

# Exploring ICT as a Catalyst for Technological Adoption: Insights from Action Research

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**Abstract.** This research delves into the multifaceted challenges of open defecation and the constrained adoption of sanitation technology in rural Raichur villages, with a particular focus on Mamanathodi, Karnataka, India. Against a global backdrop where 3.6 billion lack improved sanitation, the study employs Participatory Rural Appraisal (PRA) and Human-Centered Design (HCD) methodologies, emphasizing the pivotal role of community-led initiatives customized to local norms. Beyond presumptions that infrastructure alone eradicates open defecation, the study illuminates socio-economic factors such as financial constraints, water scarcity, and cultural beliefs contributing to its persistence in Mamanathodi. The interdisciplinary team's immersive ten-day experience, deploying PRA tools and observational techniques, brings forth nuanced insights. The research integrates demographic data, field observations, PRA tools, and scenario analyses. Proposing an ICT architecture for social change, the study advocates for data-driven, stakeholder-engaged, and convergent approaches. The envisioned architecture promises efficient data collection, stakeholder empowerment, information convergence, and cost-effective, scalable interventions. In conclusion, the paper presents recommendations urging policymakers to enhance stakeholder engagement and ensure the sustained longevity of sanitation initiatives, contributing significantly to the discourse on rural public health and hygiene practices.

**Keywords:** Open Defecation · Sanitation · Technology adoption · ICT · Sustainable Development · Rural India · Live-in-Labs®

## 1 Introduction

Open defecation, the act of relieving oneself in open spaces such as fields, forests, and streets, presents significant environmental and health hazards. Extensive research has revealed a strong link between open defecation and alarming child mortality rates, heightened malnutrition rates within communities, and escalated healthcare costs. Globally, 3.6 billion people lack improved sanitation, with 494 million practicing open defecation (OD), primarily in rural areas of Central and Southern Asia and sub-Saharan Africa [15]. The United Nations has emphasized the significance of sanitation

through Sustainable Development Goal 6.2 (SDG6.2), aiming to eradicate OD and ensure universal access to sufficient and equitable sanitation [4]. While toilet ownership has increased in India in recent years, the practice of open defecation may continue to exist even when rural households have access to latrines [4].

In 2016, India had a high open defecation (OD) rate, nearly 60% of the population, which was four times the global average [23]. Reducing OD is crucial for India to meet Sustainable Development Goal (SDG) 6.2 and improve global public health. The Swachh Bharat Mission (SBM) was launched in 2014 by the Indian government with the goal of making all states open defecation-free (ODF) by 2019, though concerns exist about the accuracy of ODF claims [2]. Reasons for continued OD practice include financial limitations, water supply issues, mistrust in the government, cultural beliefs, and personal preferences. Strategies to reduce OD involve strong district leadership, innovative behavior-change campaigns, and community mobilization efforts, though success varies across regions [12].

As a matter of fact, assuming that appropriate toilet infrastructure will eliminate open defecation may not be right, especially when researchers stress the necessity for sanitation programmes tailored for specific communities to satisfy local demand' [14]. Technology and smartphones are playing a big role among people these days [20] but in remote villages and tribal areas, we need to have different strategies to achieve our goal. [7] conducted a study that emphasized the importance of community-led initiatives in success of ODF. Studies also emphasize the link between open defecation and health risks [13], as well as social norms and cultural beliefs that shape attitudes toward ODF [10].

The aim of this study is to assess the effectiveness of systematic awareness campaigns in eliminating open defecation in the village of Mamanathodi, located in Raichur, Karnataka. Mamadadoddi is a small village or hamlet situated in the Raichur Taluk of the Raichur District in the southern Indian state of Karnataka. It falls under the administration of the Sagamkunta Panchayath. The village is located approximately 24 kilometers to the north of the district's headquarters, Raichur which is the nearest town to Mamadadoddi for all major economic activities. Mamadadoddi constitutes a vibrant and tightly-knit community nestled within a verdant, sylvan landscape. The inhabitants exhibit both warmth and purposefulness, deriving contentment from their quotidian pursuits. Central to the village is a resplendent temple that encapsulates the profound spirituality pervading the community. It functions as a focal point for religious observances, introspection, and communal revelry, hosting an array of religious rituals and festivals that magnetize participants from the broader regional vicinity. Despite its diminutive scale, agriculture prospers in Mamadadoddi, with farming assuming primacy as the principal vocation. The fecund terrain affords the villagers the capacity to cultivate a diverse spectrum of crops, thereby epitomizing their steadfast commitment to environmental stewardship. The village harmoniously amalgamates natural landscapes with human endeavors, and its linguistic fabric is characterized by the fluent discourse of both Kannada and Telugu, fostering interconnectedness with the wider regional milieu.

## 2 Method

An appraisal of the methodology employed for this study, which encompasses Participatory Rural Appraisal (PRA) and Human-Centered Design (HCD), reveals a comprehensive approach to data collection and analysis [17]. PRA, known for its participatory and community-centered nature, facilitates the active engagement of local residents, empowering them to share their perspectives and insights. HCD, on the other hand, emphasizes the user-centric design process, ensuring that interventions and solutions are tailored to the specific needs and preferences of the target population.

Together, these methodologies enable a holistic understanding of the research context and facilitate the development of contextually relevant and effective strategies for achieving the open defecation free community.

In Participatory Rural Appraisal (PRA), a range of tools is used to facilitate community engagement and data collection [22]. These tools aim to encourage active participation from local residents and uncover valuable insights into the community's needs and challenges. Common PRA tools encompass community mapping, transect walks, seasonal calendars, social mapping, and resource mapping. Community mapping assists in visually representing local resources and significant landmarks. Transect walks involve guided community journeys to discuss landscape changes and their implications. Seasonal calendars document the timing of activities, providing insights into seasonal dynamics. Social mapping reveals social structures and relationships, while resource mapping visually inventories available resources within the community. By employing these tools effectively, PRA ensures that community voices are heard, resulting in participatory, contextually relevant, and community-driven data collection. The data and information collected are analyzed alongside the secondary data obtained from visual communication and ICT derivatives to develop effective communication strategies.

The interdisciplinary team of students, comprising both engineering and humanities backgrounds, stayed in the community for ten days. The initial days were dedicated to ice-breaking, while the rest of the time was devoted to participatory research on the key challenges faced by the community. These challenges were elaborated into personas and scenarios to gain insights into the factors contributing to the rejection of toilets and the persistence of open defecation practices. The team also conducted a comprehensive review of similar studies and correlated the grounded factors with the secondary data.

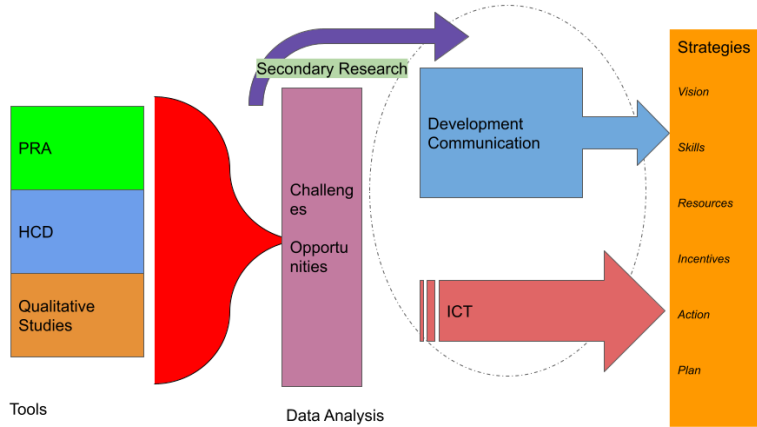


Fig. 1: Action Research methodology for Social change [11]

### 3 Data collection and analysis

Data collection and analysis serve as the cornerstone of this research offering a systematic and structured approach to acquiring, organizing, and interpreting information. This Section details the various data collection tools and data analysis.

Table 1: Demographic Data

Category	Value
Area	321.17 hectares
Population	1,298
Households	245
Female	598
Male	492
Children	205

#### 3.1 Field Observation

The Observations while walking through the village were recorded in the field journal in the AEIOU matrix. The Observations covered every walk of life , house , cattle rearing , toilet, field , school, community center , roads , water collection center , shops , tea vending centers etc. The Observations while walking through the village were recorded in the field journal in the AEIOU matrix. The Observations covered every walk of life , house , cattle rearing , toilet, field , school, community center , roads , water collection center , shops , tea vending centers etc. The village primarily relies on daily wage work in the fields for income. Some residents own farmlands, while a few seek work outside the village, mainly in Raichur. The average family income is around 10,000, with many families expressing concerns about low earnings. Old individuals receive 2,000 every 8 months, and widows receive 800 per month.

Most villagers are tribals with Below Poverty Line (BPL) cards and receive rice from ration shops. Some residents complain that the government provides only rice. The village has an Angan-wadi and a school offering classes from first to fifth standard, teaching Kannada, English, science, and math. Students receive uniforms, shoes, and food (milk and eggs). The school serves only village students, so there is no bus service. The literacy rate is 75%, and the school engages in various activities such as elections and sports competitions, with smart classrooms available. Teachers ensure that students continue their education beyond the fifth grade and assist with the admission process.

The village has a Resident Medical Practitioner (RMP), but for emergencies, residents may need to travel to another village. Most villagers are healthy and capable of working in the fields, but diseases like dengue, malaria, and cough are common, especially during the rainy season. Open defecation is a significant problem, particularly when it rains.

The figure below shows the details of the one of the observations

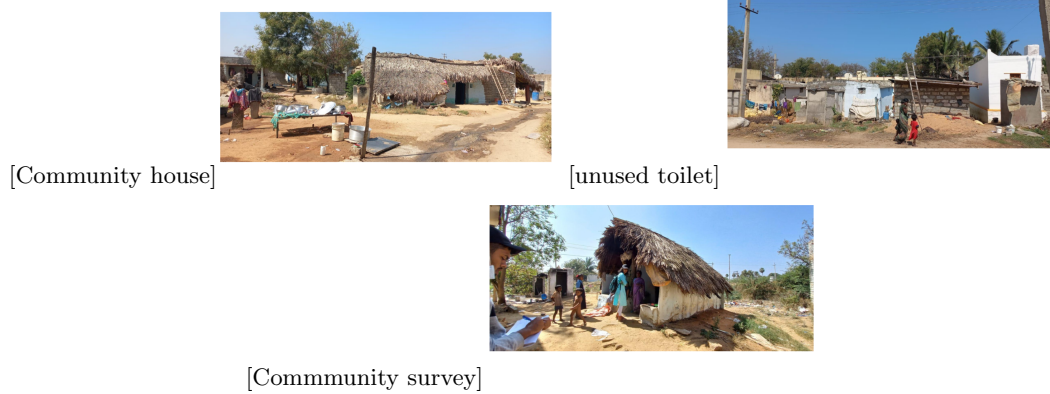


Fig. 2: Participatory Action research

### 3.2 PRA Tools

The study includes PRA tools like Resource map, Income Expenditure Chart, Seasonal Calendar, Social Mapping, and Problem Tree, and brainstorming to participatively understand the challenges and opportunities. The following table summarizes the details.

### 3.3 Scenarios

Based on the Participatory Rural Appraisal (PRA) tools and observations conducted in the initial days, two scenarios were thoroughly examined. These scenarios involved the experiences of married and young women, school-going children, youth, and men. The waste management challenges faced by married women and the difficulties associated with open dumping for children were examined in detail.

### 3.4 Action Research

Open defecation, a common practice in rural villages, poses serious threats to public health, the environment, and overall well-being. Awareness initiatives are crucial for altering behaviors by emphasizing the negative consequences of open defecation. These programs change people's perceptions about sanitation, motivating communities to use toilets by highlighting the health risks and dignity concerns. Behavioral change has a ripple effect, where one person's change inspires others, leading to a shift in societal norms. Individual household visits have been effective, with nearly 60 households visited to raise awareness. Additionally, the team has collaborated with local schools to incorporate ongoing campaigns into the academic curriculum, enhancing the impact of these efforts.

### 3.5 Secondary Research

This secondary data has effectively triangulated the gaps in development communication concerning Open Defecation Free (ODF) initiatives in villages. It has done so by incorporating input from all stakeholders, including both administrative bodies and beneficiaries. The subsequent table elaborates on which of these gaps can be mitigated through the use of technology.

Table 2: Summary of Findings

Sl No	Tool	Findings
1	Resource Map	Key resources and their spatial representation are done with the help of villages; the resources were noted at various locations either by the local community members or by the instruction of the community members. The figure above shows the spatial representation of the resources present in the table.
2	Season Calendar	Mapping Done for Twelve Months for Water, Sanitation, Energy, Waste Management, Health, Agriculture, Environment, Culture, Hygiene, Livelihood, Education, and Risk Management. Rainy seasons are the most productive time as the community is engaged in agriculture, but that is also the time when they are affected by diseases due to poor hygiene and waste management. This negatively affects productivity. During the summer months, they go out for labor work due to the non-availability of water and extreme conditions for cultivation in nearby towns. Women are unemployed during this period.
3	Income Expenditure Map	Key income comes from agriculture in rain-fed seasons and migrated labor in summer seasons. The expenditures include those for health, fertilizers, and education. The considerable spending on health is due to poor hygiene and sanitation.
4	Problem Tree	Problem trees drawn for challenges in agriculture, water, sanitation, health, etc. Waste management and open defecation are two challenges identified in every problem tree drawn.
5	Brainstorming	Expenditure Sheet analysis, we conducted a brainstorming session with three distinct groups of individuals, including older farmers, educated youth under the age of 30, and government officials. During this session, we discussed the key findings from the aforementioned tools and prioritized the key challenges. The summary of the discussion is presented in a Kumo diagram.

Table 3: Factors Affecting Social Change

Factors	Triangulation Citation	Field Gaps Identified	Impact on Social Change [11]
Public Private Partnership	[3] [1]	No platform for convergence among stakeholders.	Everyone has a different vision and action plan among stakeholders
Demystified social norms	[6], [9]	Identified the impact of social norms at the individual, family, and community levels is important	Action plan, Incentives
Correlation with Health	[19]	Lack of data and convergence	incentives
targeting key drivers	[19], [18]	Participative Collection of Drivers not possible with mono dialogues. Democratic participation is not observed among the stakeholders	Skill, Incentives
Data-driven model-based analysis	[21], [5]	Beneficiaries and stakeholders lack knowledge, scaling up the information gathering and analysis, and action becomes very lengthy and costlier	Skill and resources are lacking





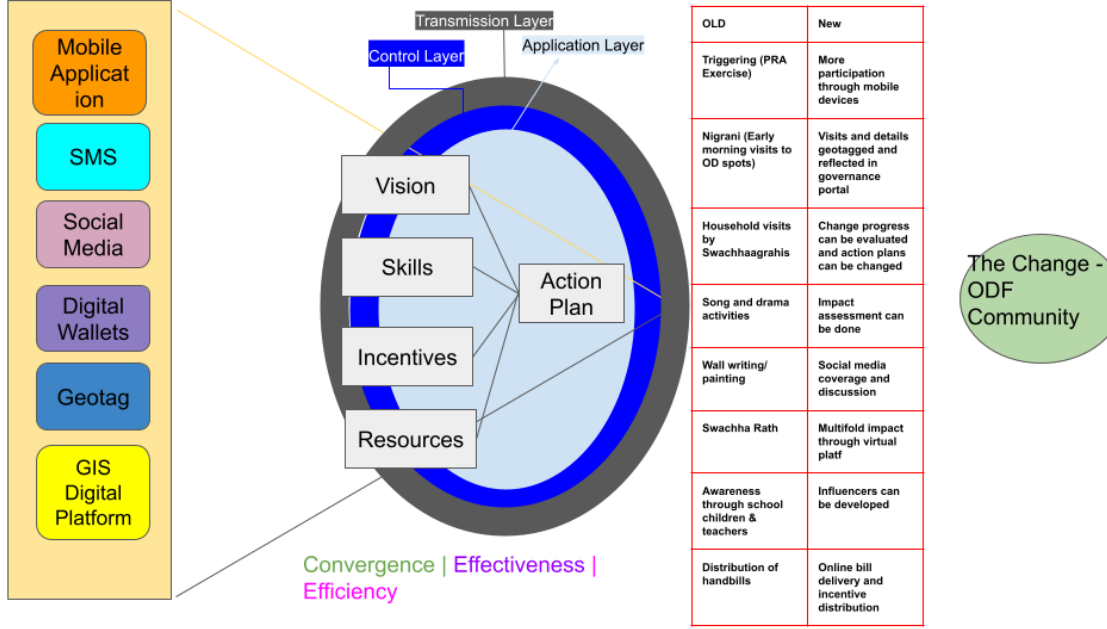


Fig. 4: ICT architecture

## 5 Conclusion

In conclusion, this study illuminates the persistent challenges of open defecation and the limited adoption of toilet technology in rural Raichur villages, proposing the integration of ICT (Information and Communication Technology) features for structured awareness programs. Utilizing Participatory Rural Appraisal (PRA) and Human-Centered Design (HCD), the findings underscore the pivotal role of community-led initiatives and tailored sanitation programs in realizing open defecation-free communities.

Emphasizing the necessity of understanding social norms, cultural beliefs, and local demands for effective sanitation strategies, the study suggests that ICT stands as a potent force for amplifying awareness and encouraging the adoption of sanitation technology in rural landscapes.

In light of these insights, practical recommendations for policymakers and practitioners emerge:

### 1. Amplifying Stakeholder Engagement:

- Extend the discourse on the involvement of government agencies and NGOs in supporting rural sanitation efforts. Foster collaborative partnerships and resource mobilization to fortify and expand initiatives.

### 2. Ensuring Long-Term Sustainability:

- Scrutinize the enduring sustainability prospects of the sanitation initiatives outlined in the study, particularly in maintaining open defecation-free status. Establish mechanisms for continuous monitoring, evaluation, and adaptive management to ensure sustained success.

These recommendations offer pragmatic guidance for leveraging ICT in the effective implementation of sanitation awareness programs in rural contexts, contributing to the broader discourse on enhancing public health and hygiene practices.

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