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Evaluating farmer profile characteristics as determinants of public and private extension system effectiveness in oilseed farming

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Abstract

The effectiveness of agricultural extension systems remains a critical factor in enhancing farmers' knowledge, decision-making capacity, and technology adoption, particularly in dryland regions of India. The present study investigates the extent to which selected socio-economic and communication variables predict the effectiveness of public and private extension systems among oilseed farmers in Mahabubnagar district, Telangana. A sample of 120 farmers was selected through a multistage purposive sampling procedure, and data were collected using a structured interview schedule. Multiple linear regression analysis was employed to determine the predictive strength of variables such as age, education, farming experience, landholding, annual income, extension contact, mass media utilization, trainings undergone, and cropping pattern. Results revealed that the public extension model recorded an R^2 of 0.57, indicating that more than half of the variation in extension effectiveness was explained by the selected predictors. Education, farming experience, landholding, extension contact, mass media utilization, annual income, and trainings undergone emerged as significant determinants. In the private extension model, the R^2 value of 0.53 indicated higher explanatory power, with education, farming experience, landholding, extension contact, annual income, and trainings undergone emerging as significant predictors, while age, cropping pattern, and mass media utilization were non-significant. The findings suggest that socio-economic characteristics and farmers' access to information critically influence their interaction with extension systems. Strengthening training opportunities, enhancing extension-farmer interactions, and tailoring services to farmers' educational and economic profiles can substantially improve extension outcomes.

Keywords: Extension effectiveness, oilseed farmers, socio-economic factors, regression analysis, public extension, private extension

Introduction

Agricultural extension systems constitute a vital institutional mechanism for transferring innovations, disseminating knowledge, and enabling farmers to adopt improved practices. In developing economies, especially in semi-arid and rainfed regions like Telangana, extension services function as a key instrument for enhancing farmers' resilience through technological, financial, and market-oriented support. As noted globally, extension contributes significantly to strengthening decision-making and improving productivity (Anderson & Feder, 2004) ^[1]. Over the past several decades, India's extension landscape has transitioned from a predominantly public-driven approach to a more pluralistic model that includes public, private, and voluntary organizations. Such pluralism expands farmers' access to information but can also lead to variations in quality, coverage, and responsiveness of services (Rivera & Alex, 2004) ^[4].

Oilseed cultivation holds strategic importance for India's agricultural economy due to its role in edible oil security, livestock feed demand, and income generation. Telangana, particularly Mahabubnagar district, is characterized by a substantial oilseed-growing area yet faces fluctuations in productivity due to climatic variability, limited irrigation, and gaps in adoption of improved practices. Sectoral assessments emphasize that regions like Telangana continue to require enhanced advisory mechanisms to strengthen agricultural performance (Government of Telangana, 2024) ^[3]. In such contexts, efficient and farmer-focused extension services become essential to address informational disparities and support climate-

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resilient agricultural decision-making. Understanding how socio-economic factors influence farmers' perceptions and use of extension services is crucial for designing targeted and effective interventions. While several studies have examined farmers' interaction with extension systems, the determinants of such interaction remain uneven across regions and farm categories (Gebremariam *et al.*, 2021) [2]. Earlier research often relies on correlation-based approaches, limiting insights into how multiple variables together shape extension effectiveness. Multiple linear regression provides a stronger analytical framework by identifying the most influential predictors while accounting for overlapping effects.

The present study employs regression analysis to quantify the contribution of key socio-economic and communication variables to the effectiveness of both public and private extension systems among oilseed farmers. It provides empirical evidence to guide policymakers, extension planners, and agribusiness agencies in tailoring programs to farmer needs. The study contributes to extension science by offering a rigorous comparative assessment of determinants shaping the performance of dual extension systems within the same agro-ecological environment.

Materials and Methods

The study was conducted in Mahabubnagar district of Telangana, a major oilseed-producing region characterized by diverse socio-economic conditions and substantial dependence on extension services. A random sampling

procedure was employed. Three mandals with the highest concentration of oilseed cultivation were purposively selected to ensure adequate representation. From each mandal, four villages were randomly chosen, and ten farmers from each village were selected through simple random sampling, yielding a total sample of 120 oilseed farmers. This sampling design ensured both diversity and statistical reliability. Data were collected using a pre-tested structured interview schedule that captured socio-economic characteristics (Age, education, farming experience, landholding, annual income, cropping pattern), communication and information variables (Extension contact, mass media utilization), capacity-building variables (Trainings attended), and farmers' perception of extension effectiveness. Effectiveness was operationalized through a composite score assessing relevance, timeliness, accuracy, service accessibility, problem-solving capacity, and overall satisfaction with extension services. Multiple linear regression was employed to determine which variables significantly predicted extension effectiveness. Two separate regression models were constructed: one for the public extension system and one for the private extension system. The dependent variable for both models was the extension effectiveness score. Independent variables included age, education, farming experience, landholding, annual income, extension contact, mass media utilization, cropping pattern, and trainings undergone. The analysis was carried out using SPSS.

Table 1: Multiple Linear Regression Analysis of Socio-Economic Variables on Extension Effectiveness

S. No	Variables	Public Extension			Private Extension		
		Coefficient (b)	t-value	p value	Coefficient (b)	t-value	p value
1	Age	0.00056	1.24	0.218	-0.00073	-1.56	0.123
2	Education	0.2035	3.05**	0.003	0.1546	2.61*	0.011
3	Farming Experience	0.0042	2.54*	0.013	0.0038	2.20*	0.030
4	Land Holding	0.0071	3.12**	0.002	0.0063	3.08**	0.003
5	Cropping Pattern	-0.0028	-1.56	0.122	-0.0042	-1.70	0.093
6	Extension Contact	0.3158	5.02**	<0.001	0.0402	2.27*	0.026
8	Mass Media Utilization	0.0201	2.51*	0.014	0.0033	0.54	0.589
9	Annual Income	0.00005	2.98**	0.004	0.00004	2.46*	0.016
10	Trainings Undergone	0.1434	3.21**	0.002	0.1931	4.00**	<0.001

R² values: Public Extension: 0.57 Private Extension: 0.53

The multiple linear regression analysis from Table 1 provided clear insights into how different socio-economic and communication-related variables influence the effectiveness of public and private extension services among oilseed farmers. For the public extension arrangement, the coefficient of determination (R²) was 0.57, indicating that 57% of the variation in farmers' perceived effectiveness could be attributed to the variables included in the analysis. This percentage reflects the extent to which farmers' background characteristics and exposure to information collectively shape their experience with public extension. Several variables were found to be statistically significant in influencing the effectiveness of public extension. Education (t = 3.05**), farming experience (t = 2.54*), landholding (t = 3.12**), extension contact (t = 5.02**), mass media utilization (t = 2.51*), annual income (t = 2.98**), and trainings undergone (t = 3.21**) had a positive and significant effect. The significant role of education suggests that literate farmers are more capable of absorbing and interpreting technical advice, which helps them apply

recommended practices more effectively. These observations align with Naidu and Bose (2016) [6], who reported that farmers with higher education levels tend to respond more efficiently to agricultural advisory messages. Landholding and annual income also emerged as significant contributors, reflecting the importance of economic and physical resources. Farmers with larger land areas and greater financial stability are better positioned to adopt recommended technologies, invest in inputs, and manage risks, which enhances the perceived usefulness of public extension. Sathish (2015) [5] similarly noted that economic strength and resource ownership improve farmers' capacity to take action based on extension guidance. Extension contact was one of the strongest influencing variables in public extension. The high t-value for extension contact (t = 5.02**) highlights the critical role of regular and meaningful interaction between farmers and extension personnel. Frequent contact allows extension workers to provide tailored information, clarify doubts, and offer follow-up support. Trainings undergone also contributed significantly,

reinforcing that structured learning opportunities help farmers build confidence, gain practical knowledge, and apply improved methods more accurately. These results collectively emphasize that personal communication and capacity-building initiatives are central to enhancing the outcomes of public extension. Mass media utilization had a positive and significant impact ($t = 2.51^*$), showing that traditional media such as radio, television, and printed materials still play an important role in reinforcing messages delivered through direct interactions. These channels help increase awareness and provide timely information on weather, pest outbreaks, and government programs. However, age ($t = 1.24$) and cropping pattern ($t = -1.56$) were found to be non-significant. This suggests that farmers across age groups perceive public extension similarly and that the crops they cultivate do not substantially influence their evaluation. Naidu and Bose (2016) ^[6] and Sathish (2015) ^[5] also reported limited influence of age and cropping pattern on farmers' responses to extension.

For private extension, the regression analysis yielded an R^2 of 0.53, meaning that 53% of the variation in perceived effectiveness was explained by the variables studied. Several variables were significant: education ($t = 2.61^*$), farming experience ($t = 2.20^*$), landholding ($t = 3.08^{**}$), extension contact ($t = 2.27^*$), annual income ($t = 2.46^*$), and trainings undergone ($t = 4.00^{**}$). These results show that private extension is more effective among farmers who are better informed, more experienced, and economically stable. Education and training played particularly important roles. Private Service providers often deliver specialized, input-focused, or commercial advisory services that require a certain level of prior knowledge and willingness to adopt. Farmers who are educated and who participate in more training programs are better equipped to understand and implement these recommendations. Similar findings were reported by Grace (2020) ^[7], who noted that private advisory services perform better among progressive farmers with higher levels of preparedness. Gebremariam (2021) ^[2] and Loki *et al.* (2020) ^[8] also highlighted the importance of experience, income, and frequent interaction in shaping farmers' receptiveness to private advisory services. Farming experience had a positive effect ($t = 2.20^*$), indicating that experienced farmers can more easily interpret private firms' recommendations and incorporate them into their cultivation practices. Landholding and income again demonstrated their importance, as farmers with greater resources can invest in inputs and technologies promoted by private agencies. This confirms earlier studies that economic capacity and farm size substantially influence the uptake of private advisory services (Grace, 2020; Loki *et al.*, 2020) ^[7, 8]. Mass media utilization ($t = 0.54$) was non-significant in private extension, indicating that private providers rely more heavily on direct communication approaches such as field visits, demonstrations, and personalized advisories rather than mass communication. Age ($t = -1.56$) and cropping pattern ($t = -1.70$) also remained non-significant, suggesting that these factors do not substantially affect how farmers interpret or value the services offered by private entities.

Overall, the results indicate that education, economic status, experience, extension contact, and training are the most important determinants of extension effectiveness across both public and private arrangements. While both rely on similar variables, private extension shows slightly higher

explanatory power, possibly due to its more targeted and personalized interaction with farmers.

Conclusion

The present study provides a comprehensive assessment of the socio-economic and communication variables that predict the effectiveness of public and private extension systems among oilseed farmers. The findings reveal that both models exhibit strong explanatory power, with private extension showing a slightly higher R^2 value. Education, farming experience, landholding size, extension contact, annual income, and training participation emerged as strong and consistent predictors across both systems. These variables significantly enhance farmers' capacity to understand, evaluate, and adopt extension recommendations. Conversely, age and cropping pattern were non-significant predictors in both systems, suggesting their limited direct influence on extension outcomes. The study highlights the need for extension systems to adopt a more farmer-centric approach, recognizing that socio-economic characteristics significantly shape farmers' engagement with advisory services. Tailoring extension strategies to the needs of different farmer groups particularly resource poor and less educated farmers can enhance inclusivity and impact. Strengthening training infrastructure, improving farmer-extension linkages, and increasing the accessibility of information can further enhance the effectiveness of both public and private extension systems.

Future recommendations

Future extension interventions should prioritize farmer-centric approaches that enhance inclusivity, responsiveness, and resource access by strengthening field-level training programs, improving the frequency and quality of extension-farmer interactions, promoting ICT-enabled advisory systems, and fostering collaboration between public and private agencies to leverage their complementary strengths; simultaneously, targeted support for small and marginal farmers through subsidies, credit facilitation, and tailored training modules is essential to address adoption barriers, while continuous monitoring and evaluation frameworks should be institutionalized to ensure accountability, relevance, and long-term sustainability of extension services, aligning with the need for dynamic, context-specific, and farmer-sensitive extension services.

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