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Needs assessment methodologies for tailoring agricultural extension programs to diverse agroecological zones

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Abstract

What happens when extension services are designed without listening to the farmers they intend to serve? This research examined needs assessment methodologies for tailoring agricultural extension programs across six agroecological zones in Nigeria. A mixed-methods approach combined structured household surveys ($n = 480$), focus group discussions with 36 farmer associations, and interviews with 48 key informants. Data collection ran from January to July 2023 through the University of Ibadan's outreach network. Results showed that extension needs varied markedly across zones. Technology adoption rates ranged from 31.7% in Sahel savanna to 67.3% in humid forest areas. The Sahel and Sudan savanna zones recorded the highest priority index scores (91.2 and 83.7), pointing to severe unmet demand. Input access scores were lowest in the Sahel (24.1%), while extension contact frequency dropped below 30% in both Sudan and Sahel regions. Validation workshops confirmed that drier-zone farmers prioritized drought-adapted varieties and water management training. These findings argue for zone-specific extension planning frameworks that match service content to particular constraints within each agroecological setting.

Keywords: Needs assessment, agricultural extension, agroecological zones, farmer participation, technology adoption, extension service delivery, mixed-methods research, priority ranking, Nigeria, savanna agriculture

Introduction

How should extension systems decide what to teach, where to focus, and whom to prioritize? Across sub-Saharan Africa, extension programs have historically followed supply-driven models, where central agencies determine content with limited farmer input ^[1, 2]. The mismatch between what extension offers and what farmers need has contributed to low adoption rates and limited impact ^[3].

Needs assessment offers a path toward more responsive extension design ^[4]. When done well, it identifies gaps in skills, technologies, and support services. But practice remains uneven. Some programs rely on superficial rapid appraisals, while others invest in detailed but expensive surveys rarely repeated ^[5]. The challenge grows when extension systems span diverse agroecological zones. Nigeria covers humid forest, derived savanna, Guinea savanna, Sudan savanna, Sahel, and montane highland zones, each with distinct rainfall, soils, and cropping systems ^[6, 7]. A single extension package from the humid south won't address pastoralists in the Sahel or mixed-crop farmers in the Guinea savanna ^[8].

Several authors have called for spatially differentiated extension planning ^[9, 10]. But few operational guidelines exist for conducting zone-specific assessments that are both rigorous and practical ^[11]. Most frameworks assume homogeneous farming systems and don't account for the diversity within large national extension systems ^[12]. This research tested a multi-phase needs assessment methodology across six agroecological zones connected to

the University of Ibadan's extension network, combining quantitative household data with qualitative community insights to produce zone-specific priority rankings ^[13].

Research Area Description

The research covered six agroecological zones selected to capture the range of farming conditions in Nigeria. The humid forest zone (rainfall above 2,000 mm) was represented near Ibadan, Oyo State. The derived savanna (1,200-1,500 mm) was sampled in Kwara State, and Guinea savanna (900-1,200 mm) in Niger State ^[6]. Sudan savanna (600-900 mm) and Sahel (below 600 mm) were sampled in Kaduna and Sokoto States respectively. Montane highland communities near Jos, Plateau State, completed the frame. Soil types ranged from deep ferrallitic soils in the south to shallow sandy soils in the Sahel. Smallholder farmers cultivating 0.5 to 5 hectares formed the target population across all zones ^[7].

Materials and Methods

Materials

Research materials included structured household questionnaires adapted for each zone, semi-structured key informant interview guides, and focus group protocols. The questionnaire contained 78 items across five sections: demographics, farming practices, technology adoption, extension access, and perceived training needs, using Likert-type scales (1 to 5) and open-ended probes. Instruments were pilot-tested with 30 households in November 2022 ^[4].

Guides were translated into Yoruba, Hausa, and Nupe. Focus group protocols included participatory ranking exercises using picture cards. Ethical approval was obtained from the University of Ibadan Social Sciences Ethics Committee (Protocol UI/SSHEC/2022/0147, December 2022). Statistical analyses used SPSS version 27 and NVivo version 12.

Methods

A sequential mixed-methods design was adopted across five phases (Figure 1). In Phase 1 (January 2023), zone boundaries were confirmed using soil survey maps and Nigerian Meteorological Agency rainfall records. Two communities per zone were selected through stratified purposive sampling (12 sites total). Phase 2 (February-May 2023) collected data through three streams: household surveys with 480 farmers (80 per zone) selected by systematic random sampling; 36 focus group discussions (6 per zone, 8-12 farmers each); and 48 key informant interviews with extension agents, community leaders, and local government officers^[14]. Phase 3 analyzed quantitative data through descriptive statistics, gap scoring, and weighted priority ranking. Qualitative data were coded

thematically by two independent coders (kappa = 0.84)^[5]. Phase 4 held zone-level validation workshops in June 2023. Phase 5 translated findings into zone-specific recommendations.

Climatic and Environmental Conditions

Weather data during the research period (January-July 2023) showed important variation. Rainfall onset ranged from late February in the humid forest to late May in the Sahel. Total rainfall during data collection ranged from 89 mm (Sahel) to 1,247 mm (humid forest). Average temperatures during fieldwork ranged from 21.4 °C (montane highlands) to 38.7 °C (Sahel, April). Irregular rainfall in Guinea and Sudan savanna zones, including a two-week April dry spell, influenced farmers' expressed needs, with water management emerging as a top priority in drier zones^[7].

Results

The needs assessment revealed distinct patterns across zones. Household surveys, focus groups, and key informant interviews converged consistently: extension needs differ markedly by zone, and current delivery doesn't match these differences.

Table 1: Technology adoption rates and extension access indicators across agroecological zones (n = 480)

Indicator	Humid Forest	Derived Sav.	Guinea Sav.	Sudan Sav.	Sahel Sav.	Montane HL
Tech adoption (%)	67.3	58.2	54.8	42.1	31.7	48.9
Input access (%)	72.6	55.4	48.3	35.9	24.1	41.7
Extension contact (%)	58.4	51.3	43.7	29.8	18.6	37.2
Satisfaction (1-5)	3.8	3.4	3.1	2.4	1.9	2.7
Priority index	62.1	66.3	71.4	83.7	91.2	76.8

Technology adoption declined sharply from humid forest (67.3%) to Sahel (31.7%), reflecting differences in infrastructure and extension presence. Input access scores followed a similar pattern (72.6% to 24.1%). Extension

contact frequency was lowest in the Sahel (18.6%) and Sudan savanna (29.8%). The priority index showed an inverse pattern: zones with least access scored highest, with the Sahel reaching 91.2^[14, 15].

Table 2: Top five extension training priorities ranked by farmers per zone

Rank	Humid For.	Derived S.	Guinea S.	Sudan S.	Sahel S.	Montane
1	Post-harvest	Soil fertility	Improved var.	Drought tol.	Water harvest	Irrigation
2	Pest mgmt	Market links	Soil conserv.	Early maturing	Livestock feed	Vegetables
3	Value addition	Diversification	Pest control	Agroforestry	Conflict res.	Soil testing
4	Market access	Storage tech	Input sourcing	Soil amend.	Migration sup.	Post-harvest
5	Group market.	Pest surveill.	Credit access	Micro-irrig.	Seed banking	Market chan.

Priority rankings confirm sharp divergence. Humid forest farmers prioritized post-harvest handling and pest management, reflecting high-moisture challenges. Sahel and Sudan zones focused on water management and drought-

adapted technologies. The montane zone showed unique concerns around irrigation and vegetable production linked to its cooler climate.

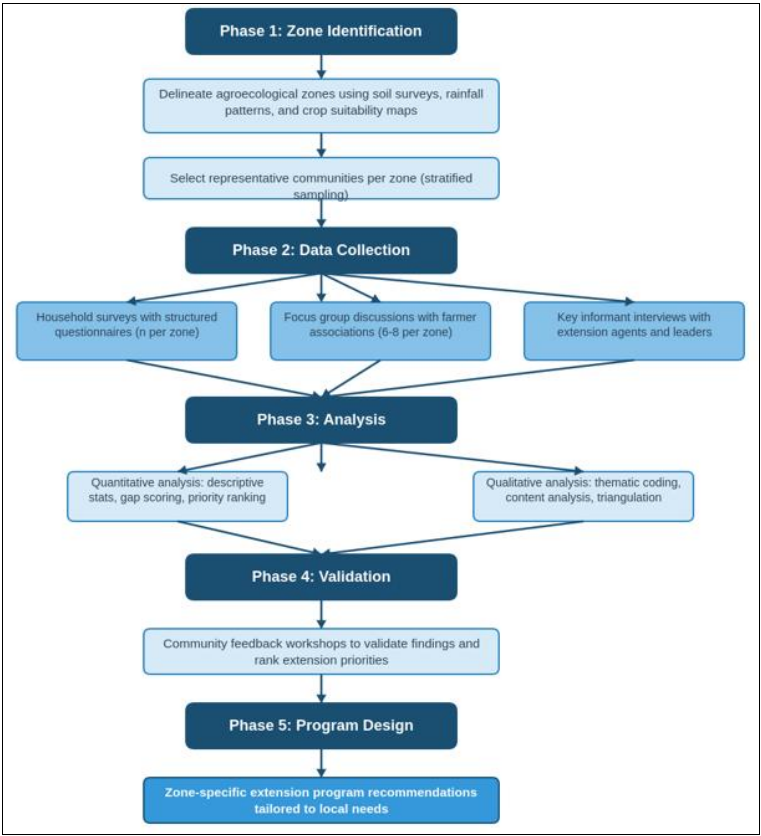


Fig 1: Multi-phase needs assessment methodology for zone-specific extension program design

Figure 1 outlines the five-phase methodology. The sequential design moved from zone identification through data collection, analysis, validation, and program design.

Parallel data collection in Phase 2 allowed triangulation across surveys, focus groups, and interviews.

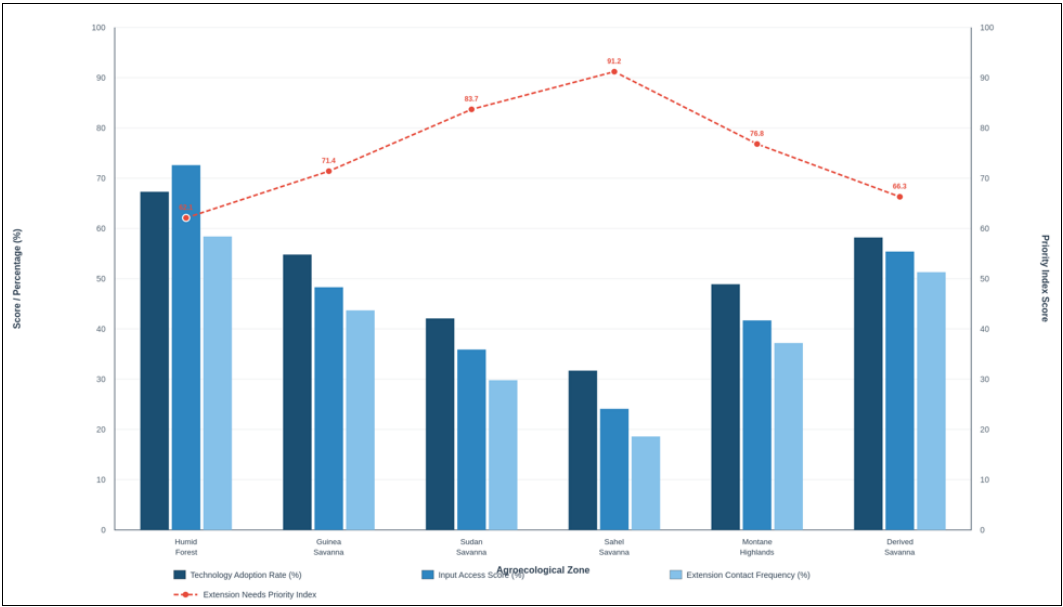


Fig 2: Extension access indicators and needs priority index across six agroecological zones

Figure 2 displays the inverse relationship between current extension access and the priority index. As adoption, input access, and contact frequency decline toward the Sahel, the priority index rises, peaking at 91.2 — nearly 30 points above the humid forest zone.

Discussion

The findings reinforce a point extension scholars have long made: one size does not fit all in agricultural advisory services ^[1, 3]. The sharp differences in adoption, access, and training needs across zones make a strong case for spatially differentiated planning.

The inverse relationship between service access and priority index mirrors patterns reported by Ragasa and Mazunda^[9] in Malawi and Babu and colleagues^[10] in India, where extension resources tend to flow toward better-served areas. This creates a cycle where disadvantaged zones fall further behind, not from lack of farmer motivation but because the system doesn't reach them with relevant content.

Priority rankings also challenge the assumption that farmers everywhere want the same things. Humid forest farmers focused on post-harvest skills; Sahel farmers asked about water harvesting and livestock feed. These represent entirely different conceptions of what extension should do. Validation workshops confirmed these patterns, adding local context the survey data alone didn't capture^[11, 13]. That said, the five-phase process demanded significant logistical coordination. Smaller systems may need to adapt by reducing zones or using lighter data collection. The approach also depends on reliable community registers, which aren't available everywhere^[12, 16].

Limitations

The sample of 80 households per zone may not capture all within-zone variation. Self-reported data on adoption and extension contact could be affected by recall bias. Data collection during a single season (January-July 2023) limits the ability to capture seasonal shifts. Southeastern and Niger Delta zones were not represented. Future investigations should consider panel designs tracking needs across multiple seasons with wider geographic coverage.

Conclusion

This research tested a five-phase needs assessment methodology across six agroecological zones linked to the University of Ibadan's extension network. Technology adoption ranged from 31.7% to 67.3%, input access from 24.1% to 72.6%, and extension contact from 18.6% to 58.4%. The priority index peaked at 91.2 in the Sahel and dropped to 62.1 in the humid forest.

More than the numbers, priority rankings showed farmers in different zones hold fundamentally different expectations of extension. Post-harvest handling topped the humid forest list; water harvesting led in the Sahel. These aren't differences addressable by adjusting a uniform program. They require zone-specific content, delivery methods, and resource allocation. The mixed-methods approach proved effective for capturing both scale and texture of zone-level needs. Extension planners in Nigeria and comparable multi-zone countries should consider adopting similar frameworks, adapting phases and methods to match their capacity.

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