



{ MUDIMA }



The Effect of Agricultural Extension Workers' Performance on the Adoption of Cattle-Maize Integration Technology in Kabangka District, Muna Regency

La Ode Muh. Ikhsanuddin^{1*}, Weka Widayati², Hartina Batoa³

Universitas Halu Oleo

Corresponding Author: La Ode Muh. Ikhsanuddin ikhsanuddinlaode@gmail.com

ARTICLE INFO

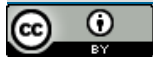
Keywords: Agricultural Extension Workers' Performance; Technology Adoption; Cattle–Maize Integration; Agricultural Extension

Received : 6 May 2026

Revised : 21 June 2026

Accepted : 22 July 2026

©2026 Iksanuddin, Batoa, Widayati :
This is an open-access article distributed
under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

This study aims to analyze the effect of agricultural extension workers' performance on the adoption of beef cattle and maize integration technology in Kabangka District, Muna Regency. The research was conducted from March to May 2026 in Kabangka District, Muna Regency, Southeast Sulawesi. The study population consisted of farmers who cultivated maize and raised beef cattle within an integrated farming system, totaling 102 farmers. The sample was determined using the Slovin formula with a 5% margin of error, resulting in 81 farmer respondents. Data were collected through questionnaires using a five-point Likert scale and structured interviews. The performance of agricultural extension workers was measured based on indicators of planning, implementation, and evaluation of extension activities, while the adoption of integration technology was measured through the application of maize waste utilization as animal feed, livestock manure utilization as organic fertilizer, agricultural waste management, and the implementation of an integrated maize–cattle farming system. Data were analyzed using the Structural Equation Modeling-Partial Least Square (SEM-PLS) approach. The results showed that the performance of agricultural extension workers was categorized as high, with an average score of 3.93, while the adoption level of beef cattle and maize integration technology was also categorized as high, with an average score of 4.08. Hypothesis testing results indicated that the performance of agricultural extension workers had a positive and significant effect on the adoption of integration technology, with a path coefficient value of 0.870, a T-statistic value of 7.637, and a P-value of 0.000. These findings indicate that better performance of agricultural extension workers in conducting extension activities, providing assistance, and delivering technological information will increase the level of adoption of beef cattle and maize integration technology among farmers. This study concludes that agricultural extension workers' performance plays an important role as a driving factor in the successful adoption of integrated cattle–maize farming technology in Kabangka District, Muna Regency

INTRODUCTION

The agricultural sector plays a strategic role in Indonesia's economic development as it serves as a food provider, a source of income for rural communities, and an employer. One of the priority commodities for development is corn (*Zea mays* L.), which not only serves as a food ingredient but also as a main raw material for the livestock feed industry. Muna Regency is one of the corn-producing regions

in Southeast Sulawesi Province that has shown quite good progress. Data from the Muna Regency Office of Food Crops, Horticulture, and Plantations shows that the harvested area of corn increased from 5,836 hectares in 2023 to 9,297 hectares in 2024, with production reaching 22,703 tons. In addition to producing kernels as the main product, corn plants also produce waste in the form of stalks, leaves, and

cobs, which have potential to be used as livestock feed.

On the other hand, Muna Regency is also one of the areas for beef cattle development in Southeast Sulawesi. The beef cattle population increased from 19,966 heads in 2023 to 21,563 heads in 2024. This situation shows the potential for developing an integrated system of beef cattle and corn that uses corn waste as animal feed and cattle manure as organic fertilizer. This integration system is considered capable of improving the efficiency of agricultural resource use, enhancing soil fertility, and increasing farm productivity sustainably (Devendra and Thomas 2002)..

Even though it has a lot of potential, the implementation of integrated beef cattle and corn farming technology in Muna Regency is still not optimal. Research by Estin et al. (2025) shows that farmers still mostly use natural forage as livestock feed rather than agricultural waste. Fyka and Rahmawati (2021) also found that corn farming and livestock businesses are still managed separately, so the benefits of integration haven't been fully utilized. In addition, Asmawati et al. (2025) reported that the level of agricultural technology adoption among corn farmers is still varied, influenced by their knowledge, experience, and access to information.

This situation shows that the adoption rate of beef cattle and corn integration technology is still relatively low. From the perspective of diffusion of innovation theory, the success of technology adoption is influenced by the role of change agents who function to spread information and encourage the implementation of innovations at the user level. In the agricultural sector, this role is carried out by agricultural extension workers through outreach, guidance, and coaching activities for farmers (Rogers et al. 2014). Therefore, the performance of extension workers in carrying out outreach activities is suspected to be an important factor that can affect the level of technology adoption by farmers.

Besides performance, the competency of extension workers also determines the success of the extension process. Extension workers who have good technical, managerial, and social competencies

are better able to provide information that meets farmers' needs and facilitate effective learning processes. On the other hand, farmers' behavior, reflected in their knowledge, attitudes, and actions toward innovation, also plays an important role in deciding whether to accept and implement the introduced technology. Therefore, it is suspected that farmers' behavior not only directly influences technology adoption but also acts as a variable that bridges the impact of extension workers' performance and competence on the adoption of integrated beef cattle and corn farming technology.

Kabangka District is one of the areas in Muna Regency that has great potential for developing the integration of beef cattle and corn farming because it is supported by the existing corn cultivation and beef cattle farming as well as the presence of field agricultural extension workers who actively assist farmer groups. However, the level of technology integration adoption by farmers is still uneven, raising questions about the factors that influence the successful adoption of this technology. So far, research examining the impact of the performance and competence of extension workers on the adoption of beef cattle and corn integration technology, while involving farmer behavior as a mediating variable, is still relatively limited, especially in Kabangka District, Muna Regency.

Based on these conditions, this study was conducted to find out whether the performance and competence of extension workers affect the adoption of beef cattle and corn integration technology in Kabangka District, Muna Regency. Additionally, this study also examines whether farmers' behavior plays a role in mediating the relationship between extension workers' performance and competence and the adoption of this integration technology. Therefore, the aim of this study is to analyze the influence of extension workers' performance and competence on the adoption of beef cattle and corn integration technology, as well as to analyze the role of farmers' behavior as a mediating variable in that relationship in Kabangka District, Muna Regency.

METHODS

This study used a quantitative approach with a survey method to analyze the influence of agricultural extension workers' performance on the adoption of integrated beef cattle and corn farming technology in Kabangka District, Muna Regency. The research was conducted from March to May 2026 in Kabangka District, which was purposively selected because it is one of the main corn production centers as well as a beef cattle development area with the potential for implementing a cattle–corn integration system. The study population consisted of all farmers who cultivate corn and raise beef cattle within a single farming system and are members of farmer groups guided by field agricultural extension workers (PPL), totaling 102 people. The research sample was determined using Slovin's formula with a 5% margin of error, resulting in 81 farmer respondents selected purposively according to the research criteria. The data used consisted of both primary and secondary data. Primary data was collected through structured interviews using a five-point Likert scale questionnaire to measure the performance of extension workers and the adoption of the corn–cattle integration technology, while secondary data was obtained from the Central Bureau of Statistics, the Muna Regency Plant,

Horticulture, and Plantation Office, the Muna Regency Animal Husbandry and Animal Health Office, as well as various relevant literature and research results. The performance of extension workers was measured through indicators of planning, implementation, and evaluation and reporting of extension activities, while the adoption of integration technology was measured through the level of use of corn waste as animal feed, the use of animal manure as organic fertilizer, management of agricultural waste, and the implementation of corn and beef cattle business integration systems. The data was analyzed using descriptive analysis to describe the characteristics of the respondents and the conditions of each research variable, as well as simple linear regression analysis to test the effect of extension workers' performance on the adoption of beef cattle and corn integration technology in Kabangka District, Muna Regency. Before testing the hypotheses, the research instruments were tested for validity and reliability to ensure the data used in the analysis was suitable.

RESULTS AND DISCUSSION

Performance of Agricultural Extension Workers (X₁)

Table 1. Descriptive Analysis Results of Agricultural Extension Workers' Performance Variables (X₁)

No	Indicator	Mean	Category
1	Extension program according to the needs of farmers	3,91	Height
2	The purpose and objectives of counseling are clearly conveyed	3,89	Height
3	The schedule of counseling activities is clearly arranged	3,88	Height
4	Extension workers have an extension work plan	3,94	Height
5	Farmers are involved in extension planning	3,85	Height
6	Implementation of counseling according to schedule	3,98	Height
7	Farmers actively participate in counseling activities	4,02	Height
8	Counseling materials are easy to understand	3,96	Height
9	Use of counseling methods and media	3,93	Height
Average Extension Performance Variable (X ₁)		3,93	Height

Source: Processed Primary Data (2026).

Based on Table 5.8, the performance variable of agricultural extension workers obtained an average score of 3.93 with a high category. These results show that extension workers in Kabangka District

have carried out counseling activities well, both at the planning and implementation stages. The indicator with the highest score was the activeness of farmers participating in extension activities at 4.02,

while the lowest value was found in the involvement of farmers in extension planning at 3.85.

The high level of farmer activity shows that the extension workers are able to build effective communication and learning processes, so farmers are encouraged to join the extension activities. Meanwhile, the relatively lower level of farmer involvement in planning indicates that farmers' participation in identifying needs and developing extension programs still needs to be improved.

Overall, the research results show that the performance of agricultural extension workers is in the high category. This indicates that the extension workers have been able to carry out their extension functions effectively, thus supporting the increase of farmers' knowledge and encouraging the application of technology for integrating beef cattle and corn in Kabangka District, Muna Regency.

Integration Technology Adoption (Y)

Table 2. Descriptive Analysis Results of Technology Integration Adoption Variable (Y)

No	Indicator	Mean	Category
1	Feed processing	4,03	Height
2	Organic fertilizer processing	4,11	Height
3	Utilization of corn waste	4,02	Height
4	Integrated farming system	4,16	Height
Average Integration Technology Adoption Variable (Y)		4,08	Height

Source: Processed Primary Data (2026).

Based on Table 5.9, the technology adoption variable for integration has an average score of 4.08, which falls into the high category. This result shows that farmers in Kabangka District have implemented integrated cattle and corn farming technology in their farming activities. The indicator with the highest value is the integrated farming system at 4.16, while the lowest value is in the utilization of corn waste at 4.02.

The high value of the integrated farming system shows that farmers have been able to combine corn cultivation and cattle raising by making use of available resources. Farmers understand the mutual relationship between crops and livestock, like using corn waste as feed and using animal waste as organic fertilizer.

Besides that, the high value of organic fertilizer processing shows that farmers have been using livestock manure to support corn crop productivity. Meanwhile, the implementation of feed processing and the use of corn waste shows that farmers are starting to optimize agricultural by-products as a valuable resource.

Overall, the research results show that the level of adoption of the technology for integrating beef cattle and corn is high. This indicates that the applied technology fits the farmers' needs and can support farm efficiency by making optimal use of local resources.

Convergent Validity

Table 3. Results of Convergent Validity Testing Based on Loading Factor

	Technology Adoption (Y)	Extension Worker Performance (X1)
AT1	0.934	
AT2	0.856	
AT3	0.927	
AT4	0.859	
AT5	0.953	

	Technology Adoption (Y)	Extension Worker Performance (X1)
AT6	0.923	
AT7	0.838	
AT8	0.873	
AT9	0.942	
Kin.P1		0.914
Kin.P2		0.949
Kin.P3		0.957
Kin.P4		0.867
Kin.P5		0.851
Kin.P6		0.932
Kin.P7		0.950
Kin.P8		0.849
Kin.P9		0.943

Based on the results of the convergent validity test, all indicators of the Extension Performance variable (X) and Technology Integration Adoption (Y) had loading factor values above 0.70. The highest loading factor was found in the Kin.P3 indicator at 0.957, while the lowest was in the AT7 indicator at 0.838. Since all indicators have loading

factor values greater than 0.70, all indicators are considered valid and can represent the constructs being measured. Therefore, the measurement model has met the convergent validity criteria and is suitable for use in the next stage of analysis.

Discriminant Validity

Table 4. Results of Discriminant Validity Test Based on Fornell-Larcker Criteria

Variabel	Technology Adoption (Y)	Extension Worker Performance (X1)
Technology Adoption (Y)	0,901	
Extension Worker Performance (X1)	0,996	0,913

Based on the results of testing discriminant validity using the Fornell-Larcker criteria, the square root of the AVE for each construct is greater than 0.70. This result indicates that the indicators for each construct are able to adequately explain the variables being measured. Therefore, the measurement model has met the discriminant validity criteria and can be used in structural analysis.

Construct Reliability and Validity

Table 5. Results of Construct Reliability and Validity Testing

Variable	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	AVE
Technology Adoption (Y)	0,971	0,972	0,975	0,813
Extension Worker Performance (X1)	0,976	0,977	0,978	0,834

The reliability test results show that all variables have Cronbach's Alpha and Composite Reliability values greater than 0.70. In addition, the Average Variance Extracted (AVE) values for each variable are also greater than 0.50. These results indicate that the research instruments are very

reliable and can adequately explain the variance of the indicators. Therefore, the constructs used in this study are considered reliable and valid

F Square Value

Table 7. Effect Size (F-Square) Test Results

Technology Adoption (Y)	Technology Adoption (Y)
Extension Worker Performance (X1)	2.086

The F-Square value of the influence of Extension Workers' Performance on Technology Integration Adoption is 2.086. According to Hair et al. (2022), an F-Square value above 0.35 indicates a large effect size. So, Extension Workers'

Performance has a very strong impact on Technology Integration Adoption.

Hypothesis Test

Table 8. Results of Hypothesis Testing of the Structural Model

Variable Relationships	Original Sample/O	Sample (M)	Standard Deviation (STDEV)	T Statistics	P Value
Extension Performance (X1) → Technology Adoption (AT)	0,870	0,883	0,114	7,637	0,000

Based on the results of the hypothesis testing, the relationship between Extension Workers' Performance and Technology Integration Adoption has a path coefficient value of 0.870, with a T-

Statistic of 7.637 and a P-Value of 0.000. The T-Statistic is greater than 1.96 and the P-Value is less than 0.05, so the research hypothesis is accepted.

These results show that the performance of extension workers has a positive and significant effect on the adoption of cattle and corn integration technology in Kabangka District, Muna Regency. The better the performance of extension workers in carrying out extension activities, the higher the level of technology adoption by farmers. Conversely, if the performance of extension workers declines, the level of technology adoption by farmers also tends to

decrease. This finding emphasizes that extension workers play a strategic role as change agents in speeding up the acceptance and implementation of agricultural innovations at the farmer level.

Discussion

The Influence of Extension Workers' Performance on the Adoption of Beef Cattle and Corn Integration Technology in Muna Regency

Table 9. Test Results of the Influence of Extension Workers' Performance on Technology Adoption

Variable Relationships	Original Sample (O)	T Statistics	P Value	Remarks
Extension Performance (X1) → Technology Adoption (AT)	0,870	7,637	0,000	Signifikan

Based on the results of hypothesis testing using the Structural Equation Modeling-Partial Least Square (SEM-PLS) approach, it was found that the path coefficient is 0.870 with a t-statistic of 7.637 and a p-value of 0.000. These results show that the performance of extension workers has a positive and significant effect on the adoption of beef cattle and corn integration technology in Muna Regency. The results indicate that the hypothesis proposed in this study can be accepted. This finding suggests that improving the performance of extension workers will be followed by an increase in the level of technology integration adoption by farmers. On the other hand, low performance of extension workers could potentially hinder the process of accepting and applying technological innovations at the farmer level.

A good extension worker's performance is reflected in their ability to transform information and knowledge to farmers so that they can improve their capacity to understand, evaluate, and apply an innovation. From the perspective of modern agricultural extension theory put forward by Romadi & Warnaen (2021), the success of extension work is not only determined by the intensity of information delivery but also by the extension worker's ability to build participatory communication, develop farmers'

capacities, and create a learning environment that supports behavior change

CONCLUSION

The performance of agricultural extension workers in Kabangka District falls into the high category with an average score of 3.93. This shows that the extension workers have been able to carry out their roles in supporting the extension process through program planning, activity implementation, information delivery, and using extension methods that meet farmers' needs.

The adoption of technology for integrating beef cattle and corn is in the high category, with an average score of 4.08. This result shows that farmers have been able to apply integration technology by using corn waste as feed, processing organic fertilizer, and implementing an integrated farming system in their farming activities.

The performance of extension workers has a positive and significant impact on the adoption of beef cattle and corn integration technology in Kabangka District, Muna Regency. The SEM-PLS analysis shows a path coefficient value of 0.870 with a T-Statistic of 7.637 and a P-Value of 0.000. These results indicate that the better the extension workers perform in providing guidance, delivering information, and facilitating farmers, the higher the level of technology integration adoption by the farmers.

Recomendation

For Agricultural Extension Workers

Agricultural extension workers are advised to improve the quality of their outreach by using a more participatory approach, especially by involving farmers in program planning so that the application of integrated technology better fits the farmers' needs.

For Farmer

Farmers are advised to be more active in attending extension activities and taking advantage of the guidance provided by agricultural extension workers. Farmers' activeness in receiving information, discussing, and applying introduced technology becomes an important factor in the success of adopting integrated beef cattle and corn farming technology.

For Local Governments and Relevant Agencies

Local governments and relevant agencies are advised to support the improvement of extension workers' performance by providing supporting facilities for extension activities, strengthening mentoring programs, and developing demonstration activities for the integration of beef cattle and corn technology. This support is needed so that the process of spreading and implementing integration technology can run optimally.

For Future Researchers

It is recommended that future research develops further studies by considering other factors that could influence the adoption of integration technology, such as farmer characteristics, institutional support, access to information, and socio-economic factors, so that it can provide a broader picture of the factors affecting the successful implementation of agricultural technology.

REFERENCES

- Asmawati, A., Hamzah, A., & Jayadisastra, Y. (2025). Respon Petani Pada Penggunaan Benih Jagung Bisi II di Desa Wakadia Kecamatan Watopute Kabupaten Muna. *Jurnal Ilmiah Inovasi dan Komunikasi Pembangunan Pertanian*, 4(1), 34–40.
- Badan Pusat Statistik. (2024). Statistik Produksi Tanaman Pangan Indonesia. Badan Pusat Statistik.
- Devendra, C., & Thomas, D. (2002). Crop–animal systems in Asia: Importance of livestock and characterisation of agro-ecological zones. *Agricultural Systems*, 71(1–2), 5–15.
- Dinas Peternakan dan Kesehatan Hewan Kabupaten Muna. (2024). Data Populasi Ternak Sapi Potong Kabupaten Muna Tahun 2024. Dinas Peternakan dan Kesehatan Hewan Kabupaten Muna.
- Dinas Tanaman Pangan, Hortikultura, dan Perkebunan Kabupaten Muna. (2024). Data Luas Panen dan Produksi Jagung Kabupaten Muna Tahun 2024. Dinas Tanaman Pangan, Hortikultura, dan Perkebunan Kabupaten Muna.
- Estin, Rahman, & Syamsuddin. (2025). Jenis dan Kualitas Nutrien Tumbuhan sebagai Sumber Hijauan Pakan Ternak Sapi di Kecamatan Duruka Kabupaten Muna. *Jurnal Ilmiah Peternakan Halu Oleo*, 7(1), 65–75. <https://doi.org/10.56625/jipho.v7i1.58>
- Fyka, S. A., & Rahmawati, S. Y. (2021). Analisis Manfaat Usahatani Jagung Pakan Ternak terhadap Pendapatan Rumah Tangga Petani Jagung di Kecamatan Watopute Kabupaten Muna. *Prosiding Seminar Nasional Tahun 2021*.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis*. Cengage Learning.
- Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of innovations. Dalam *An Integrated Approach to Communication Theory and Research* (hlm. 432–448). Routledge.
- Romadi, U., & Warnaen, A. (2021). Sistem Penyuluhan Pertanian: Suatu Pendekatan Penyuluhan Pertanian Berbasis Modal Sosial pada Masyarakat Suku Tengger. *Tohar Media*.