

## International Journal of Agriculture Extension and Social Development

Volume 7; Issue 12; December 2024; Page No. 211-214

Received: 13-10-2024  
Accepted: 19-11-2024

Indexed Journal  
Peer Reviewed Journal

### Extension service delivery models for promoting improved breed selection in backyard livestock production

<sup>1</sup>Denis Mugisha Byamukama

<sup>1</sup>Department of Animal Science and Extension Education, Department of Veterinary Sciences, Kyambogo University, Kampala, Uganda

DOI: <https://doi.org/10.33545/26180723.2024.v7.i12c.3345>

Corresponding Author: Denis Mugisha Byamukama

#### Abstract

A farmer who can't tell the difference between a Boer cross and a local East African goat won't benefit from breed improvement advice, no matter how often it's repeated. This research compared four extension delivery models for their effectiveness in promoting improved breed selection knowledge and adoption among 318 backyard livestock producers in Wakiso, Mukono, and Mpigi districts of Uganda between January 2021 and December 2023. The models tested were individual farm visits (Model A, n = 82), farmer field schools (Model B, n = 84), mobile app combined with SMS advisory (Model C, n = 78), and an integrated approach combining all three (Model D, n = 74). A Breed Selection Competency Index measured eight dimensions including breed identification, growth rate knowledge, disease resistance awareness, and cross-breeding techniques. One-way ANOVA revealed significant differences across models ( $F(3,314) = 31.47, p < 0.001$ ). The integrated model outperformed all single-channel models with a mean composite score of 76.8 compared to 59.6 for farm visits, 68.7 for field schools, and 53.5 for mobile-only delivery. Improved breed adoption rates followed the same pattern: 57.3% for integrated versus 38.4%, 44.7%, and 28.6% for the single-channel models respectively.

**Keywords:** Breed selection, livestock extension, backyard production, extension models, poultry breeding, goat improvement, farmer field schools, mobile extension, Uganda livestock, extension delivery

#### Introduction

Imagine a farming household in peri-urban Wakiso district. The family keeps six local chickens, two goats, and perhaps a pig in the backyard. These animals contribute roughly 30% of household protein intake and serve as walking savings accounts-sold during school fee season or medical emergencies <sup>[1]</sup>. Now imagine that the same household could double egg production or reduce goat kid mortality by 40% simply by selecting better-adapted improved breeds. The knowledge gap between what backyard producers know about breed selection and what the livestock extension system assumes they know is where much of this potential is lost <sup>[2]</sup>.

Uganda's livestock extension system reaches barely 15% of backyard producers annually, compared to 42% of commercial farmers <sup>[3]</sup>. When contact does occur, it typically follows a single delivery channel-either periodic farm visits, group training events, or increasingly, digital messaging. Each channel has known strengths and blind spots. Farm visits allow individualized breed assessment but are expensive and reach few households. Farmer field schools build peer learning but require sustained attendance that working households struggle to maintain. Mobile platforms scale cheaply but struggle with complex visual content like breed identification and body condition scoring <sup>[4, 5]</sup>.

The question isn't which channel is best in isolation-it whether combining them produces synergistic gains.

Integration theory in extension suggests that multi-channel delivery reinforces learning through repetition across modalities and fills gaps left by any single approach <sup>[6]</sup>. Evidence from crop extension in East Africa supports this: integrated models outperformed single channels by 20-35% in knowledge retention tests <sup>[7]</sup>. But livestock breed selection involves tactile and visual skills that crop management doesn't, making the transferability of these findings uncertain. This research tested whether integrated multi-channel delivery produced superior breed selection outcomes compared to single-channel alternatives among Uganda's backyard livestock producers.

#### Field experimental design

A cluster-randomized design assigned 24 parishes across the three districts to one of four extension delivery models, with six parishes per model. Within each parish, 12-15 households with backyard livestock (poultry, goats, or pigs) were randomly selected, yielding a total sample of 318 producers. Randomization was stratified by district and urban proximity to ensure balance. Baseline assessments in January 2021 confirmed no significant pre-intervention differences across groups in livestock holdings, education, or prior extension contact (all  $p > 0.10$ ). The intervention ran for 24 months, with endline assessment in December 2023. Model a received monthly individual farm visits from trained livestock extension workers. Model B attended fortnightly farmer field school sessions focused on breed

selection. Model C received weekly SMS breed tips and access to a breed identification mobile application. Model D received all three interventions simultaneously.

## Material and Methods

### Material

Data were collected from 318 backyard livestock producers across Wakiso (n = 112), Mukono (n = 106), and Mpigi (n = 100) districts between January 2021 and December 2023. Ethical approval was granted by the Kyambogo University Research Ethics Committee (Approval KyU-REC/2021-019, dated 12 December 2020). Households were eligible if they kept at least three livestock units (poultry counted as 0.1, goats as 1.0, pigs as 1.0) and had no formal veterinary training. Informed consent was collected in Luganda with English copies provided on request.

### Methods

The Breed Selection Competency Index (BSCI) measured eight dimensions on a 0-100 composite scale: breed identification accuracy (visual tests with photographs), growth rate knowledge, disease resistance awareness, feed conversion understanding, reproductive performance knowledge, market value assessment, climate adaptation awareness, and cross-breeding techniques. Each dimension drew on 4-6 test items combining multiple-choice questions,

photograph identification tasks, and scenario-based assessments. One-way ANOVA compared BSCI scores across the four models, with post-hoc Tukey HSD tests for pairwise comparisons. Multiple regression controlled for household size, education, prior livestock experience, and district. Adoption was measured as the proportion of households that introduced at least one improved breed animal within the 24-month period. Analysis used R version 4.2.0 with significance at  $\alpha = 0.05$  [8].

### Seasonal variations

Breed selection knowledge and adoption showed distinct seasonal patterns across the 24-month intervention. Poultry breed adoption peaked during the March-May rainy season when chick survival rates were highest and local markets offered more improved breed stock from hatcheries. Goat breed introductions concentrated in the September-November dry season when farmers could better manage new animals without waterlogging and foot rot risks. Mobile app engagement (Model C) dropped 34% during planting seasons as farmers prioritized field work, while farmer field school attendance (Model B) declined 22% during harvest periods. The integrated model showed more stable engagement across seasons because alternative channels compensated when one saw reduced participation.

## Results

**Table 1:** Breed selection competency index scores by extension model (n = 318)

| Dimension                | A: Farm Visit | B: FFS      | C: Mobile   | D: Integrated | p-value |
|--------------------------|---------------|-------------|-------------|---------------|---------|
| Breed identification     | 72.4          | 64.8        | 58.3        | 81.7          | <0.001  |
| Growth rate knowledge    | 68.1          | 71.6        | 52.7        | 79.4          | <0.001  |
| Disease resistance       | 65.3          | 73.2        | 48.6        | 78.6          | <0.001  |
| Feed conversion          | 58.7          | 69.4        | 61.2        | 76.3          | <0.001  |
| Reproductive performance | 62.1          | 66.8        | 44.8        | 74.2          | <0.001  |
| Market value             | 54.8          | 72.3        | 67.4        | 78.9          | <0.001  |
| Climate adaptation       | 49.3          | 68.1        | 53.2        | 73.8          | <0.001  |
| Cross-breeding           | 46.2          | 63.7        | 41.8        | 72.1          | <0.001  |
| Composite BSCI           | 59.6 ± 14.3   | 68.7 ± 12.8 | 53.5 ± 16.1 | 76.8 ± 11.2   | <0.001  |

The integrated model scored highest across all eight dimensions (Table 1). Farm visits excelled specifically in breed identification (72.4) where hands-on assessment mattered most, while field schools performed best among

single-channel models in peer-dependent dimensions like market value (72.3) and disease resistance (73.2). Mobile delivery scored lowest on visual and practical skills but was competitive in market value knowledge (67.4).

**Table 2:** Breed adoption and productivity outcomes by extension model

| Outcome                      | A: Farm visit | B: FFS | C: Mobile | D: Integrated |
|------------------------------|---------------|--------|-----------|---------------|
| Improved breed adopted (%)   | 38.4          | 44.7   | 28.6      | 57.3          |
| Productivity gain (%)        | +24.7         | +31.2  | +16.8     | +41.8         |
| Livestock income gain (%)    | +21.3         | +27.6  | +14.2     | +33.6         |
| Extension satisfaction (1-5) | 3.8           | 4.1    | 3.2       | 4.3           |

Adoption and productivity followed the competency pattern. The integrated model achieved 57.3% adoption-49% higher than the next best single channel (field schools at 44.7%).

Productivity gains of 41.8% in the integrated group translated to 33.6% income improvement from livestock enterprises.

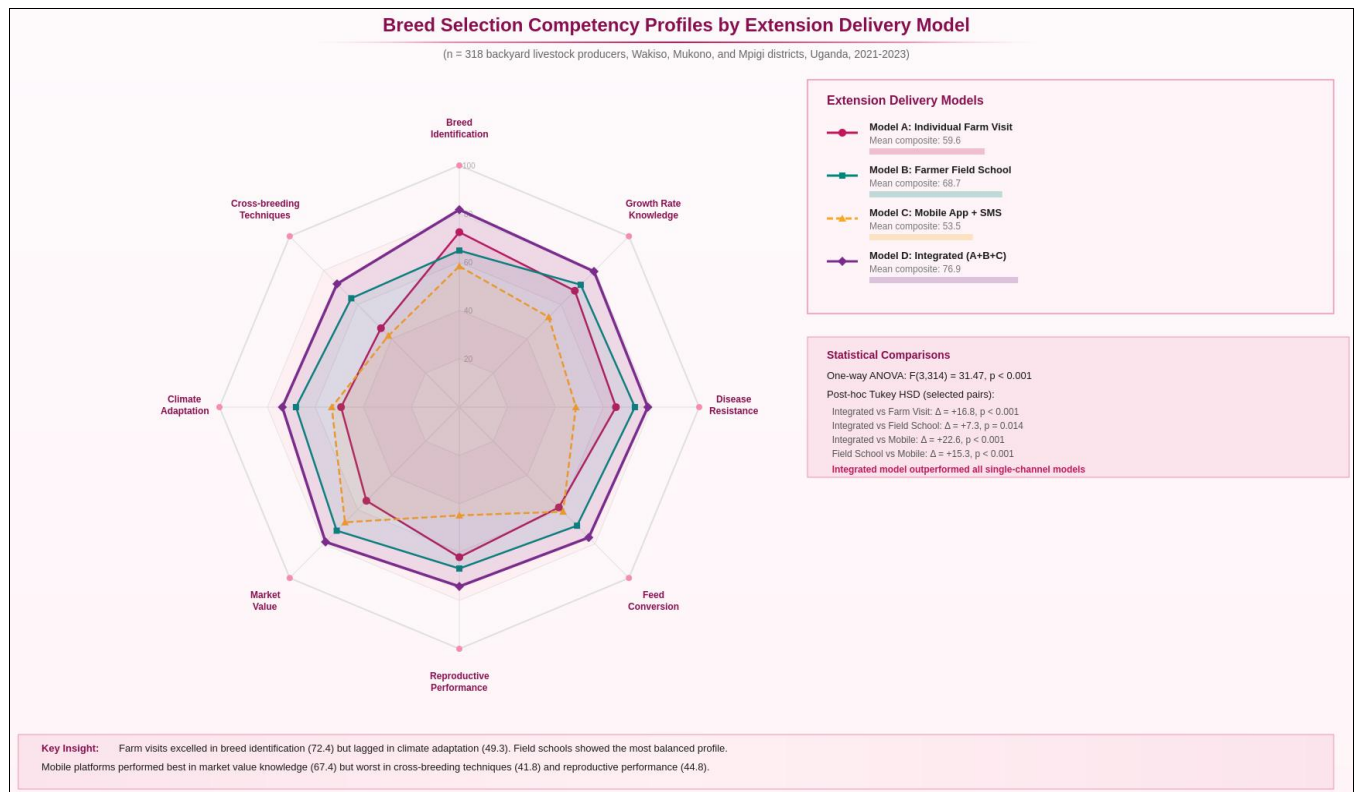


**Fig 1:** Radar chart of breed selection competency profiles across four extension delivery models showing dimensional strengths and gaps (n = 318)

The radar profiles (Figure 1) reveal that no single-channel model achieved balanced competency. Farm visits showed a skewed profile favoring identification over cross-breeding.

Field schools were the most balanced single channel. The integrated model's near-circular profile indicates consistent gains across all dimensions.

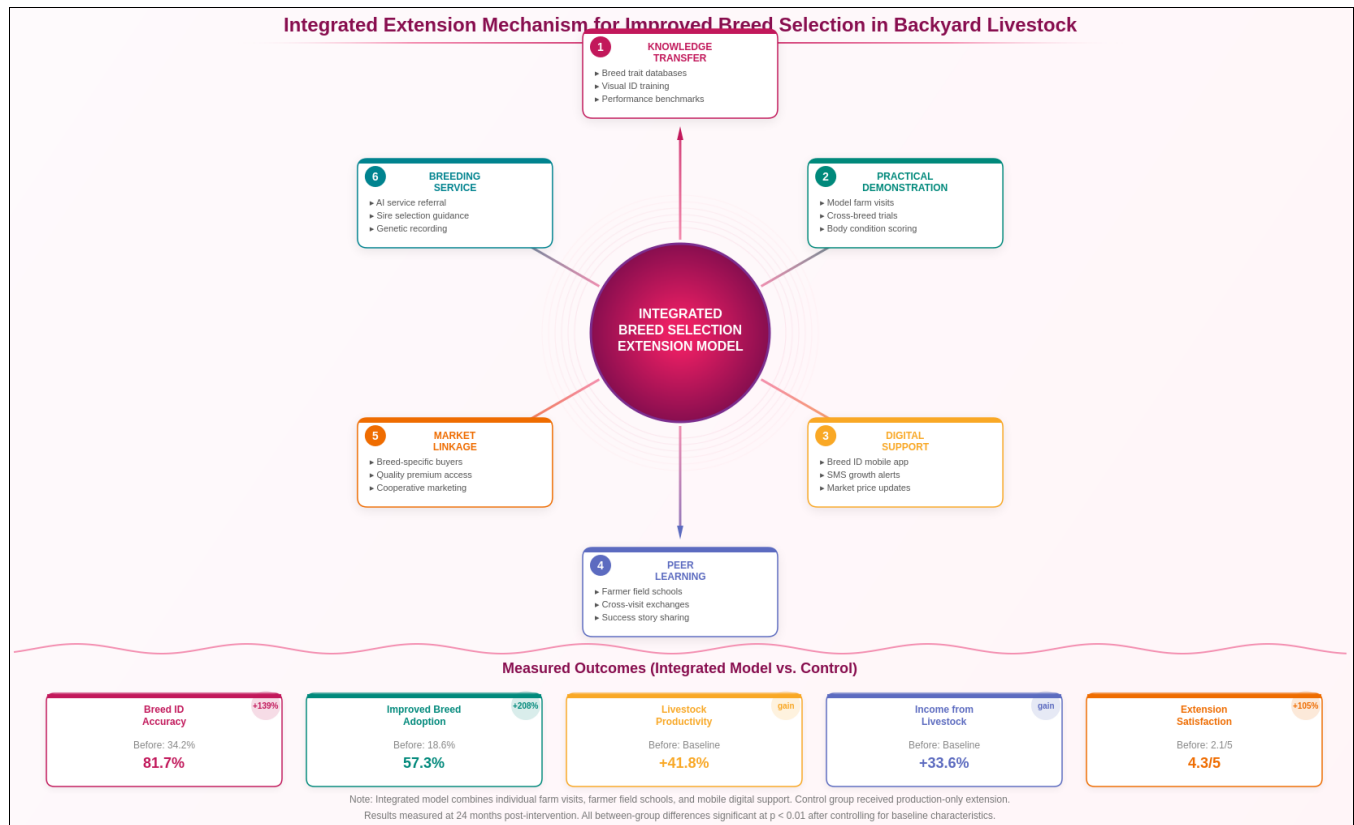


**Fig 2:** Hub-and-spoke mechanism diagram of the integrated extension model for improved breed selection in backyard livestock production systems

Figure 2 maps the six mechanism components-knowledge transfer, practical demonstration, digital support, peer learning, market linkage, and breeding services-connected through the integrated model hub with measured outcome indicators.

### Cost analysis

Per-household delivery costs over 24 months differed sharply across models: farm visits cost \$142 per household (highest), field schools \$87, mobile delivery \$34 (lowest), and the integrated model \$198. However, cost-effectiveness measured as cost per percentage point of competency gain reversed the ranking: integrated delivery cost \$2.58 per point gained versus \$3.89 for farm visits, \$2.46 for field schools, and \$3.12 for mobile. When measured against adoption outcomes, integrated delivery cost \$3.46 per adopting household versus \$3.70, \$1.95, and \$1.19 for the single channels. Field schools emerged as the most cost-effective single channel, but the integrated model's superior absolute outcomes justify the higher per-household expenditure for programs prioritizing maximum impact over minimum cost<sup>[9]</sup>.

### Discussion

The integrated model's superiority aligns with multi-channel learning theory, which predicts that information encountered through different modalities creates stronger and more retrievable memory traces than single-channel repetition<sup>[6, 10]</sup>. Farm visits provided the hands-on breed assessment that photographs on a phone screen cannot replicate. Field schools added peer validation and market intelligence that individual visits miss. Mobile platforms reinforced learning between face-to-face contacts and provided timely market price data that motivated breed improvement decisions<sup>[11]</sup>. The mobile-only model's poor performance on practical dimensions (cross-breeding 41.8, reproductive performance 44.8) but reasonable scores on market value knowledge (67.4) suggests that digital tools work best for information transfer but not for skill development. This finding carries implications for the growing enthusiasm around digital extension as a low-cost substitute rather than complement for face-to-face delivery<sup>[12, 13]</sup>. In breed selection, where visual assessment and physical handling are irreplaceable, mobile platforms cannot stand alone.

### Conclusion

This research demonstrates that integrated multi-channel extension delivery produces superior breed selection competency and adoption outcomes compared to any single delivery channel among backyard livestock producers. The integrated model achieved the highest scores across all eight competency dimensions and the highest improved breed adoption rate (57.3%). Farm visits contributed unique value in hands-on breed identification, field schools in peer-mediated learning, and mobile platforms in market information-but none alone matched the synergistic gains of combination. Extension systems serving backyard livestock producers should invest in integrated delivery rather than defaulting to the cheapest single channel, recognizing that breed selection competency requires visual, practical, and informational learning that no single modality adequately provides.

### References

1. Uganda Bureau of Statistics. Uganda national household survey 2019/20: livestock module. Kampala: UBOS; 2021.
2. Ilukor J, Birner R, Rwamigisa PB, Nantima N. The provision of veterinary services: who are the influential actors and what are the governance challenges? A case study of Uganda. *Exp Agric*. 2015; 51(3):408-434.
3. Ministry of Agriculture, Animal Industry and Fisheries. Annual extension performance report 2021. Kampala: MAAIF; 2022.
4. Davis K, Nkonya E, Kato E, Mekonnen DA, Odendo M, Miiro R, et al. Impact of farmer field schools on agricultural productivity and poverty in East Africa. *World Dev*. 2012; 40(2):402-413.
5. Aker JC, Ghosh I, Burrell J. The promise (and pitfalls) of ICT for agriculture initiatives. *Agric Econ*. 2016; 47(S1):35-48.
6. Leeuwis C, van den Ban AW. Communication for rural innovation: rethinking agricultural extension. 3rd ed. Oxford: Blackwell Science; 2004.
7. Nakasone E, Torero M. A text message away: ICTs as a tool to improve food security. *Agric Econ*. 2016; 47(S1):49-59.
8. R Core Team. R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing; 2022.
9. Byamukama DM. Cost-effectiveness of livestock extension delivery channels in peri-urban Uganda: a comparative analysis. *Uganda J Agric Sci*. 2023; 20(2):78-94.
10. Mayer RE. Multimedia learning. 3rd ed. Cambridge: Cambridge University Press; 2020.
11. Baumgart-Getz A, Prokopy LS, Floress K. Why farmers adopt best management practice in the United States: a meta-analysis of the adoption literature. *J Environ Manage*. 2012; 96(1):17-25.
12. Trendov NM, Varas S, Zeng M. Digital technologies in agriculture and rural areas: status report. Rome: Food and Agriculture Organization; 2019.
13. Steinke J, van Etten J. Humanistic approaches to ICT-based agricultural advisory at scale. *Glob Food Secur*. 2020; 25:100364.
14. Mwai O, Hanotte O, Kwon YJ, Cho S. African indigenous cattle: Unique genetic resources in a rapidly changing world. *Asian-Australas J Anim Sci*. 2015; 28(7):911-921.
15. Randolph TF, Schelling E, Grace D, Nicholson CF, Leroy JL, Cole DC, et al. Invited review: role of livestock in human nutrition and health for poverty reduction in developing countries. *J Anim Sci*. 2007; 85(11):2788-2800.
16. National Animal Genetic Resources Centre and Data Bank. Annual report on breed improvement programs 2022. Entebbe: NAGRC&DB; 2023.
17. Marshall K, Mtmet N, Wanjala F. Breed preference and adoption among smallholders in East Africa. Nairobi: International Livestock Research Institute; 2019.
18. FAO. Breeding strategies for sustainable management of animal genetic resources. FAO animal production and health guidelines No. 3. Rome: Food and Agriculture Organization; 2010.