

SMART BOREHOLE MONITORING SYSTEM

Problem Statement

1. In rural Limpopo, boreholes are the primary source of water for irrigation, livestock, and domestic use among small-scale farmers. However, these farmers face a growing crisis of unmonitored and unreliable borehole performance.

Because most boreholes lack any form of real-time monitoring, farmers only realize water scarcity when pumps suddenly run dry—often in the middle of a planting season—leading to total crop failure, food insecurity, and loss of income.

2. The problem is intensified by erratic rainfall patterns and declining groundwater levels. Many of Limpopo's aquifers are unconfined and rely on seasonal rainfall recharge, causing severe fluctuations in water availability. In areas such as Dalmada, Seshego, and Mogwadi, farmers have been forced to abandon food gardens seasonally due to unreliable water supply.
3. Empirical studies show that four out of six villages in rural Limpopo have failed or non-functional borehole systems, with infrastructure left to deteriorate. Across Africa, over 50 000 water points have failed, representing a loss of US\$215–360 million in investment. In addition, groundwater quality is deteriorating: 33% of boreholes in Vhembe tested positive for *E. coli* contamination, posing health risks to both humans and livestock.
4. The high cost of drilling new boreholes—R50 000 to R150 000 or more—places modern water management solutions out of reach for most smallholders. As a result, these communities face increasing vulnerability to climate change, declining agricultural productivity, and reduced resilience to drought.
5. Without an effective monitoring and prediction system, farmers cannot plan irrigation schedules, crop cycles, or water-sharing practices. The lack of data-driven decision-making leads to over-extraction, aquifer depletion, and eventual borehole collapse—further deepening rural poverty and dependence on unreliable rainfall.