

# **Improving Delivery of Sustainable Rural Sanitation by Applying Systems Thinking**

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**2017RDZ8224**

## **ABSTRACT**

Sustainable sanitation remains a significant challenge in many parts of rural India, where rapid demographic shifts, resource limitations and gaps in governance are impacting sustainability of sanitation solutions and natural resources. This study applies a systems thinking approach to explore the complexities of rural sanitation service delivery by focusing on the interconnections of infrastructure, stakeholder participation and behaviour change.

A comprehensive literature review was conducted to establish the foundation of the study through four focus areas namely- sanitation interventions, issues in implementation, context-specific innovations and integration of strategies for identifying the gaps and areas of further interventions required in the existing system. The review mapped the gaps in the existing system revealing that while infrastructure-based interventions have improved the sanitation coverage of the country; usability, maintenance and long-term sustainability of sanitation facilities remain a major concern. Despite many policy-level interventions such as Swachh Bharat Mission (SBM), achieving a sustainable sanitation system requires a more holistic, multi-dimensional approach that considers not only tangible factors such as infrastructure, but also considers intangible factors such as socio-cultural behaviours, economic and environmental sustainability. Many government initiatives have been continuously working towards improving delivery of water and sanitation facilities, but failed to consider the aspects of maintenance of the facilities, waste management system, water scarcity and population growth combined with a shifting demography. Additionally, sanitation solutions often fail to account for the diverse needs of different demographic groups, such as elderly, women and people with disabilities. The study highlights the need for contextualised, user-centric approaches that integrate socio-cultural practices of the local communities along with technological advancements to create a sustainable sanitation ecosystem.

This research applies a mixed-methods approach combining qualitative and quantitative data collection methods to capture data through field studies in Uttar Pradesh and Assam, for analysing the current sanitation scenarios, user experiences and systems for policy implementation. The field study locations were selected with a motive to understand the existing scenario of the sanitation ecosystem in two regions representing distinct socio-environmental conditions. The western region of Uttar Pradesh was studied which is going through a rapid urban expansion and water contamination, while Assam with its

flood-prone geography and humid climate conditions struggles with seasonal disruptions to sanitation infrastructure and crisis in water access.

The findings in these areas indicate that there are many systemic challenges that persist in the sanitation system. It is found that the waste management systems in the rural areas are still inefficient or non-existent which is increasing the risk of disease and environmental degradation. The lack of context specific strategies for stakeholders and their behaviour change leads to communities often reverting back to old habits such as open defecation considering non-functional toilet facilities or issues of water accessibility. An Actionable Framework is proposed by the research integrating persona specific solutions and an index for sustainable systems with the use of Digital Twin technology for real-time monitoring. The research emphasises on the importance of contextualised and participatory way of problem solving through inculcation of nature centric values and awareness for ensuring long-term viability and sustainability of rural sanitation systems.

The study concludes that ensuring long-term viability of rural sanitation systems requires adoption of contextualized, behaviourally informed and nature-centric strategies that can bridge the existing gaps in sanitation service delivery to establish a sustainable sanitation system for the present and future generations of human society.

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