Making geospatial technology work from farm to policy scales in West Africa

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Abstract

Despite growing efforts to promote sustainable intensification (SI) in West Africa, decisions around input use, land management, and risk often rely on coarse data or fragmented systems. Geospatial technologies can play a key role in improving how smallholder farmers, value chain stakeholders, institutions, and policymakers manage resources and uncertainty. These tools address challenges, such as the shortage of insurance claims assessors and suboptimal input use. Field boundary delineation is particularly relevant, with potential to support input planning, verify field size in labour arrangements, and facilitate yield loss assessments. While farmers can engage with these tools when properly trained, adoption remains limited due to social, technical, and institutional barriers, with additional concerns about how digitisation may perpetuate inequities or increase farmers' exposure to external pressures.

To understand these challenges, we apply the Technology Acceptance Model (TAM) to assess perceived usefulness, ease of use, and behavioural intentions towards geospatial tools among smallholder farmers in northern Ghana and Senegal. Data come from participatory field mapping workshops, focus group discussions, and socioeconomic surveys covering demographics, smartphone ownership, and adoption of sustainable practices such as System of Rice Intensification (SRI) and Integrated Soil Fertility Management (ISFM). Farmers acknowledged the benefits of field mapping for planning and oversight but cited persistent barriers, including limited smartphone access, digital literacy, GPS inaccuracy, and poor network coverage. Barriers varied by gender and age, with 20 % of men and only 3 % of women in northern Ghana owning a smartphone. Still, "adoption champions" emerged across demographics—farmers who engaged in innovative farming practices and digital tools, and who supported peer learning.

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We analyse these findings within broader institutional and data coordination systems with financial and governance implications. Remote sensing (RS) shows growing potential for large-scale field delineation and crop monitoring to inform policy, subsidy allocation, and insurance. However, in smallholder settings, RS-based tools depend heavily on ground-truthing by extension agents, who validate data with local knowledge and deliver tailored support. In contexts of limited trust among farmers, extension agents, decisionmakers, and other actors, enhancing transparency and data accuracy can drive more equitable, resilient SI—if intelligently co-constructed across scales and roles.