Making Geospatial Technology Work From Farm to Policy Scales in West Africa

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BACKGROUND

Left: Current practice of rice farming (broadcast seeding), right: Resource-efficient rice farming at a farmer field school in Podor, Senegal.

- **Sustainable intensification (SI) in West Africa** is constrained by **fragmented and coarse data**
- **Geospatial technologies** can improve how **farmers and institutions manage resources and risks**
- **Field boundary mapping** is relevant for farm management, service provision, and policy support
- **Adoption is uneven** due to technical, social, and institutional barriers across actors
- **Risks** remain that digitisation **reinforces inequities** or farmer dependency **if not managed inclusively**
- This research **maps geodata flows and bottlenecks** across **farmers and institutions** to understand **how geospatial tools can support SI**

METHODS

Analytical lens: Technology Acceptance Model (TAM)

- **Perceived usefulness, ease of use, behavioural intention[1] / opportunities**
- **Study sites: Northern Senegal & northern Ghana**

Small-scale farmers
- **Workshops**: Participatory mapping using smartphones & GPS
- **Focus groups**: Farmer experiences & challenges
- **Socioeconomic surveys**: Demographics, smartphone ownership, adoption of sustainable practices (SRI, ISFM*)

Institutions
- **Focus groups**: Extension staff, financial & research institutions
- **Expert interviews:** Geodata use, storage, sharing practices

Large-scale planning & policy
- **Large-scale geodata**: Remote sensing-based agricultural mapping, field boundary data aggregation, and ground validation requirements

*System of Rice Intensification, Integrated Soil Fertility Management

RESULTS

Representation of smallholder realities in large-scale statistics

Subsidy allocation
Land registration / tenure frameworks
Climate risk & disaster response programs

Small-scale Farmers

- **Adoption practices**: Varied use of agriculture apps with and without geolocation information
- **Perceived usefulness**: Input planning and labour verification; partly strong interest in geotools, partly mistrust
- **Ease of use**: Barriers from GPS inaccuracy, language / literacy, digital skills
- **Gender dimension**: Sharp contrast in smartphone ownership (20% men vs. 3% women in Ghana; N=1001)
- **Opportunities**: Emergence of "**adoption champions**" across demographics; inclusion of **low-barrier geotools in trainings**

Participatory mapping in Podor, Senegal, Feb 2024.

Verified spatial information

Advice, credit, loans, insurance

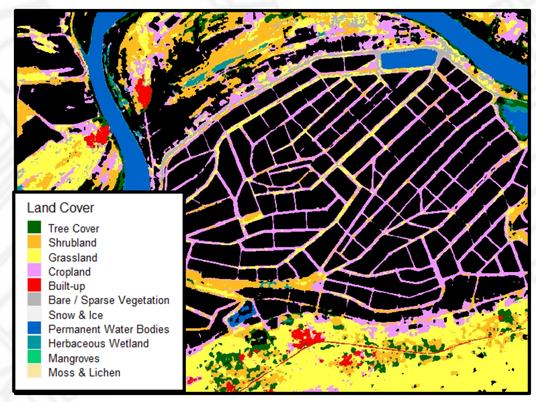
The value of geospatial technology lies in how data, people, and institutions connect and interact

National targets and standards
Large-scale data for finance products (e.g. index insurance)

Aggregated and validated geodata
Technical assessments / monitoring reports

Large-scale Planning & Policy

- **Perceived usefulness**: Remote sensing offers scalable field delineation and crop monitoring, valuable for subsidy allocation, insurance design, and national planning
- **Ease of use & integration:** Effectiveness depends on combining remote sensing outputs with ground data provided by farmers and extension agents
- **Equity and representation**: Risks if smallholder perspectives are not incorporated
- **Opportunities**: Improve trust and governance issues; transparency in data handling and sharing required



Sentinel-2-based field boundary delineation against ESA WorldCover.

Institutions

Public agricultural agencies / development authorities
Insurance providers
Financial institutions / banks
Research institutions
Private sector / ag-tech companies

- **Extension agents as validators**: Time / workload constraints
- **Perceived usefulness**: Insurance verification, subsidy targeting, bank loans
- **Ease of use**: Institutional bottlenecks regarding training, digitization gaps, and data handling capacity
- **Opportunities**: Integration of farmer-generated data, workflow efficiency, increased credibility in claims assessment

[1]Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Science*, 35(8), 982–1003.

CONCLUSIONS & RECOMMENDATIONS

- **Barriers and enablers across all levels:**
  → **Barriers**: (Digital) literacy, gendered access, training deficits, institutional resource constraints, data governance gaps
  → **Enablers**: Peer learning and digital champions, institutional interest in efficiency, co-construction of data
- **Center farmer perspectives**: Geospatial technologies enhance sustainability in West African agriculture when farmers' skills, constraints, and perceived value guide design, use, and training
- **Use hybrid approaches**: Combine farmer-driven mapping with remote sensing to improve accuracy and applicability of geospatial outputs
- **Align tools across scales**: Ensure institutional and farmer-level tools are compatible

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COINS
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