Case Study: FarmerChat: AI-Powered Agricultural Advisory at Scale

Abstract

Smallholder farmers across low- and middle-income countries face persistent information gaps driven by climate variability, emerging pests and diseases, and limited access to extension services, disproportionately affecting women and marginalised groups. This case study presents FarmerChat, an AI-powered agricultural advisory platform developed by Digital Green to deliver timely, localized, and actionable guidance to small-scale farmers at scale. The objective of the use case is to demonstrate how Generative AI, combined with trusted agricultural knowledge and inclusive design, can strengthen extension systems, improve decision-making, and enhance farm productivity and resilience. FarmerChat employs a multimodal, multilingual approach using large language models grounded through retrieval-augmented generation, expert validation, and human feedback, and is deployed through partnerships with public extension systems, farmer collectives, and digital channels. Early evidence from independent evaluations shows high user satisfaction, strong adoption of recommended practices, and meaningful behavior change in areas such as pest management, input use, and climate-adaptive practices, with particularly positive outcomes for women farmers and frontline extension workers. The case highlights the importance of embedding AI solutions within local institutions, applying robust ethics and governance safeguards, and designing for low-literacy, low-connectivity contexts. FarmerChat demonstrates the potential of responsibly deployed AI to transform agricultural advisory into a scalable, inclusive, and farmer-centered public good.

FarmerChat: AI-Powered Agricultural Advisory at Scale

Background and Context

India's 150 million smallholder farmers underpin rural livelihoods and national food security, yet continue to face persistent information gaps driven by climate volatility, emerging pests and diseases, fragmented markets, and limited access to extension services. Nearly 58% of farm households lack formal extension support, and productivity per unit of land remains below that of other major agricultural producers.

Digital Green's theory of change posits that **timely, localized, and trusted agricultural advisory** enhances farmers' self-efficacy, leading to improved decision-making, adoption of good practices, and ultimately better productivity, resilience, and incomes. Over the past 17 years, our community video–based extension model has demonstrated adoption rates up to 24% higher than traditional systems while reducing cost per adoption by tenfold. Building on this evidence, Digital Green has transitioned toward a digital-first, AI-enabled advisory model to reach scale while retaining contextual relevance.

AI Use Case Description

a. Solution Description

FarmerChat is an AI-powered agricultural advisory platform designed for smallholder farmers and frontline extension workers. It uses **Generative AI**, including Large Language Models (LLMs), to provide real-time, conversational guidance through text, voice, and images. Farmers can ask questions in local languages, share photos of crops or livestock, and receive actionable recommendations adapted to their context.

Given agriculture's high-stakes nature, FarmerChat does not rely on generic AI outputs. Responses are grounded in curated, expert-verified agricultural knowledge using a retrieval-augmented generation (RAG) architecture. Domain-specific improvements including fine-tuned speech-to-text for local accents and strengthened image-based diagnostics ensure accuracy despite noisy inputs such as low-quality images or field-recorded voice notes. Continuous reinforcement learning from human feedback (RLHF), led by agricultural experts, improves relevance and safety over time.

Beyond individual queries, FarmerChat functions as a **learning knowledge system**. Aggregated interaction data surfaces emerging trends such as pest outbreaks or misinformation which inform iterative model updates and advisory refinement.

b. Deployment & Implementation

FarmerChat is free for farmers and embedded within existing agricultural ecosystems.
Deployment follows a dual strategy:

- **Institutional Partnerships:** Integration into public extension systems through state Departments of Agriculture and Horticulture, State Rural Livelihoods Missions, Departments of Animal Husbandry, and partnerships with FPOs, SHGs, and community organizations. These actors support onboarding, trust-building, and last-mile adoption.
- **Digital Acquisition:** Direct farmer outreach via platforms such as Facebook and YouTube, supported by localized SEO/ASO strategies and telecom partnerships to improve reach in low-connectivity areas.

Field-level orientation sessions, peer demonstrations, and extension worker facilitation reinforce adoption and sustained use.

c. Evidence of Scale

FarmerChat is currently active across India, Kenya, Nigeria, Ethiopia, and Brazil. In India more than 4 Lakh users have been onboarded in the platform. The platform aims to reach **1 million users by April 2026** and **5.5 million users by April 2028**, while reducing per-user delivery costs to below USD 1 and maintaining free access for farmers.

d. Identified Users

Primary users are **smallholder farmers**, with a deliberate focus on women farmers and low-resource households. Secondary users include frontline extension workers who use the tool to enhance service quality and efficiency.

e. Evidence of Impact

Independent evaluations demonstrate substantial impact. A 60 Decibels survey of 353 farmers found 74% rated guidance as highly relevant, 83% reported easier information access, and 80% considered it comprehensive. The platform achieved a Net Promoter Score of 72, with 34% using it as their sole information source and 57% as primary source. **IDinsight's evaluation** with 663 respondents showed 60% took action based on advice, concentrating on pest/disease management, fertilizer use, and livestock care. In-app surveys revealed 70% of active users applied recommendations within 30 days. Cost efficiency improved dramatically from $35 per farmer in traditional extension to under $1 through AI-enabled channels, with adoption rates up to 10 times higher.

f. Ethics & Governance

FarmerChat applies multi-layered AI safety mechanisms:

- **Grounded responses** via RAG and expert-verified knowledge bases
- **Risk mitigation** through intent classification and escalation of high-risk queries

- **Bias monitoring** across gender and region
- **Data privacy protections**, including PII redaction, anonymization, encryption, and farmer data ownership

g. Inclusion

The platform is co-designed with farmers and partners, prioritizing low-literacy usability through voice, images, and spoken responses. Multilingual access, offline integrations, and compatibility with low-end smartphones enhance reach. Evidence shows improved work efficiency and confidence among extension workers—particularly women—who use FarmerChat to support farmers during critical crop stages.

Challenges and Lessons Learned

Strong partnerships with government institutions, agricultural universities, and research centers have enhanced advisory relevance and uptake. Key challenges include linguistic diversity, region-specific terminology, and digital access gaps. Leveraging national language AI initiatives, expanding voice support, and exploring low-bandwidth features have proven essential.

Lesson learned: AI advisory is most effective when embedded in trusted local systems, continuously validated by experts, and designed around farmers' real communication practices.

Conclusion

FarmerChat demonstrates how responsibly deployed Generative AI can strengthen agricultural extension at scale improving access, relevance, and equity for smallholder farmers. By combining advanced AI with grounded knowledge, inclusive design, and institutional partnerships, the solution offers a replicable model for climate-resilient and farmer-centered digital advisory systems.

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