the highest near rating, extensive open-defecation is prevalent in Old Colony due to its compactness and close proximity to agricultural fields. Despite having better
sanitation facilities, Yadavanne had the lowest *near* rating due to its large size, requiring people without private toilets to cover larger distances to reach the open fields and bushes.

**Revised sanitation approach structure**

In addition to the above factors, solid waste management and access to education were found to play an important role in the community’s approach to sanitation. A revised sanitation approach framework (Figure 9) was developed to include the two new influencing factors – solid waste management and access to education.

![Figure 9. Revised (red dashed line) societal sanitation-approach structure](image-url)
The term solid waste includes garbage (degradable organic and food waste), rubbish (non-biodegradable plastics, wood, metal), debris (bricks, masonry and pipes), sludge and solids from domestic sewage, dead animals, compost pits and other discarded farming material. The waste generated depends on dietary habits, lifestyles, and degree of urbanization (Park 2009). In the rural agrarian areas, ash and hay are produced in large quantities and disposed in earmarked pits around the household to compost for use in the fields. With modern influences, increased use of plastic (cups, shampoo sachets, bottles, etc.) is resulting in non-biodegradable that is generally burnt. The technology to be used is influenced by the type of waste generated, which in turn depends on the rural/urban settings of the community. In such settings the generation of ash can be integrated with EcoSan with minimal water requirement and the resulting compost utilized as fertilizer (Mani et al 2007).

Figure 10 illustrates the characteristics of the waste generated for each of the five hamlets. Yadavanne generates the highest percentage (55%) of non-biodegradable waste and the least degradable waste (15%) in the less than 5 kg category. In Old Colony, all the waste generated is degradable and weighs less than 5 kg. New Colony, Ungra and Pura generate 50–70% of degradable waste in this category making waterless compost toilets a viable option.
Accessibility to educational institutions (anganwadis, schools) and health institutions (Community Health Centres, hospitals) influence the sanitation and hygiene practices of the community, as people are likely to take informed decisions on matters of personal hygiene. The health benefits that accrue, particularly to adolescent girls, are valuable. Access to sanitation in schools is chiefly important as these students then persuade their parents to provide the same facilities in their residences (Penn, 2005).

Hamlets nearer to health/educational institutions have shown increased awareness levels and conversancy with sanitation facilities. All four hamlets except Old Colony have anganwadis for children up to the age of 6 years. They are run by the Integrated Child Development Scheme (ICDS). During the survey, it was observed that the water for cooking (mid-day meals) and drinking is procured from the open water tanks nearby. There are no toilets in these anganwadis; the children and teacher relieve themselves along the roadside.

There is a lower primary school each in New Colony (up to Grade 5) and Pura (up to Grade 8), and an upper primary school in Ungra (up to Grade 10) run by the Panchayat and the Sarva Shiksha Abhiyan. The water for the cooking (mid-day meals) and drinking is pumped to a water tank from a private bore well. There are gender-separate toilet blocks for the staff and students. The school surroundings and toilets are cleaned and maintained by the children under the teacher’s guidance.

Comparative analysis and solutions
A comparative analysis of the different hamlets was carried out to ascertain the varying extent of influences on the community’s sanitation approach. These comparative assessments
expressed as weighted scales (+ is low to ++++ high) based on first-hand verification on site by the research team and results from the data analysis. Figure 11 illustrates the hamlet-specific relative strength of each of the factors.

![Comparative analysis of influencing factors](image)

**Figure 11. Comparative analysis of influencing factors.**

Following this appropriate design strategies were devised for each hamlet, maximizing community acceptability and effectiveness. These include: (a) providing sanitation facilities in individual homes; (b) providing sanitation facilities at schools and *anganwadis*. The advantages and disadvantages in each have been summarized in Table 1.

<table>
<thead>
<tr>
<th>Individual toilets</th>
<th>Schools</th>
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<td><strong>Advantages</strong></td>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td>* Well maintained</td>
<td>* Limited number of users</td>
</tr>
<tr>
<td>* Easier to monitor and study impact</td>
<td>* Difficult to identify just few families</td>
</tr>
<tr>
<td>* Panchayat approval not needed</td>
<td>* Superstitions may prevent usage</td>
</tr>
<tr>
<td></td>
<td>* Easier to teach/influence children</td>
</tr>
<tr>
<td></td>
<td>* Teachers can help with monitoring usage</td>
</tr>
<tr>
<td></td>
<td>and impact</td>
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<table>
<thead>
<tr>
<th><strong>Disadvantages</strong></th>
<th><strong>Advantages</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>* Difficulty in acquiring permission,</td>
<td>* Well maintained</td>
</tr>
<tr>
<td>land and funding from the Panchayat</td>
<td>* Easier to monitor and study impact</td>
</tr>
<tr>
<td>and schools</td>
<td>* Panchayat approval not needed</td>
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<tr>
<td></td>
<td>* Teachers can help with monitoring usage</td>
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<td></td>
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<td>* Teachers can help with monitoring usage</td>
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<td></td>
<td>and impact</td>
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**Table 1. Advantages and disadvantages of two sanitation strategies.**
In Old colony and New Colony water availability, awareness and technology were the main factors to be accommodated wherein waterless compost toilets that do not pollute ground water are suitable, in addition to water-based modified septic tank based toilet developed by IISc (Mani et al 2007). However in response to risk of water scarcity, the design would need minimise water use. Sensitizing the community about different technological options would complement the participatory evolution of viable designs.

In Ugra, Pura and Yadavanne, the major factors influencing sanitation approach were natural terrain (supporting open defecation) and low-awareness level. A combination of both modified compact septic tank based toilets and/or waterless compost toilets may be adopted as water availability is not a constraint. However, awareness camps are still imperative to educate people about sanitation and to familiarize them about the new designs. Table 2 summarizes the appropriate type of sanitation facility for each hamlet.

<table>
<thead>
<tr>
<th>Hamlets</th>
<th>Awareness camps</th>
<th>Waterless compost toilets</th>
<th>Modified septic tank based toilets</th>
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<td>Ugra</td>
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<td></td>
<td>✓</td>
</tr>
<tr>
<td>New Colony</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Old Colony</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Pura</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Yadavanne</td>
<td>✓</td>
<td></td>
<td>✓</td>
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Table 2. Hamlet-wise approaches for provision of appropriate sanitation.
The sanitation-approach framework has been exhaustively used to assess sanitation in the five village clusters and to identify critical influencing factors. Two additional factors that influence community’s sanitation practices were identified and integrated in the framework.

CONCLUSIONS

The paper presents an evaluation of the robustness, relevance and applicability of the sanitation-approach structure, as tested on five agrarian villages in Ungra (Karnataka, India). Most of the factors in the structure had either a direct or an indirect influence on current sanitation practices. In addition, that solid waste management and access to education also played a crucial role in determining the community’s sanitation approach. Accordingly, the framework has been revised to include these two new factors.

Each of the five villages was evaluated to discern the factors influencing sanitation practices. Significant diversity was evident to distinguish the sanitation practices of one village from the other. Estimated marginal means were arrived at for each of the likely factors influencing a community’s access/preference to sanitation. This investigation, based on relative magnitudes of each various influencing factors, viz., water availability, disease incidence levels, awareness, open-defecation, access to sanitation facilities, etc., provided interesting insights into the community’s sanitation practices. Open defecation was the most pronounced, evidently encouraged by open rural environment, and varying access to water. Establishing the influence of awareness levels on the sanitation habits, subsequently leading to lower disease incidence levels was unconvincing, revealing the fact that there were other stronger factors influencing open defecation practices. On the whole, the revised Sanitation-Approach framework provided a comprehensive basis to discern a community’s sanitation practices and in articulating appropriate sanitation designs.
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