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ICT Integration in Agricultural Extension: A Comparative Study of India and Lesotho

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Abstract: -

Information and Communication Technologies (ICTs) are changing the way farmers receive and use agricultural information, making vital knowledge more accessible, and timely than ever before. This study compares how India and Lesotho are integrating ICTs into their agricultural extension systems, looking closely at the tools they rely on, the benefits for farmers, the challenges they face, and what each country can learn from the other. In India, digital innovations such as mobile apps, online platforms, artificial intelligence tools, and social media are supported by strong policies and widespread digital infrastructure. Lesotho, although limited by connectivity challenges and mountainous terrain, makes effective use of radio programmes, SMS alerts, community ICT centres, and NGO-supported advisory services to reach its smallholder farmers. The findings show that ICTs are helping farmers in both countries make more informed decisions, access better markets, adapt to changing weather, and adopt improved practices. Yet digital literacy gaps, poor infrastructure, language issues, and funding constraints still hinder progress. The study encourages mutual learning to build more inclusive and practical ICT strategies for sustainable agricultural development.

Keywords: ICT, Extension, Agricultural, Lesotho etc.

1. Introduction:

Information and Communication Technologies (ICTs) have emerged as transformative tools in agricultural extension, enabling the dissemination of timely, relevant, and location-specific information to farmers. ICT encompasses a wide range of technologies including mobile telephony, internet platforms, radio, television, and satellite systems. In the

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context of agriculture, ICT facilitates access to weather forecasts, market prices, pest alerts, and best practices, thereby enhancing productivity, resilience, and sustainability (Saravanan, 2020; Nyambam & Mlozi, 2012).

Agricultural extension is the process of transferring innovations, research findings, and practical knowledge from institutions to farmers. Traditionally reliant on face-to-face interactions and printed materials, extension services have increasingly adopted ICTs to overcome logistical and resource constraints, particularly in rural and remote areas (Nzonzo & Mogambi, 2016). This shift has allowed for broader outreach and more dynamic engagement with farming communities.

In the context of developing nations, access to accurate and actionable information is now recognized as a critical asset. Farmers require real-time data on weather, market prices, pest outbreaks, and agronomic practices to make informed decisions and seize opportunities for growth (Mojaki & Keregero, 2019). Strengthening the flow of agricultural information, both vertically from institutions and horizontally among farmers, has been shown to improve smallholder productivity, link farmers to profitable markets, and contribute to national food security and economic development (Dankwah & Hawa, 2014).

Oladele (2006) emphasizes that ICTs reduce transaction costs and open new communication channels, thereby enhancing the efficiency and integration of agricultural systems. This perspective is echoed across the literature, which consistently highlights ICT as a driver of rural transformation and social inclusion.

India and Lesotho offer contrasting yet instructive examples of ICT integration in agricultural extension. India, with its vast agricultural landscape and over 118 million farmers, has leveraged mobile applications, e-platforms, and artificial intelligence tools to scale digital extension services (Singh *et al*., 2023). Lesotho, a small landlocked country in Southern Africa, faces infrastructural limitations but has innovated with radio broadcasts, SMS alerts, and community ICT centres to support its predominantly subsistence farming population (Akintunde & Oladele, 2019).

This study aims to:

1. Compare ICT tools used in agricultural extension in India and Lesotho.
2. Analyse the impact of ICT on farmers' decision-making and livelihoods.
3. Evaluate challenges and limitations in ICT adoption.
4. Explore opportunities for cross-learning and collaboration.

2. ICT Tools in Agricultural Extension India

India's ICT ecosystem in agriculture is multifaceted, reflecting its scale, diversity, and policy support.

Mobile Applications

India has witnessed a proliferation of agricultural mobile apps:

- *Kisan Suvidha*: Offers weather forecasts, market prices, and expert advice.
- *IFFCO Kisan*: Provides multilingual content and expert consultations.
- *mKisan*: SMS-based advisory platform by the Ministry of Agriculture.
- *AgriApp*, *RML AgTech*, and *CropIn*: Private sector innovations offering precision farming and analytics.

These apps are accessible via smartphones and increasingly cater to regional languages, enhancing usability amongst rural populations.

E-Platforms

- *e-Choupal*: Developed by ITC Ltd., connects farmers to markets and information hubs.
- *Agmarknet*: Disseminates market data from over 7,000 markets.
- *Digital Green*: Uses community videos for farmer training and peer learning.

Advanced Technologies

India has integrated cutting-edge technologies into extension services:

- Remote sensing and GIS for crop monitoring and land use planning.
- AI tools for pest prediction, irrigation scheduling, and yield forecasting (Kumar *et al.*, 2024).

Social Media and Community Networks

- WhatsApp groups facilitate peer-to-peer learning and expert outreach.
- YouTube channels such as *Krishi Jagran* and *AgriGuru* offer tutorials, market updates, and success stories.

India's mobile subscriber base exceeds 1.1 billion, with rural internet penetration reaching 37% in 2023 (TRAI, 2023).

Lesotho

Lesotho's ICT tools are tailored to its terrain, infrastructure limitations, and socio-economic context.

Radio and SMS Alerts

- *Lesotho Agricultural Information Service* broadcasts weather updates, farming tips, and market information.
- SMS services by *Vodacom Lesotho* and *World Vision* provide crop advisories and alerts.

Radio remains the most accessible medium, reaching over 80% of rural households (Lesotho Bureau of Statistics, 2022).

As a prove that radio remains one of the most widely used ICT tools for agricultural extension, particularly in remote and mountainous regions. A notable feature of these broadcasts is the phrase "Re bitsa lihoai" meaning "We call the farmers" which is used to open programmes and signal that the content is specifically designed for rural farming communities. This culturally resonant phrase fosters a sense of inclusion and ownership, encouraging farmers to engage actively with the information presented. According to Nthama and Oladele (2024), radio-based extension services in Lesotho have significantly influenced the adoption of practices such as organo-mineral fertilisers and soil conservation techniques.

Community ICT Centres

Thaba-Tseka ICT Centre and *Maseru Rural Hub* offer training, internet access, and digital literacy programmes.

- Supported by the Ministry of Communiations and UNESCO, these centres serve as digital bridges for remote communities.

NGO-Led Mobile Advisory Services

- *World Vision Lesotho*: Provides SMS-based alerts and training modules.
- *FAO Lesotho*: Piloted e-extension platforms in collaboration with local extension officers.
- *Send a Cow Lesotho*: Offers mobile-based agricultural advice and community engagement.

Despite limited infrastructure, mobile penetration in Lesotho is around 75%, and there is growing enthusiasm amongst extension professionals for e-extension adoption (Mojaki & Keregero, 2019).

3. Comparative Analysis

Dimension	India	Lesotho
ICT Infrastructure	Advanced; high mobile and internet penetration	Limited; especially in rural highlands
Farmer Literacy & Access	Moderate to high; increasing digital literacy	Low; especially among older and remote populations
Government Support & Policy	Strong; Digital India, eNAM, National e-Governance Plan	Growing; donor-driven, Ministry of Agriculture initiatives
Scale of Implementation	National; millions of farmers	Localised; focused on smallholder communities
Strengths	Scalability, innovation, multilingual platforms	Community engagement, radio accessibility
Weaknesses	Digital divide, coordination gaps	Infrastructure, funding, technical capacity

India benefits from robust infrastructure and policy frameworks, enabling large-scale deployment of ICT tools. Lesotho, while constrained by geography and resources, has leveraged community-driven models and low-tech solutions to reach its farmers effectively.

4. Impact on Farmers

ICT tools have significantly enhanced farmers' decision-making capabilities in both countries.

India

- Mobile apps and e-platforms provide real-time data on weather, pests, and market prices.
- Farmers report improved planning, reduced input costs, and better market access.
- WhatsApp groups and YouTube tutorials foster peer learning and rapid dissemination of expert advice (Singh et al., 2023).

Lesotho

- Radio and SMS services help farmers adapt to climate variability, improve livestock care, and access new techniques.
- Community ICT centres promote digital inclusion and localised learning.
- Farmers report increased awareness, adoption of improved practices, and better engagement with extension officers (Akintunde & Oladele, 2019).

While India's ICT tools offer precision and scale, Lesotho's tools are more accessible to low-literacy users and foster community resilience.

5. Challenges and Limitations

Despite their successes, both countries face significant challenges in ICT adoption.

- **Digital Divide**: In India, rural-urban gaps persist; in Lesotho, digital literacy is low.
- **Infrastructure Gaps**: Electricity and internet access are unreliable in Lesotho's highlands and India's tribal regions.
- **Language and Cultural Barriers**: India's linguistic diversity complicates content delivery; Lesotho faces dialect-specific challenges.
- **Funding and Sustainability**: NGO-led initiatives in Lesotho depend on external funding; India faces coordination issues among stakeholders (FAO, 2021; Akintunde & Oladele, 2019).

These challenges underscore the need for context-specific solutions and inclusive strategies.

6. Opportunities for Cross-Learning

India → Lesotho

- Scalable mobile platforms like *mKisan* and AI-based advisory systems could be adapted for Lesotho's context.
- India's experience with multilingual content delivery can help Lesotho reach diverse communities.

Lesotho → India

- Community-driven ICT models emphasising local engagement and low-cost solutions offer valuable lessons.
- Lesotho's use of radio and SMS in remote areas can inspire India's outreach in tribal and hilly regions.

Joint Initiatives

- Collaborative research, capacity building, and shared digital resources can foster innovation and resilience.
- International organisations such as FAO and World Bank can facilitate knowledge exchange and funding support (World Bank, 2022).

7. Conclusion

ICT has emerged as a transformative force in agricultural extension, making information more accessible, timely, and actionable. India and Lesotho, despite their differences in scale and infrastructure, demonstrate the potential of digital tools to empower farmers. Context-specific, inclusive, and farmer-centred ICT strategies are essential to maximise impact. Cross-learning and collaboration between nations can accelerate progress towards sustainable agriculture and rural development.

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