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Communication Behavior and Communication Barriers Between Agricultural Extension Agents and Farmers: A Systematic Review

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ABSTRACT: Effective communication between agricultural extension agents and farming communities is a fundamental driver of knowledge transfer, technology adoption, and overall agricultural development. Guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework, this systematic review synthesizes literature across developing agrarian contexts to evaluate extension-farmer communication behaviors and multi-dimensional barriers. From an initial database search of 1,420 records, 56 eligible studies were included in the qualitative synthesis. The review traces the evolution of extension paradigms from linear, top-down approaches to two-way participatory models and digital/ICT advisory services. It categorizes the primary obstacles disrupting knowledge exchange into five distinct dimensions: language and literacy gaps, socio-cultural hierarchies, gender-based exclusions, structural institutional constraints, and digital infrastructure divides. The findings demonstrate that while vertical agent-to-farmer channels deliver technical innovations, horizontal peer-to-peer networks are essential for information validation and community-wide adoption. Strategic recommendations emphasize capacity building in facilitation soft skills, scaling up peer-led participatory approaches, developing local-language visual media, and establishing interactive digital-extension hybrid models.

KEYWORDS: Agricultural extension, Communication behavior, Communication barriers, Knowledge transfer, and Participatory extension.

INTRODUCTION

Agricultural extension and advisory services serve as the vital bridge linking agricultural research, policy interventions, and rural farming communities (Anderson & Feder, 2004; Leeuwis & Van den Ban, 2004; Davis et al., 2022). Across developing agrarian economies, the transformation of smallholder agriculture relies heavily on the efficient flow of technical knowledge, market information, and sustainable management practices from extension agents (technicians) to local producers (Christoplos, 2010; Abenga et al., 2022; Becerra-Encinales et al., 2024). However, despite decades of institutional reforms and technological innovations, persistent communication breakdowns continue to hinder effective advisory delivery and slow technology adoption rates worldwide (Aker, 2011; Davis & Sulaiman, 2022; Le Thi Hoa Sen et al., 2025). In resource-constrained environments such as Nepal, Sub-Saharan Africa, and Southeast Asia these communication deficits are exacerbated by complex topographies, diverse local languages, low digital literacy, rigid socio-cultural hierarchies, and institutional decentralization struggles (Gautam & Andersen, 2016; Ghimire & Suvedi, 2017; Bhusal et al., 2021).

Comprehensive Theoretical Frameworks

To fully account for the complex dynamics governing extension communication across the literature, this synthesis integrates three core theoretical perspectives.

Diffusion of Innovations Theory

Examines how agricultural technologies and practices spread through social systems via specific communication channels over time. It highlights attributes such as relative advantage, compatibility, complexity, trial ability, and observability, while

addressing "agent bias" where non-adoption is mistakenly blamed on farmer reluctance rather than structural message failure (Rogers, 1983; Anderson & Feder, 2004).

Participatory and Social Learning Theories

Replaces historical linear paradigms with non-hierarchical, two-way dialogic communication. These models emphasize co-learning, local knowledge integration, and horizontal peer validation (such as Farmer Field Schools) as prerequisite conditions for sustainable behavioral change (Chambers et al., 1989; Braun et al., 2006; FAO, 2006).

Agricultural Information Systems & Digital Advisory Models

Evaluates modern Information and Communication Technologies (ICTs)—ranging from mobile SMS and voice advisory services to interactive digital platforms—analyzing how technology interacts with local media, infrastructure limitations, and end-user digital literacy.

Research Questions

While individual empirical studies have examined targeted aspects of extension such as specific mobile apps, gender disparities, or localized field trials there remains a critical need for an integrated, PRISMA-guided review that consolidates the multi-dimensional scope of communication behaviors and systemic barriers across global literature. Guided by the PRISMA 2020 protocol, this systematic review addresses three core research questions:

- What communication behaviors, channels, and operational paradigms characterize extension-farmer interactions across traditional, participatory, and digital systems?
- What multi-dimensional barriers (linguistic, socio-cultural, gender, institutional, and technological) disrupt effective knowledge transfer between extension technicians and farming communities?
- What evidence-based strategies, policy frameworks, and hybrid extension models can mitigate communication friction and optimize agricultural information exchange in resource-constrained contexts?

METHODS

This review was conducted in alignment with the PRISMA 2020 statement guidelines for systematic reviews (Page et al., 2021).

Eligibility Criteria

Studies were included based on the following criteria

- Population: Agricultural extension agents, public/private advisory officers, lead farmers, and smallholder farming communities (Swanson et al., 1997; Hossain et al., 2011; Ayele & Beyene, 2024).
- Intervention/Exposures: Communication mechanisms, extension advisory delivery, ICT implementation, and technician-farmer interactions (Aker, 2011; Narine et al., 2019; Rohit et al., 2023).
- Outcomes: Primary outcomes included communication efficacy, technology adoption rates, behavioral responses, and identified communication barriers (Moyo & Salawu, 2018; Kumar et al., 2020; Becerra-Encinales et al., 2024).
- Study Designs: Peer-reviewed empirical studies, qualitative narrative analyses, institutional reports, and theoretical reviews (Benor et al., 1984; Birner et al., 2009; Davis & Sulaiman, 2022).
- Language & Timeframe: Literature published in English between 2000 and 2026, alongside seminal theoretical foundations such as Rogers' Diffusion of Innovations (Rogers, 1983; Rogers, 2003; Le Thi Hoa Sen et al., 2025).
- Exclusion criteria comprised non-peer-reviewed opinion pieces, studies lacking empirical or theoretical grounding in extension systems, and articles not directly addressing agent-farmer communication dynamics (Christoplos, 2010; Abenga et al., 2022).

Search Strategy and Information Sources

Systematic electronic searches were carried out across major databases, including Scopus, Web of Science, AGRIS, Google Scholar, and ResearchGate (Aker, 2011; Becerra-Encinales et al., 2024). The initial search strategy employed combinations of Boolean operators and keywords: ("agricultural extension" OR "extension agent" OR "advisory service") AND ("communication behavior" OR "communication barrier" OR "information exchange") AND ("technology adoption" OR "ICT in extension" OR "farmer learning") (Gautam & Andersen, 2016; Kigatiira et al., 2018; Pal et al., 2023).

PRISMA Flow of Literature Selection

The systematic literature selection process is depicted below:

- Identification: Database searching yielded 1,420 initial records.

- Screening: After duplicate removal, 850 records were screened via titles and abstracts, resulting in the exclusion of 610 non-relevant records.
- Eligibility: Full texts of 240 potentially relevant articles were evaluated against pre-defined inclusion/exclusion criteria. A total of 184 studies were excluded due to lack of direct focus on technician-farmer communication channels or structural barriers (Anderson & Feder, 2004; Abenga et al., 2022).
- Inclusion: A total of 56 core studies met all criteria and were synthesized qualitatively (Leeuwis & Van den Ban, 2004; Davis et al., 2022; Becerra-Encinales et al., 2024).

Synthesis of Extension Communication Behaviors

Synthesized evidence highlights an evolution in extension communication paradigms.

Evolution of Models

Early paradigms, such as the Transfer-of-Technology (ToT) model, relied on one-way transmission, framing the farmer as a passive recipient (Rasmussen, 1989; Rogers, 2003). The subsequent Training and Visit (T&V) system attempted to formalize field visits but retained top-down rigidity, often collapsing due to high operational costs and failure to incorporate indigenous knowledge (Benor et al., 1984; Anderson & Feder, 2004). Modern approaches favor participatory frameworks like Farmer Field Schools (FFS), which emphasize experiential learning and two-way dialogue between agents and farmers (Chambers et al., 1989; Braun et al., 2006; FAO, 2006).

Horizontal vs. Vertical Flows

Synthesized data shows that while vertical communication (technician-to-farmer) provides formal technical knowledge, horizontal communication (farmer-to-farmer) dominates rural learning (Ahmed, 2012; Wu & Zhang, 2013; Ngarawula & Wahyudi, 2023). After receiving advisory messages, a majority of farmers pass information to family members and peers in informal settings such as fields, coffee shops, and community gatherings (Ahmed, 2012; Escalada & Heong, 2004). Farmers rely heavily on peer validation before deciding to adopt recommended practices (Palis, 2006; Davis et al., 2022).

Categorization of Communication Barriers

The systematic review classified identified barriers into five main categories:

Linguistic and Literacy Gaps

High reliance on complex technical jargon or non-native official languages limits comprehension among smallholders, accounting for 30% to 40% of communication breakdowns in rural areas (Gautam & Andersen, 2016; Umar et al., 2024; Pal et al., 2023). Low textual literacy further prevents farmers from utilizing written advisories (Swanson et al., 1997; Abenga et al., 2022).

Socio-Cultural and Relational Dynamics

Power asymmetries between university-educated agents and rural farmers foster a passive dynamic where farmers nod out of courtesy without intending to adopt recommendations (Chambers, 1997; Leeuwis & Van den Ban, 2004). Cultural nuances and conflict with traditional practices create skepticism toward extension advice (Palis, 2006; Wilmes & Swenson, 2019; Mehmedi et al., 2025).

Gender-Based Exclusion

Female producers who form a significant portion of the agricultural workforce face exclusion due to socio-cultural norms, domestic time constraints, and an underrepresentation of female extension workers, who often comprise less than 20% of field staff (Doss, 2001; FAO, 2011; Mbo'o-Tchouawou & Colverson, 2014)

Institutional and Structural Constraints

Severe staffing shortages lead to high agent-to-farmer ratios, preventing regular contact (Birner et al., 2009; Davis & Sulaiman, 2022). Furthermore, extension training programs focus heavily on technical agronomy, frequently omitting adult education, active listening, and cross-cultural facilitation skills (Ghimire & Suvedi, 2017; Surya et al., 2021)

Technological Infrastructure Limits

Digital extension (e-extension) faces challenges from poor connectivity, device costs, digital illiteracy, and a reliance on one-way text broadcasts that lack interactive feedback loops (Fafchamps & Minten, 2012; Aker, 2023; Kagunyu et al., 2023; Gebru et al., 2024).

DISCUSSION

The PRISMA-guided synthesis indicates that extension communication barriers do not operate independently; rather, they form an interconnected network of friction points (Gautam & Andersen, 2016; Becerra-Encinales et al., 2024). A structural barrier like high agent ratios forces reliance on mass media or digital SMS, which in turn hits a wall when encountering low digital literacy,

language barriers, or lack of interactive dialogue (Duncombe, 2014; Le Thi Hoa Sen et al., 2025). When interpreting these findings through theoretical lenses, the synthesis highlights a key operational conflict:

- **Diffusion of Innovations:** Explains how attributes such as trialability and relative advantage drive adoption schedules, but can lead to "agent bias" by attributing non-adoption to farmer traditionalism rather than message delivery flaws (Rogers, 1983; Anderson & Feder, 2004; Rogers, 2003).
- **Participatory Communication:** Corrects this by fostering non-hierarchical, two-way dialogue, which builds trust and aligns technical advice with local realities (Chambers, 1997; FAO, 2006; Davis et al., 2022). However, participatory methods (e.g., FFS) are resource-intensive and difficult to scale without integration into broader digital or community-led networks (Braun et al., 2006; Aker, 2023).

In federalized, geographically diverse contexts like Nepal, these dynamics manifest as fragmented institutional delivery, male out-migration leaving under-serviced female farmers, and terrain constraints that hinder face-to-face contact (Gautam & Andersen, 2016; MoALD, 2021; Bhusal et al., 2021). Overcoming these challenges requires multi-channel approaches that combine participatory models with localized community media (such as local-language community radio) and hybrid digital platforms (Escalada et al., 1999; Mittal & Mehar, 2023; Masangano & Mthinda, 2024).

CONCLUSIONS

This systematic review confirms that extension communication is a multi-faceted process constrained by linguistic, socio-cultural, institutional, gender, and technological barriers. Overcoming these barriers requires moving away from linear transmission models toward inclusive, multi-channel, and participatory communication systems that integrate local knowledge and foster interpersonal trust. Reformat agricultural education to include modules on active listening, adult learning principles, cross-cultural facilitation, and participatory communication alongside agronomic technical training. Recruit gender friendly extension personnel, adapt training schedules to accommodate female farmers' daily routines, and target women as primary agricultural decision-makers. Institutionalize Farmer Field Schools (FFS) and train local lead/key farmers to serve as communication bridges within their local communities. Deliver advisories in native dialects using visual and audio media, such as community radio and video demonstrations. Transition digital extension from one-way text pushes toward interactive voice/messaging platforms that support two-way dialogue.

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