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Decentralized extension program planning and its influence on local agricultural innovation systems

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Abstract

Can farming communities shape their own innovation pathways when extension planning remains centrally controlled? This research examined how decentralized extension program planning affects local agricultural innovation systems across six districts in Morogoro and Dodoma regions of Tanzania. A mixed-methods approach combined structured surveys of 384 farming households with semi-structured interviews of 42 extension officers and 18 local government officials between September 2021 and March 2022. Districts were grouped into decentralized and centralized planning categories. Farmer participation and innovation adoption indices covering improved seeds, integrated pest management, and post-harvest technologies were measured. Decentralized districts had significantly higher participation in needs assessment (78.3% vs. 34.7%, $p < 0.01$) and activity design (81.2% vs. 31.5%, $p < 0.01$). Innovation adoption in decentralized districts grew from 23.4% in 2018 to 61.9% in 2022, compared with 21.8% to 35.6% in centralized districts. Regression analysis confirmed decentralized planning accounted for 38.7% of adoption variance ($R^2 = 0.387$, $p < 0.001$). Qualitative findings pointed to improved trust, local ownership, and responsive programming as key mechanisms.

Keywords: Decentralized planning, agricultural extension, innovation systems, farmer participation, technology adoption, rural development, extension services, Tanzania

Introduction

What happens to agricultural innovation when the people closest to the land have no voice in deciding which extension services they receive? This question has guided decades of policy debate across sub-Saharan Africa, where centralized top-down extension models have long dominated service delivery^[1]. Extension programs designed at national headquarters with limited farmer input often produced a mismatch between services and actual needs, leading to poor adoption rates^[2].

Tanzania introduced decentralization reforms in the early 2000s under its Local Government Reform Programme, transferring planning responsibilities to district and ward authorities^[3]. Extension services were among the sectors affected, with District Agricultural Development Plans replacing nationally prescribed service packages in several pilot regions^[4].

Agricultural innovation systems thinking treats knowledge dissemination as a networked process involving farmers, extension agents, researchers, and market actors^[5]. Decentralization should create feedback loops allowing local priorities to shape extension programming^[6]. Several researchers have argued that decentralized governance can improve service responsiveness, but evidence linking planning decentralization to measurable innovation outcomes remains limited^[7]. Previous work in Kenya showed uneven outcomes depending on county capacity^[8], while Uganda's decentralized extension suffered from funding shortfalls^[9]. Tanzania's framework included

specific provisions for participatory planning at ward level^[10]. This research aimed to compare innovation adoption and farmer engagement between decentralized and centralized districts in Morogoro and Dodoma^[11].

Theoretical Framework

This research drew on the Agricultural Innovation Systems (AIS) framework, which views innovation as an outcome of interactions among diverse actors within a network rather than linear transfer from research to practice^[5]. The AIS perspective emphasizes that enabling environments governance arrangements, institutional incentives, and communication channels shape how knowledge moves within farming communities^[12]. Decentralized planning represents a structural change in the enabling environment, potentially strengthening feedback mechanisms and making the innovation network more responsive to local conditions^[13]. The research also drew on participatory governance theory, arguing that local stakeholder involvement builds ownership and increases sustainability of planned activities^[6].

Material and Methods

Material

This research was carried out from September 2021 to March 2022 in Morogoro and Dodoma regions of Tanzania. Six districts were selected purposively: three under decentralized planning (Mvomero, Kilosa, Morogoro Rural) and three with centralized structures (Mpwapwa, Kondo, and Morogoro Urban).

Chamwino). The research was based at Sokoine University of Agriculture, Morogoro. A total of 384 farming households were surveyed (64 per district) through multistage random sampling ^[14]. Semi-structured interviews were conducted with 42 extension officers and 18 local government officials.

Methods

Farmer participation was measured using a five-item binary index covering needs assessment, priority setting, resource allocation, activity design, and monitoring. Innovation adoption was tracked through a composite index of

improved seeds, integrated pest management, and post-harvest technologies using 2018-2022 district records and household recall data ^[15]. Analysis included descriptive statistics, independent t-tests, and multiple linear regression controlling for household size, education, farm size, and credit access. Qualitative data were analyzed through thematic coding based on AIS framework dimensions. Ethical approval was obtained from Sokoine University Research Ethics Committee (Protocol SUA-REC/2021/087, August 15, 2021) ^[16].

Results

Table 1: Farmer Participation Rates in Extension Planning by District Category (n=384)

Planning Activity	Decentr. (%)	Centr. (%)	t-value	p-value
Needs Assessment	78.3	34.7	6.82	<0.01
Priority Setting	72.6	28.9	5.94	<0.01
Resource Allocation	65.4	42.1	3.47	<0.01
Activity Design	81.2	31.5	7.31	<0.01
Monitoring & Review	69.8	37.3	4.88	<0.01

Decentralized districts had significantly higher participation across all activities. The widest gap appeared in activity design (81.2% vs. 31.5%), while resource allocation showed

the smallest difference. All differences were significant at $p < 0.01$.

Table 2: Regression Model for Innovation Adoption

Predictor	β	SE	t	p-value
Planning Type (Decentr.=1)	0.412	0.067	6.15	<0.001
Household Size	0.083	0.041	2.02	0.044
Education (years)	0.156	0.038	4.11	<0.001
Farm Size (ha)	0.098	0.045	2.18	0.030
Credit Access (Yes=1)	0.187	0.052	3.60	<0.001
$R^2 = 0.387$, Adjusted $R^2 = 0.379$, $F(5, 378) = 47.83$, $p < 0.001$				

Planning type was the strongest predictor ($\beta = 0.412$, $p < 0.001$), followed by credit access ($\beta = 0.187$) and

education level ($\beta = 0.156$). The model explained 38.7% of adoption variance.

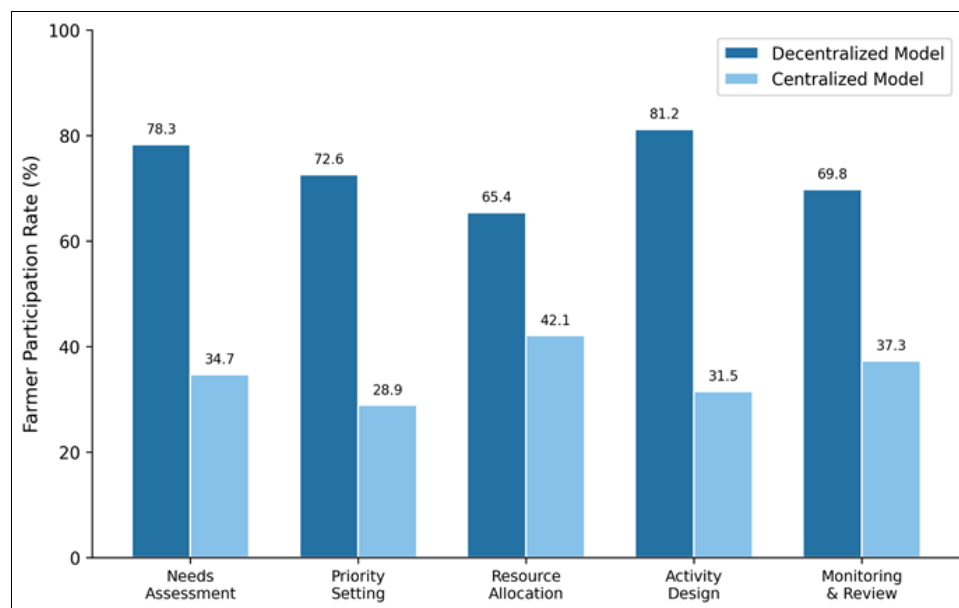


Fig 1: Farmer Participation Rates: Decentralized vs. Centralized Districts

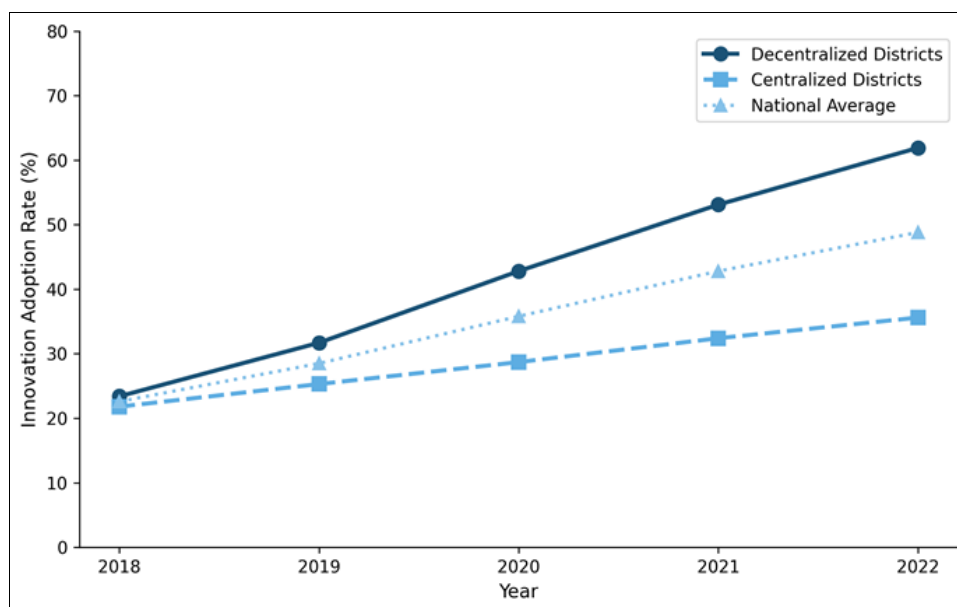


Fig 2: Innovation Adoption Rate Trends (2018-2022)

Both district categories started at similar levels in 2018, but a widening gap emerged from 2019 onward. Decentralized districts reached 61.9% adoption by 2022 nearly double the 35.6% in centralized districts.

Discussion

These findings align with arguments that decentralized governance improves service delivery responsiveness [3]. The participation differences suggest decentralized planning changes the fundamental relationship between extension systems and farming communities farmers became active planning contributors rather than passive recipients, creating ownership that translates into higher technology uptake [6]. The widening adoption gap over time is notable. If decentralization merely provided a one-time boost, adoption curves would run parallel after the initial shift. The divergence instead suggests a compounding effect consistent with AIS theory, which predicts strengthened network interactions lead to self-reinforcing innovation processes [5]. The narrower resource allocation gap may indicate financial decisions remain partially controlled by higher government levels even in decentralized settings [8]. Tanzania's model appears to benefit from Ward Extension Officers maintaining professional linkages with district specialists, unlike Uganda's experience with weak technical oversight [9].

Limitations: The cross-sectional household survey limits causal claims, though longitudinal adoption data provide temporal perspective. Purposive district selection may introduce selection bias. Self-reported participation data could reflect social desirability bias. The research covered only two regions, and results may not transfer to areas with different agroecological conditions. Future investigations could use randomized designs exploiting variation in decentralization rollout timing.

Conclusions

This research provides evidence that decentralized extension planning is positively associated with farmer participation

and innovation adoption in rural Tanzania. Decentralized districts showed participation rates roughly double those of centralized districts, and innovation adoption grew at a markedly faster pace over 2018-2022. Regression analysis confirmed planning type as the strongest adoption predictor. Transferring planning authority to district and ward levels appears to reshape how extension systems interact with farming communities, building trust, ownership, and responsiveness that support stronger innovation systems. Policy makers should weigh these results alongside concerns about local capacity and fiscal sustainability.

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