

2. Adoption of Mobile-Based Advisory Services by Smallholder Farmers: Drivers, Barriers, and Impact on Decision-Making

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1. Introduction

The agricultural sector, particularly in developing economies, is characterised by a high proportion of smallholder farmers operating in resource-constrained environments. These farmers are often at the mercy of unpredictable weather patterns, volatile market prices, pest and disease outbreaks, and limited access to critical inputs and knowledge. Traditional agricultural extension services, while valuable, often struggle to reach remote areas effectively due to funding limitations, infrastructure deficits, and a low ratio of farmers to extension workers (Aker *et al.*, 2011). This information asymmetry significantly hinders productivity, profitability, and climate resilience for smallholder farmers.

In recent decades, the widespread proliferation of mobile phone technology, even in rural areas, has presented an unprecedented opportunity to democratize access to agricultural information. Mobile-based advisory services (MBAS) leverage this ubiquitous technology to deliver tailored agricultural advice, market

intelligence, weather updates, and other crucial information directly to farmers' handsets. These services range from simple SMS-based alerts to interactive voice response (IVR) systems, dedicated mobile applications, and even video-based content (Cole & Ofori-Dwumfuo, 2017). The potential of MBAS to transform smallholder agriculture by enhancing informed decision-making and improving livelihoods is increasingly recognised.

This article aims to provide a structured overview of the adoption dynamics of MBAS among smallholder farmers. We delve into the principal drivers that encourage farmers to embrace these services and the persistent barriers that impede wider adoption. Furthermore, we explore the tangible and intangible impacts of MBAS on various facets of farmers' decision-making processes, from input selection to market participation.

2. Conceptual Framework: Technology Adoption in Agriculture

The adoption of agricultural technologies, including information and communication technologies (ICTs) such as MBAs, is a

complex process influenced by myriad factors. Rogers' Diffusion of Innovations theory (2003) provides a foundational framework, emphasising five key attributes of an innovation that affect its adoption rate: relative advantage, compatibility, complexity, trialability, and observability. In the context of MBAS, these attributes manifest as follows:

- a. **Relative Advantage:** The perceived benefits of using MBAS compared to traditional information sources (e.g., higher yields, better prices, reduced risk).
- b. **Compatibility:** How well MBAS align with existing farming practices, cultural norms, and farmers' information-seeking behaviours.
- c. **Complexity:** The ease of understanding and using the MBAS interface and content.
- d. **Trialability:** The ability of farmers to experiment with MBAS on a limited basis before full adoption.
- e. **Observability:** The visibility of the results and benefits of using MBAS to other farmers.

Beyond these innovation-specific attributes, other socio-economic, institutional, and technological factors also play crucial roles. This article integrates

these broader factors into its analysis of MBAS adoption.

3. Drivers of MBAS Adoption

Several compelling factors encourage smallholder farmers to adopt MBAS. These drivers can be categorised into economic, informational, social, and technological aspects.

3.1. Economic Drivers

The promise of improved economic outcomes is perhaps the most potent motivator for MBAS adoption.

- a. **Increased Productivity and Yields:** Access to timely information on optimal planting times, fertiliser application, pest control, and irrigation techniques can lead to improved crop management and higher yields.
- b. **Better Market Access and Prices:** MBAS often provide real-time market price information, enabling farmers to make informed decisions about when and where to sell their produce, thereby maximising profits and reducing exploitation by intermediaries.
- c. **Reduced Risk and Losses:** Weather forecasts can help farmers mitigate risks associated with extreme weather events, while alerts on disease outbreaks can facilitate

timely interventions, minimising crop losses.

3.2. Informational Drivers

The inherent value of accessible and relevant information is a significant pull factor.

- a. **Timely and Accurate Information:** MBAS can deliver information far more rapidly and frequently than traditional extension methods, which is critical for time-sensitive agricultural decisions.
- b. **Personalised Advice:** Advanced MBAS can tailor advice based on a farmer's specific crop, soil type, location, and stage of cultivation, making the information highly relevant.
- c. **Diverse Information Offerings:** Beyond basic agronomy, MBAS often include information on credit, insurance, post-harvest management, and government schemes, providing a holistic support system.

3.3. Social and Institutional Drivers

External influences from peers, communities, and support structures also play a role.

- a. **Peer Influence and Social Learning:** Successful adoption by early adopters within a community

can create a demonstration effect, encouraging others to try MBAS.

- b. **Trust in Information Source:** Farmers are more likely to adopt services provided by trusted organisations, be they government bodies, NGOs, or reputable private companies.
- c. **Government and NGO Support:** Initiatives by governments and non-governmental organisations to promote and subsidise MBAs can significantly boost adoption rates.

3.4. Technological Drivers

The evolving landscape of mobile technology itself contributes to adoption.

- a. **Increasing Mobile Penetration:** The sheer number of mobile phone users in rural areas provides a vast potential audience for MBAS.
- b. **Affordability of Handsets and Services:** Declining costs of basic mobile phones and competitive tariff plans make MBAS more accessible.
- c. **Ease of Use of Mobile Interfaces:** As mobile interfaces become more intuitive and user-friendly, even less digitally literate farmers can engage with MBAS.

4. Barriers to MBAS Adoption

Despite the compelling drivers, several significant barriers hinder the widespread and sustained adoption of MBAS among smallholder farmers.

4.1. Economic Barriers

Financial constraints can limit access and usage.

a. **Cost of Mobile Phones and Data:**

While declining, the initial cost of a smartphone and recurring data or subscription fees can still be prohibitive for the poorest farmers.

b. **Low Digital Literacy:** Many smallholder farmers, particularly older generations, lack the necessary literacy and numeracy skills to use mobile applications or even navigate complex SMS menus effectively.

4.2. Infrastructural and Technological Barriers

External limitations often impede effective service delivery.

a. **Limited Network Coverage:** Rural and remote areas often suffer from poor or non-existent mobile network coverage, rendering MBAS inaccessible.

b. **Irregular Power Supply:** Lack of reliable electricity for charging mobile phones is a pervasive issue in many farming communities.

c. **Feature Phone Dominance:** While smartphones are becoming more common, many smallholder farmers still rely on basic feature phones, limiting the types of MBAS they can access (e.g., sophisticated apps).

4.3. Content and Service Design Barriers

The design and relevance of the services themselves can deter adoption.

a. **Lack of Localisation and Context-Specificity:** Generic advice that does not account for local soil conditions, climate, cropping patterns, or cultural practices is often disregarded by farmers.

b. **Language Barriers:** Information not provided in local languages can be a significant deterrent.

c. **Trust and Credibility Issues:** Farmers may be sceptical of information from unknown sources or if initial advice proves inaccurate or unhelpful.

d. **Information Overload:** Farmers can be overwhelmed by too much information, especially if it is not well-structured or prioritised.

4.4. Socio-Cultural and Institutional Barriers

Deep-seated social norms and institutional structures can impede adoption.

- a. **Gender Disparities:** Women farmers often have less access to mobile phones, lower digital literacy, and less control over household resources, limiting their ability to adopt MBAS.
- b. **Resistance to Change:** Some farmers may be set in their traditional practices and resistant to adopting new technologies or advice.
- c. **Weak Linkages with Traditional Extension:** MBAS are most effective when integrated with, rather than replacing, face-to-face extension, but such integration is often lacking.

Table 1: Summary of Drivers and Barriers to MBAS Adoption

Category	Drivers	Barriers
Economic	Increased yields, better market prices, reduced losses, and cost savings	Cost of devices & data, poverty
Informational	Timely & accurate data, personalised advice, diverse offerings	Generic content, language barriers, information overload, trust deficit
Technological	High mobile penetration, affordability of devices, ease of use	Poor network coverage, irregular power supply, and feature phone limitations
Socio-Cultural/Inst.	Peer influence, trusted sources, government support	Low digital literacy, gender gap, resistance to change, and

		weak extension links
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5. Impact of MBAS on Farmers' Decision-Making

The ultimate goal of MBAS is to empower smallholder farmers with the information needed to make better, more informed decisions. The impact can be observed across various stages of the agricultural value chain.

5.1. Pre-Production Decisions (Planning)

- a. **Crop Selection:** Access to market demand forecasts and price trends helps farmers choose crops with higher profitability potential.
- b. **Input Procurement:** Information on the quality and availability of seeds, fertilisers, and pesticides, along with price comparisons, enables optimal input purchase decisions.
- c. **Weather-Based Planning:** Accurate weather forecasts assist in deciding planting dates, irrigation schedules, and protective measures against adverse weather events.

5.2. Production Decisions (Farm Management)

- a. **Pest and Disease Management:** Real-time alerts and recommendations on identifying and managing pests and diseases

facilitate timely intervention, reducing crop damage.

b. Fertiliser and Water

Management: Tailored advice on optimal nutrient application and irrigation techniques leads to more efficient resource use and higher yields.

c. Harvesting Timeliness:

Information on optimal harvest times based on crop maturity and market readiness can maximise quality and returns.

5.3. Post-Production and Marketing Decisions

a. Market Channel Selection:

Access to diverse market price information helps farmers choose the most remunerative selling points and channels.

b. Price Negotiation:

Armed with market data, farmers are in a stronger position to negotiate fair prices for their produce, reducing exploitation by intermediaries.

c. Storage and Value Addition:

Advice on post-harvest handling, storage techniques, and potential for value addition can extend shelf life and increase product value.

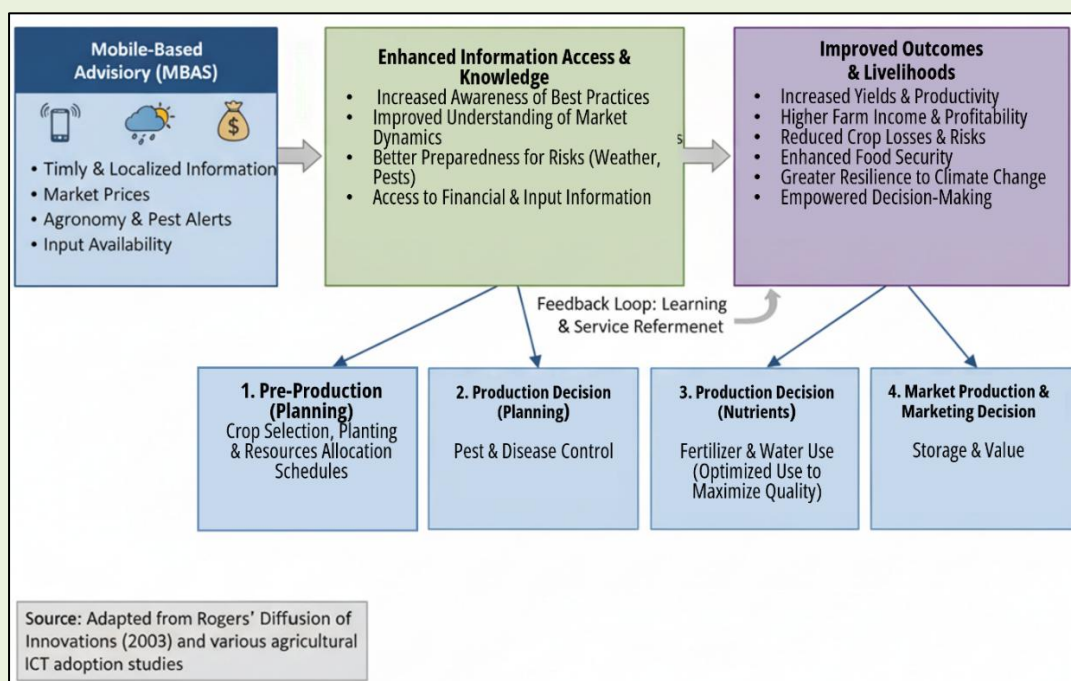


Figure 1 : Impact Pathways of MBAS on Smallholder Farmers' Decision-Making

6. Case Studies and Empirical Evidence

Numerous studies have empirically demonstrated the impact of MBAS. For instance, a study in India by Muto and Yamano (2009) found that farmers

receiving price information via mobile phones increased their profits by 10% due to better selling decisions. Similarly, the Esoko platform in Ghana has been shown to improve farmers' access to market

information, leading to better price realisation. In Kenya, the iCow platform, which provides dairy farming advice, has been associated with increased milk yields among subscribing farmers (Cole & Ofori-Dwumfuo, 2017).

However, it is also important to note that the impact is not uniformly positive and depends heavily on service quality, the deployment context, and the socio-economic characteristics of the target farmers. Challenges such as information overload, irrelevance, and insufficient digital literacy can limit the realised benefits.

7. Policy Implications and Recommendations

To maximise the potential of MBAS for smallholder farmers, a multi-faceted approach involving policymakers, service providers, and researchers is necessary.

7.1. Policy Recommendations

a. Infrastructure Development:

Governments must prioritise investments in rural mobile network coverage and reliable electricity supply to ensure equitable access.

b. Digital Literacy Programs:

National and local initiatives are needed to enhance digital literacy among farming communities, specifically targeting women and older farmers.

c. Enabling Regulatory

Environment: Policies that encourage private sector participation in MBAS, promote data sharing, and protect farmer data privacy are crucial.

d. Integration with Traditional

Extension: Policies should foster collaboration between MBAS providers and traditional extension services to create a synergistic approach, rather than viewing them as competing entities.

7.2. Recommendations for Service Providers

a. Context-Specific and Localised

Content: Develop highly localised services, considering local languages, agro-ecological zones, and specific farming systems.

b. User-Centric Design:

Involve farmers in the design and testing phases to ensure services are intuitive, easy to use, and address their real information needs.

c. Tiered Services:

Offer a range of services from basic SMS alerts (for feature phone users) to advanced app-based solutions (for smartphone users) to cater to diverse technological capabilities.

d. Build Trust and Credibility:

Partner with trusted local

organisations, provide verifiable information, and demonstrate tangible benefits to build farmer confidence.

- e. **Sustainability Models:** Explore diverse business models that ensure the long-term financial viability of MBAS, potentially combining user fees with subsidies or public-private partnerships.

7.3. Recommendations for Future Research

- a. **Longitudinal Impact Studies:** More long-term studies are needed to understand the sustained impact of MBAS on farmer livelihoods, resilience, and poverty reduction.
- b. **Gender-Disaggregated Analysis:** Research should specifically investigate how MBAS adoption and impact differ for women and men farmers, and how services can be designed to address gender-specific barriers.
- c. **Cost-Benefit Analysis:** Rigorous economic evaluations are required to quantify the return on investment for farmers and other stakeholders.
- d. **Role of Intermediaries:** Explore the role of community-level intermediaries or "agripreneurs" in facilitating MBAS adoption and usage.

e. Integration of AI and Big Data:

Investigate how emerging technologies like Artificial Intelligence and Big Data analytics can enhance the personalisation and predictive capabilities of MBAS.

8. Conclusion

Mobile-based advisory services hold immense promise for revolutionising smallholder agriculture by providing timely, relevant, and actionable information to farmers who historically have been underserved. While the drivers for adoption are substantial, significant barriers remain in infrastructure, digital literacy, and service design. Addressing these challenges through targeted policy interventions, user-centric service design, and continuous research is crucial for unlocking the full potential of MBAS. By empowering smallholder farmers with better information, MBAS can significantly enhance productivity, improve livelihoods, increase food security, and increase resilience to the evolving challenges of climate change. The future of agricultural extension lies in harnessing mobile technology to foster informed decision-making and sustainable development in the smallholder farming sector.

References:

- Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

- Aker, J. C. (2011). Dialling for development: The role of mobile phones in agricultural markets in Niger. *American Economic Journal: Applied Economics*, 3(3), 126–167.
- Cole, S., & Fernando, A. N. (2020). 'Mobile'izing Agricultural Advice: Technology Adoption, Diffusion and Sustainability. *The Economic Journal*, 130(626), 564–601.
- Mittal, S., & Mehar, M. (2016). Mobile Phone-Based Agricultural Extension: A Review of Literature. *Information Development*, 32(3), 449–460.
- FAO (Food and Agriculture Organisation). (2023). *Guide on digital agricultural extension and advisory services – Use of smartphone applications by smallholder farmers*. Rome.
- Casaburi, L., Kremer, M., Mullainathan, S., & Ramrattan, R. (2020). Harnessing ICT to Increase Agricultural Production: Evidence From Kenya. Working Paper.
- Aminou, N. M., Njukwe, E., & Tamo, M. (2020). Digital Extension Services for Pest and Disease Management in West Africa: Farmers' Adoption and Impact. *Sustainability*, 12(11), 4721.
- Kassem, M. A., et al. (2021). Mobile-based advisory services for sustainable agriculture: Assessing farmers' information behaviour. *Information Development*, 37(1), 136–154.
- Oreszczyn, S., Lane, A., & Carr, S. (2010). The role of social networks in the adoption of agricultural innovations. *International Journal of Agricultural Sustainability*, 8(3), 161–172.
- Tadesse, G., & Bahiigwa, E. (2015). Mobile phone use and its impact on household welfare in rural Ethiopia. *Development Policy Review*, 33(5), 633–649.