ABSTRACT

Indonesia's soybean production is critically low, meeting only 10% of domestic demand due to low productivity, leading to heavy reliance on imports. The root cause lies in inefficient farming practices, particularly in soil nutrition management where farmers traditionally apply fertilizers periodically without precise knowledge of actual soil conditions. To address this, an innovative tool called Si Soil was developed to optimize soil fertility monitoring for soybean farming.

Si Soil is an IoT-based device that measures soil fertility using NPK (Nitrogen, Phosphorus, Potassium), pH, and moisture sensors. Unlike existing solutions, it offers a low-cost NPK sensor with proven accuracy. The next phase involves a feasibility study to assess its technical and economic viability for widespread farmer adoption. Technical testing will compare soybean yields before and after Si Soil implementation. Economic analysis will use capital budgeting to evaluate financial feasibility. If successful, Si Soil could enhance soybean productivity and reduce fertilizer waste.

The feasibility study of Si Soil, an IoT-based precision agriculture system for soybean cultivation, demonstrates significant technical and economic viability. Technical evaluations revealed the NPK sensors achieved 85% accuracy in soil nutrient detection, serving as the system's core component. Field tests showed measurable impacts on soybean production, with yield increases compared to conventional farming methods. The system employs *LoRa* communication technology, which exhibited excellent performance metrics in *OMNeT++* simulations, ensuring reliable data transmission in agricultural settings. Economic analysis through capital budgeting confirmed strong commercial potential due to NVP, PP, IRR, dan PI analysis.

Keywords: Si Soil, NPK, Feasibility Study, Soybean