Civil, Environmental and Architectural Engineering

UNIVERSITY OF COLORADO **BOULDER**

PhD Thesis Defense

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Sustainable Sanitation Systems: Understanding Priorities, Processes, and Pathways to Success

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Faculty Advisor: Dr. Amy Javernick-Will and Dr. Sherri M. Cook

Abstract:

Despite the unprecedented time, attention, and finances dedicated to increasing global access to sanitation, sanitation systems continue to fail at unacceptably high rates. Sanitation failure is a global concern, especially due to diminished public and environmental health and heightened economic costs. A commonly cited reason for sanitation failure is the selection of inappropriate technologies that do not address local priorities. To further evaluate this possible reason for failure, this dissertation employed a multi-method approach in 20 resource-limited communities in southern India with small-scale sanitation systems. Since sanitation priorities are mostly unknown, this research first focused on how to best identify a community's priorities. Findings demonstrated that interviews with community members most effectively identified sanitation priorities, contrary to common practices of using focus groups or interviewing community leaders. In addition, most priorities, and their ranked order, were community-specific, highlighting the need to conduct priority assessments in each community. If priorities are important for sanitation systems to be used and maintained, there need to be better ways to evaluate the potential of different sanitation technologies to address these priorities. As a result, a new social sustainability assessment was created to evaluate the ability of existing sanitation systems to address priorities and the potential of sanitation technologies to improve addressment. Application of this protocol showed that addressment could be improved by ensuring systems function according to their intended designs, increasing knowledge of priorities in planning, or adding resource recovery when communities value those benefits. To better understand how priority addressment, and other factors, contribute to sanitation failure and success, a qualitative comparative analysis was conducted. Results revealed that sanitation success required adequate maintenance funds, clear maintenance plans, technical support, stakeholder engagement, and community buy-in; failed systems lacked these important factors. Finally, to evaluate how sanitation sustainability is and should be measured, a comparison of six frameworks was conducted. While these frameworks include multiple pillars of sustainability, numerous and varied indicators are used, and results do not clearly distinguish between sustainable and unsustainable systems. Therefore, framework effectiveness could be improved by ensuring indicators have clear metrics, sustainable sanitation is defined, and frameworks account for context-specific differences. Overall, the results from this dissertation provide tools and recommendations to help implementing organizations, communities, and municipalities improve sustainable sanitation in resource-limited communities.

Allie is a PhD candidate in civil engineering at CU Boulder. She received her B.S. in civil engineering from Cal Poly and her M.S. in civil engineering/civil systems from CU Boulder. She also completed the Engineering in Developing Communities certificate from the Mortenson Center in Global Engineering. Allie's research has focused on sanitation in India which shaped her longstanding interests in infrastructure in resource-limited contexts and in foreign policy. Allie recently accepted the AIP State Department Fellowship and will move to D.C. this fall to pursue her foreign policy interests.