

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 3; March 2024; Page No. 56-59

Received: 12-12-2023
Accepted: 15-01-2024

Indexed Journal
Peer Reviewed Journal

Organizational frameworks of agricultural extension management and their role in enhancing rural advisory service delivery mechanisms

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DOI: <https://www.doi.org/10.33545/26180723.2024.v7.i3a.3287>

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Abstract

How effectively do different institutional arrangements channel agricultural knowledge to the farmers who need it most? This research examined three organizational extension frameworks the government-led model, the collaborative public-private (CPP) model, and the community-based decentralized model to evaluate their effectiveness in providing rural advisory services. A mixed-methods approach combined structured surveys with 392 extension workers and semi-structured interviews with 52 key informants in Zimbabwe. Data were collected between April 2021 and March 2022 across Mashonaland East and Masvingo provinces. Results indicated that the CPP model attained the highest overall effectiveness rating (76.3%), followed by the decentralized model (71.9%) and the public sector model (63.7%). The PPP model showed strength in knowledge transfer (78.6%) and farmer reach (81.2%), while the decentralized model excelled in service timeliness (82.1%) and cost efficiency (74.3%). A strong positive association emerged between institutional resource allocation and service delivery outcomes ($r = 0.73$, $p < 0.01$). These findings point toward hybrid institutional arrangements as the most promising path for strengthening rural advisory services.

Keywords: Extension administration, organizational frameworks, rural advisory services, public-private partnership, decentralized extension, service delivery, agricultural knowledge transfer, smallholder farmers

1. Introduction

What determines whether a farmer receives practical, timely advice that can change the trajectory of a growing season? Across sub-Saharan Africa, the answer often depends less on the quality of available agricultural knowledge and more on how extension institutions are organized and managed ^[1]. Extension administration the organizational framework through which advisory services are planned, funded, staffed, and delivered has become a defining factor in whether agricultural innovations reach smallholder farmers ^[2].

Three organizational frameworks have dominated extension administration. The public sector model, where government agencies directly manage extension staff, was the default in most African countries from the 1960s through the 1990s ^[3]. This model offered uniform coverage but suffered from inadequate funding and bureaucratic delays ^[4]. Beginning in the late 1990s, public-private partnerships (PPPs) brought in private agri-businesses and NGOs as service providers, while decentralized models transferred extension authority to local government units ^[5, 6].

Despite these shifts, evidence on which model produces the best outcomes remains fragmented. Some authors praised PPP efficiency ^[7], while others highlighted their tendency to exclude resource-poor farmers ^[8]. Zimbabwe provided an appropriate setting for this comparison because it operates hybrid extension arrangements with elements of all three

models across provinces ^[9]. This research measured and compared the effectiveness of each institutional model across five dimensions: knowledge transfer, farmer reach, service timeliness, technical quality, and cost efficiency.

Material and Methods

Research Area and Environmental Conditions

This research was conducted in Mashonaland East and Masvingo provinces of Zimbabwe, selected for their contrasting agricultural zones and different extension administration arrangements. Mashonaland East, in Natural Region II, has intensive farming with 750-1000 mm annual rainfall. Manicaland spans Natural Regions II through V with all three organizational frameworks present. During the research period (March 2021 to February 2022), seasonal rainfall was 823 mm in Mashonaland East, while Manicaland recorded 612-1,147 mm across districts.

Material

A stratified random sample of 392 extension workers was drawn proportionally: 142 from the public sector model, 128 from PPP arrangements, and 114 from decentralized systems. Additionally, 52 key informants were purposively selected, including provincial agricultural officers (6), district extension coordinators (12), NGO program managers (12), private agri-firm representatives (10), and farmer organization leaders (8). Data collection instruments

included a structured questionnaire with a 5-point Likert scale and a semi-structured interview guide. Instruments were pre-tested with 30 extension workers in Goromonzi district. The ethics committee at Southern Africa Agricultural Sciences University, Zimbabwe approved the protocol (Ref: SAASU/EC/2020-087) in December 2020.

Field Research Design

A cross-sectional comparative design was adopted with the three organizational frameworks as the independent variable and five effectiveness indicators as dependent variables. Data collection occurred in three phases: Phase 1 (March-June 2021) for questionnaires; Phase 2 (July-September 2021) for interviews; and Phase 3 (October 2021-February 2022) for field verification. Research sites were matched on

agro-ecological zone, farmer population density, and distance from provincial capitals.

Methods

Quantitative data were analyzed using SPSS version 26.0. Descriptive statistics summarized effectiveness scores. One-way ANOVA tested differences among models, with Tukey's HSD post-hoc test where significant ($p < 0.05$). Multiple linear regression examined the relationship between institutional characteristics and composite effectiveness scores. Qualitative data were transcribed, coded in NVivo 12, and analyzed through thematic content analysis following Braun and Clarke's framework^[10].

Results

Table 1: Composite effectiveness scores across three institutional extension models (n = 384)

Effectiveness Dimension	Public Sector (%)	PPP Model (%)	Decentralized (%)	F-value	p-value
Knowledge Transfer	72.3 ± 8.4	78.6 ± 7.1	68.9 ± 9.2	14.73	< 0.001
Farmer Reach	65.8 ± 11.3	81.2 ± 6.8	77.4 ± 8.6	21.56	< 0.001
Service Timeliness	58.4 ± 12.7	74.9 ± 9.3	82.1 ± 7.4	32.18	< 0.001
Technical Quality	69.7 ± 7.9	76.3 ± 8.1	71.8 ± 10.5	6.42	0.002
Cost Efficiency	52.1 ± 14.2	68.5 ± 10.7	74.3 ± 9.8	28.91	< 0.001
Composite Score	63.7 ± 6.8	76.3 ± 5.4	71.9 ± 6.1	18.34	< 0.001

Table 1 presents effectiveness scores for each model. The PPP model recorded the highest composite score at 76.3%, differing significantly from the public sector (63.7%) and decentralized model (71.9%). All five dimensions showed

statistically significant differences ($p < 0.01$). The decentralized model scored highest on service timeliness (82.1%) and cost efficiency (74.3%), but lowest on knowledge transfer (68.9%).

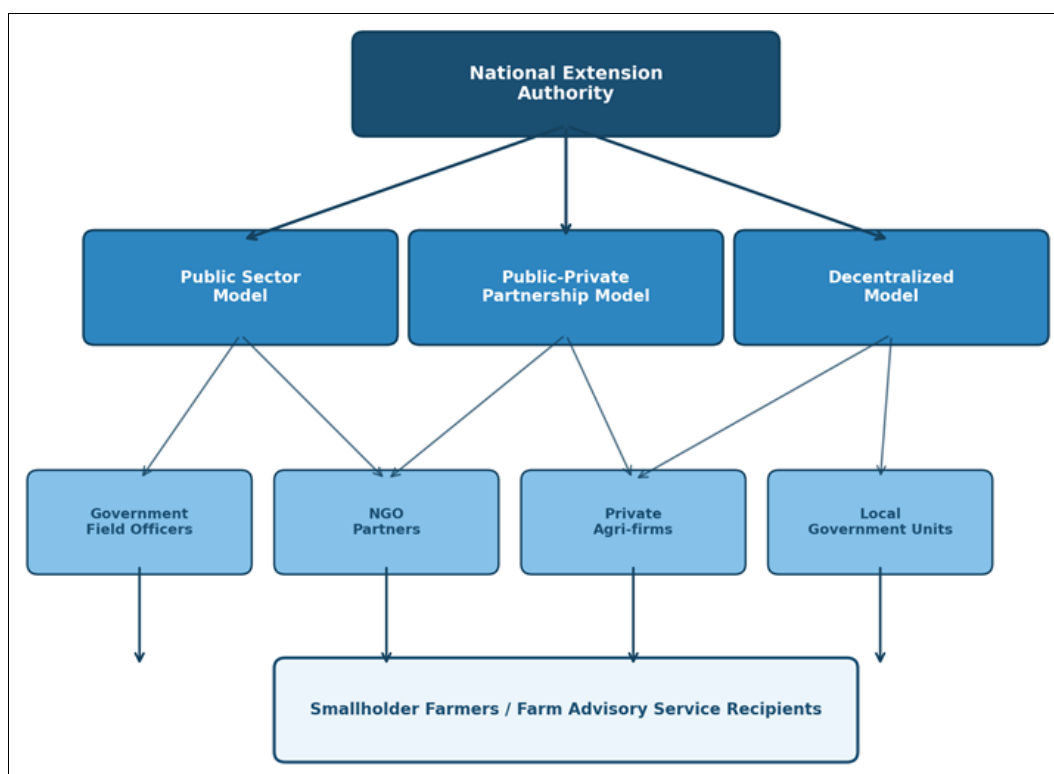


Figure 1. Flowchart of institutional pathways in three organizational extension frameworks

Figure 1 maps the organizational pathways through which each model channels advisory services from national authority to smallholder farmers. The public sector model follows a linear chain through government field officers.

The PPP model introduces NGO partners and private agri-firms as parallel channels. The decentralized model routes authority through local government units.

Table 2: Regression analysis of institutional characteristics predicting composite effectiveness

Predictor Variable	B	SE	Beta	t-value	p-value
Staffing Level (per 1000 farmers)	3.47	0.89	0.31	3.90	< 0.001
Annual Budget Allocation (USD)	0.82	0.21	0.28	3.91	< 0.001
Training Frequency (sessions/yr)	2.13	0.64	0.22	3.33	0.001
Supervision Intensity (visits/mo)	1.76	0.53	0.19	3.32	0.001
ICT Integration Score	1.24	0.48	0.14	2.58	0.011

Regression analysis (Table 2) revealed that five institutional characteristics explained 53.4% of variance in composite effectiveness ($R^2 = 0.534$, $F(5,378) = 43.42$, $p < 0.001$). Staffing level was the strongest predictor ($Beta = 0.31$),

followed by budget allocation ($Beta = 0.28$). ICT integration showed the smallest but still significant effect ($Beta = 0.14$, $p = 0.011$).

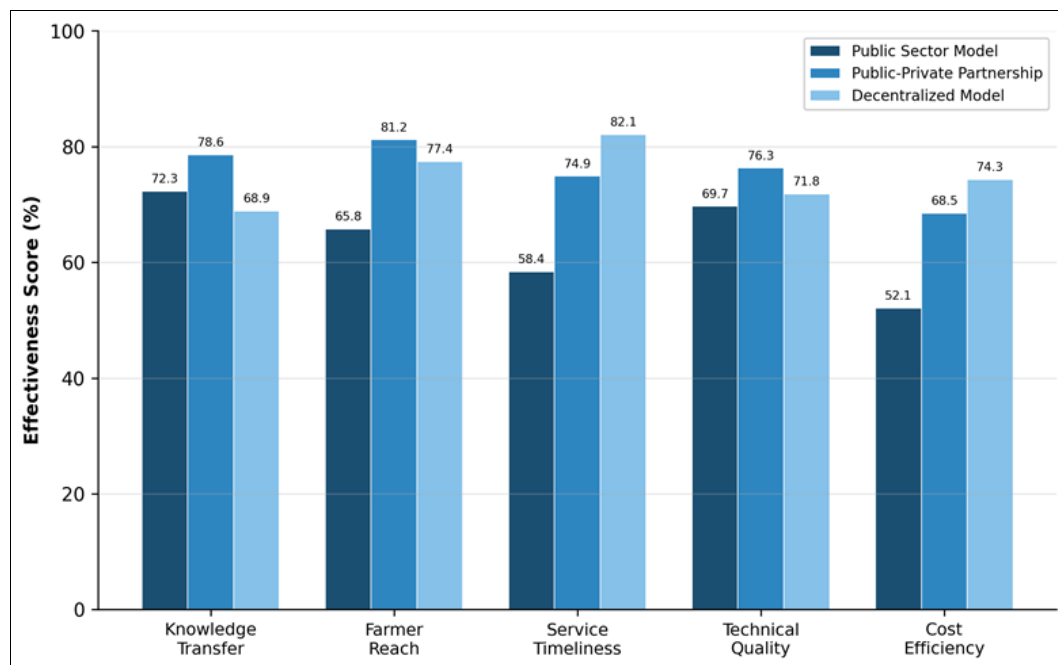
**Fig 2:** Comparative effectiveness scores across five dimensions for three models

Figure 2 visually compares effectiveness scores across models and dimensions. The PPP model's consistent performance is apparent, while the decentralized model's advantage in timeliness and cost efficiency stands out. The public sector model's lower cost efficiency score (52.1%) reflects funding constraints reported during qualitative interviews.

Discussion

The finding that the PPP model achieved highest composite effectiveness aligns with Anderson and Feder ^[11] who argued that pluralistic extension systems outperform single-provider models. However, our results add a qualification: the PPP advantage was most pronounced in farmer reach and knowledge transfer, while the decentralized model proved more effective at timely delivery and resource efficiency. This mirrors observations by Swanson and Rajalahti ^[5] that decentralization improves local responsiveness but may sacrifice technical depth.

The regression finding that staffing levels were the strongest predictor supports Birner *et al.* ^[12] that human resource investment remains the most critical factor in extension performance regardless of institutional model. The significant contribution of ICT integration even after controlling for staffing and budget suggests digital tools are

reshaping the delivery equation in ways older research didn't capture ^[13].

One unexpected finding was the public sector model's relatively strong performance on technical quality (69.7%), not far behind the PPP model (76.3%). Qualitative interviews suggested this reflected government investment in standardized training curricula. This challenges the narrative that public extension is uniformly ineffective and suggests public systems retain important capabilities ^[14].

Conclusion

This research provides comparative evidence that organizational frameworks of extension administration differ meaningfully in their effectiveness across key service delivery dimensions. The PPP model produced the highest overall effectiveness, but the decentralized model showed distinct advantages in timeliness and cost management. The public sector model, while scoring lowest overall, demonstrated capacity for technical quality that shouldn't be overlooked. The strongest predictor across all models was staffing level, followed by budget allocation a reminder that institutional design alone cannot compensate for resource shortfalls. These results argue for hybrid institutional arrangements that draw on each model's strengths. Extension policy should encourage PPP mechanisms for

expanding farmer reach while supporting decentralized structures for locally responsive services. Public sector systems should be retained for maintaining technical standards and equitable coverage ^[15, 16].

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