ISSN: 2690- 912X

Research Article

Journal of Genetic Engineering and Biotechnology Research

Factors Influencing the Adoption Rate of Artificial Insemination Technology in Beef Cattle Breeders in Damai Village, Tanralili District, Maros Regency

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Submitted: 2025, Jun 10; **Accepted:** 2025, Jul 21; **Published:** 2025, Jul 28

Citation: Syarif, I., Amrullah, T., Sultan. (2025). Factors Influencing the Adoption Rate of Artificial Insemination Technology in Beef Cattle Breeders in Damai Village, Tanralili District, Maros Regency. *J Gene Engg Bio Res, 7*(2), 01-08.

Abstract

The development of beef cattle farming is currently not well developed, especially smallholder farming, this is due to the low interest of breeders in adopting artificial insemination technology, where AI is expected to be able to increase production and improve the genetics of beef cattle. The aim of this research is to examine the intensity of counseling, level of knowledge, skills and cost of artificial insemination influencing the level of adoption of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency. The research was carried out from November 2022 to December 2022 in Damai Village, Tanralili District, Maros Regency. Thetype of research used in this research is quantitative explanatory, namely research to determine the relationship between the independent variables of counseling intensity, level of knowledge, skills and cost of artificial insemination on the dependent variable of AI technology adoption level. The number of samples used in this research was 68 respondents using random sampling techniques. In this research, multiple linear regression data analysis was used using the help of a data processing program, namely the SPSS program. Based on the results of the research and discussion in this study, a conclusion can be drawn, namely that in a joint test (simultaneous) the factors of counseling intensity, level of knowledge, skills and cost of artificial insemination have a significant influence on the level of adoption of artificial insemination technology. In the individual (partial) test, the factors of extension intensity, level of knowledge, skills did not have a significant influence and only the variable cost of artificial insemination had a significant influence on the level of adoption of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency.

Keywords: Artificial Insemination, Breeders, Beef Cattle

1. Introduction

The development of beef cattle farming in Indonesia has very promising prospects where the flow of demand for these livestock products Experiences steady growth each passing year. The importance of livestock development cannot be separated from several situations that exist at the moment, these situations include the increase in population and growth in individual income levels, which makes the demand for animal protein derived from meat also increase. The next situation is government regulations which, until now, are still implementing a policy of importing cattle from other countries. The current conditions indicate that the development of the livestock sub-sector has not progressed in accordance with the hopes and ideals of livestock development (meat self-sufficiency) [1]. The factor suspected to be the cause of the low cattle population in Indonesia is low productivity. Meanwhile, low productivity is related to livestock business management which is still below minimum standards. This is characterized by traditional maintenance methods [2].

South Sulawesi is a province that has quite large potential in the livestock sector, especially large and small livestock types. The development of the population of large types of livestock is quite growing, including beef cattle. This can be proven by the increasing population of beef cattle every year in South Sulawesi Province. In 2019 it reached 1,369,890 individuals, in 2020 it reached 1,405,246 individuals and in 2021 it reached 1,461,457 individuals [3].

Situated in South Sulawesi Province, Maros is among its constituent regencies. which is a center for beef cattle production. Beef cattle are a livestock commodity with quite high population and meat production in Maros Regency. The population value of beef cattle in Maros Regency is in the 5th highest position out of 24 districts/ cities in South Sulawesi Province (Department of Fisheries, Maritime Affairs and Livestock, Maros Regency, 2020). Beef cattle farming is prominent in Tanralili, a sub-district within Maros Regency with a substantial livestock population. The population of beef cattle in Tanralili District can be seen in Table 1.

No.	Subdistrict	Population (tail)
1.	Mandai	3,154
2.	Moncongloe	3,044
3.	Maros Baru	1,547
4.	Marusu	2,704
5.	Turikale	1,278
6.	Lau	2,712
7.	Bontoa	2,179
8.	Bantimurung	12,922
9.	Simbang	8,029
10.	**Tanralili**	**8,126**
11.	Tompobulu	16,593
12.	Camba	9,007
13.	Cenrana	10,403
14.	Mallawa	5,851
	Amount	87,547
Source: Central Statistic Agency, 2019		

Table 1: Distribution of Beef Cattle Population in Maros Regency in 2018

Referring to the table 1, it can be seen that Tanralili District is one of the districts with a fairly large Beef livestock population. The total population of beef cattle in Tanralili District is 8,126 heads or a percentage of 9.2% of the entire beef cattle population in Maros Regency, namely 87,547 heads.

The current development of artificial insemination has not had a significant impact on increasing the beef cattle population. This is because not all breeders want to adopt AI technology. The low interest of breeders in adopting AI is caused by several factors, including low knowledge, interest and expectations of breeders regarding AI technology [4].

Artificial insemination is a technology in livestock reproduction which has the benefit of Advancing the refinement of livestock genetics more rapidly, preventing the dissemination of reproductive traits diseases transmitted through natural mating, increasing the efficiency of using superior males. However, whether technology development is successful or not depends on whether farmers are willing to adopt the recommended technology [5]. As a technology, artificial insemination is expected to be a superior program to increase livestock production as well as breeder income. The aim of implementing the application of artificial insemination technology from the micro side, namely AI, is expected to be able to increase the productivity and quality of livestock businesses, while the aim from the macro side, namely AI, is believed to improve population and production, in order to meet demand which has so far been met through imports.

Adoption of technological innovation is the acceptance or use of a new idea, tool or technology by the communicator conveyed by the communicator. Adoption according to states [6]. The process of adoption is a mental decision-making activity, where individuals choose to either accept or discard a new idea. and confirming further about The decision to adopt or discard the new idea. Adoption of innovation is a change in behavior in the Aspects of knowledge, perspectives, and expertise, which is very determining for farmers/ breeders in making decisions to adopt a technology.

Based on research by, factors in the adoption of artificial insemination are influenced by several factors, including knowledge, motivation and cost of AI which have an influence on

the level of AI adoption. In research by, The aspects that drive the level of AI adoption, namely knowledge, attitudes and skills of breeders, influence the level of technology adoption IB.

One of the areas in Maros Regency. Which implements the adoption of insemination technology artificial, namely Tanralili District. Table 2 presents this information

No.	Village	Number of Breeders Participating IB	Number of Beef Cattle Breeders (People)
1.	Purna Karya	9	140
2.	Leko Pancing	8	192
3.	Kurusumange	5	179
4.	Sudirman	5	74
5.	**Damai**	**6**	**212**
6.	Allere	1	73
7.	Borong	1	99
8.	Toddo Pulia	1	154
	Amount	36	1.123
Source: Departement of Agriculture and Food Security, Animal Husbandry, Sector, Maros Regency, 2022.			

Table: 2

As presented in Table 2, the findings show that the application of artificial insemination technology by beef cattle breeders is still low, seen in Damai Village which has quite a lot of beef cattle breeders in Tanralili District, only six breeders have implemented the adoption of artificial insemination technology. Therefore, current conditions indicate that breeders' interest in adopting artificial insemination technology is still low. This is the background for wanting to carry out research entitled Factors that Influence the Level of Adoption of Artificial Insemination Technology among Beef Cattle Farmers in Damai Village, Tanralili District, Maros Regency.

2. Materials and Methods

2.1. Time and Place

This study took place between November and December 2022 in Damai Village, Tanralili District, Maros Regency. The location was selected intentionally, as the majority of the residents in Damai Village are engaged in beef cattle farming and agriculture.

2.2. Types of Research

This study employs an explanatory quantitative research design. It aims to clarify the impact of independent variables, such as the intensity of counseling, knowledge level, skills, and artificial insemination costs, on the dependent variable— the willingness of beef cattle breeders in Damai Village, Tanralili District, Maros Regency, to adopt artificial insemination technology.

2.3. Population and Sample

The participants in this study were all beef cattle breeders in Damai Village, Tanralili District, Maros Regency, with a total of 212 breeders. Due to the large population size and the explanatory nature of this research, sampling was required. To determine the sample size, Slovin's formula was applied, as follows:

$$n = \frac{N}{1Ne^2}$$

Explanation : n = Number of sample
N = Population size
e^2 = Precision (leniency level set at 10%)

So the sample size used is:

$$n = \frac{N}{1Ne^2}$$

$$n = \frac{212}{1+212(10\%)^2}$$

$$n = 68$$

It can be seen that the sample size used was 68 respondents. The sampling method used in this study was Simple Random Sampling, a type of probability sampling. This technique was implemented by selecting samples randomly.

2.4. Data Types and Data Sources

The data types utilized in this study are as follows:

- Qualitative data refers to information presented in the form of sentences or the responses provided by beef cattle breeders regarding artificial insemination technology innovations.
- Quantitative data is data in the form of numbers obtained from questionnaires related to research, such as intensity of extension, age, level of education, farming experience, and knowledge, etc.
- The data sources used in this research are:
- Primary data is data sourced from direct interviews with respondents, namely cattle breeders in Damai Village, Ta Tanralili District, Maros Regency, regarding the factors that influence the level of adoption of artificial insemination (AI) technology among beef cattle breeders.
- Secondary data refers to information obtained from sources such as books, reports, and other materials from organizations

related to the study, including data from the national statistics agency.

2.5. Method of Collecting Data

The data gathering method utilized is as follows:

- Observation, which involves collecting data through direct examination of the subject being studied.
- Interview is data obtained by means of direct interviews with respondents, namely cattle breeders. To assist with interviews, a set of predefined questions in the form of a questionnaire is employed
- Literature study, which is based on several books and journals as literature and theoretical basis related to this research.

3. Data Analysis

3.1. Scoring Scale Likert

In measuring the variables that determine the extent of adoption of artificial insemination technology among beef cattle breeders, a Likert scale measuring tool is used. According to the Likert scale is one of the most commonly used tools for assessing individual or group perceptions, attitudes, and opinions related to certain events or social phenomena, based on predefined operational definitions set by the researcher. This scale assigns a score to each indicator as a means of quantifying responses. The following scoring system was applied for data analysis:

Strongly Agree (SS)	= 5
Agree (S)	= 4
Simply Agree	= 3
Disagree	= 2
Strongly Disagree	= 1

3.2. Data Analysis Method

The data in this research were analyzed using multiple linear regression analysis.

Regression analysis was employed to identify the factors affecting the level of adoption. of artificial insemination (AI) technology among beef cattle breeders. Multiple linear regression aims to examine the influence of variable X on variable Y. To help with statistical testing of multiple linear regression using the help of the statistical program for social science (SPSS). Mathematically, the multiple regression model can be written as follows [7].

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + £$$

Explanation:
Y = Adoption rate of artificial insemination technology
α = Constant
β_1 β_2…. β_5 = Regression coefficient
X_1 = Extension intensity
X_2 = Level of knowledge skills
X_3 = Cost of artificial insemination
£ = Standard error

3.3. Simultaneous Test (F-Test)

This test is conducted to determine if the independent variables (X_1, X_2, X_5) collectively have a significant impact on the dependent variable (Y). The significance level is set at 5% (5% significance level). or 0.05 is a frequent standard measure used in research). Testing committee:

- H_0 is accepted if F counts < F table, which means that simultaneously the independent variable (X) has no real effect on the dependent variable (Y).
- H_0 is rejected if la F F count > F table, which means that simultaneously the independent variable (X) has a real effect on the dependent variable (Y).

3.4. Partial Test (T-Test)

This test is used to find out whether in the regression model the Independent variable (X), X_2 X_1) partially has a significant effect on the dependent variable (Y). Significance level using a = 5%.

3.5. Test Criteria:

- H_0 is accepted if the calculated t value is less than the t table value, indicating that the independent variable (X) does not have a significant effect on the dependent variable (Y) when considered simultaneously.
- H_0 is rejected if the calculated t value is greater than the t table value, suggesting that the independent variable (X) has a significant effect on the dependent variable (Y) on an individual basis.

All statistical analysis in this research uses the SPSS 26 for Windows program.

4. Results and Discussion

General Description of the Level of Adoption of AI Technology in Beef Cattle Farming in Damai Village, Tanralili District, Maros Regency. Adoption of artificial insemination technology is the farmer's willingness to apply artificial insemination in their farming activities to improve the quality of local livestock and accelerate the increase in livestock population. The adoption of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency remains quite low, as demonstrated in the table below:

No.	Category	Frequency (Person)	Persentage
1.	Ready	10	15
2.	Not Ready	58	85
Source: Primary data that has been processed, 2022.			

Table 3: Classification of the Number of Breeders Who Willing to Implement Artificial insemination in Damai Village, Tanralili District

Based on the results obtained more Many breeders are not willing to implement the adoption of artificial insemination technology among beef cattle breeders in Damai Village, this is due to several factors including the low level of knowledge of breeders regarding artificial insemination, the low skill of breeders in terms of detecting estrus and the additional costs that need to be incurred. breeders in terms of implementing the adoption of artificial insemination technology.

Extension activities for farmers/breeders in Damai Village are currently not optimal, the impact of increasing the knowledge and skills of farmers/breeders regarding technological innovation is still very low, this has been proven in the field, there are still many farmers/breeders who do not know the advantages and benefits of insemination technology artificial.

4.1. Multiple Regression Analysis

The following table displays the outcomes of multiple linear regression analysis performed using the SPSS software.

No	Variable	Coefficient
1.	Constant	1,523
2.	Extension intensity	0,136
3.	Knowledge level	1,093
4.	Skills	0,075
5.	IB fee	0,248
Source: Processed Primary Data, 2022.		

Table 4: Results of Multiple Regression Analysis

Based on table 15 of the multiple regressions above, the following equation results are obtained:

$$Y = \alpha + \beta_1 X_1 + \beta^2 X^2 + \beta_3 X^3 + \beta_4 X_4 + £$$

$$Y = 1{,}523 + 0{,}136 + 1{,}093 + 0{,}075 + 0{,}248 + £$$

- The constant value of 1.523 represents the adoption rate of artificial insemination technology in beef cattle farmers in Damai Village, Tanralili District, Maros Regency (Y), assuming that the intensity of extension (X_1), level of knowledge (X_2), skills (X_3), and IB costs (X_4) are all zero.
- The coefficient β1 of 0.136 indicates that with each 1-unit increase in the extension intensity (X_1), the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency will increase by 0.136. This suggests that an increase in counseling intensity positively affects the adoption of artificial insemination technology.
- The coefficient β_2 of 0.093 shows that with each 1-unit increase in the knowledge level (X_2), the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency will rise by 0.093. This indicates that higher knowledge among breeders contributes to greater adoption of artificial insemination technology.
- With a β3 value of 0.075, this indicates that a 1-unit increase in the skill variable (X_3) will lead to a 0.075 increase in the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency. This shows that the skill level of breeders regarding artificial insemination technology positively influences its adoption.
- The coefficient β_4 of 0.248 indicates that with each 1-unit increase in the cost of artificial insemination (X_4), the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency will increase by 0.248. This suggests that lower costs for artificial insemination technology facilitate higher adoption rates among breeders.

4.2. Coefficient of Determination R^2 (R Square)

No	R	R Square	Adjusted R Square	Std. Eror of The Estimate
1	.742[a]	.551	.523	1.288
Source: Processed primary data, 2022.				

Table 5: Model Summary Model Summary

In Table 16, which presents the regression summary model, the variables of extension intensity, level of knowledge, skills, and the cost of artificial insemination are analyzed in relation to their impact on the adoption level of artificial insemination technology., an R Square of 0.551 is obtained. This means that the variables of extension intensity, level of knowledge, the skills and costs of artificial insemination can influence the level of adoption of artificial insemination technology among cattle breeders cut in Damai Village, Tanrali District, Maros Regency was 55.1%. The remaining 44.9% is explained by other causes not included in this model or in this research.

4.3. Simultaneous Test Results (F-text)

The F test is carried out to test all independent variables (X) together against the variable (Y). The testing steps are as follows: Hi babe 0 (variables of extension intensity, level of knowledge, skills and cost of artificial insemination).

- If the calculated F value is greater than the F table value of 2.551, then H0 is accepted, indicating that each independent variable has a significant effect on the dependent variable, or there is a significant relationship.
- If the calculated F value is less than the F table value of 2.551, then H0 is rejected, meaning that each independent variable does not have a significant effect on the dependent variable, or there is no significant relationship.

In the regression analysis, we conducted a simultaneous test to examine the influence of extension intensity, knowledge level, skills, and the cost of artificial insemination on the adoption level of artificial insemination technology among beef cattle farmers in Damai Village, Tanralili District, Maros Regency.

Model	F	Sig
Regression Residual Total	19.350	000b
Source: Processed primary data, 2022.		

Table 6: Simultaneous Test Results (F-text)

The regression results show that the variables of extension intensity, knowledge level, skills, and artificial insemination costs significantly influence the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency, with an F value of 19.350 and a significance level (Sig) of 0.000, which is less than 0.05. Therefore, H1 is accepted. In conclusion, the hypothesis states that the independent variables simultaneously indicate that between the extension intensity variables (X1), level of knowledge (X2), skills (X3), the cost of artificial insemination (X4) simultaneously influences the level Therefore, H1 is accepted. In conclusion, the adoption of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency is significantly influenced by the variables of extension intensity, knowledge level, skills, and the cost of artificial insemination.

4.4. Partial Test Results (t-text)

The t-test is used to determine whether each independent variable has a significant relationship with the dependent variable individually. The decision rules are as follows:

- If the t-value is less than 0.05, then H1 is accepted, indicating that each independent variable has a significant effect on the dependent variable, or there is a significant relationship.
- If the t-value is greater than 0.05, then H1 is rejected, meaning that each independent variable has no significant effect on the dependent variable, or there is no significant relationship.

The hypothesis formulation steps involve testing whether the variables of extension intensity, knowledge level, skills, and artificial insemination costs have an effect on the dependent variable.

The probability (significant) result values are the same. with 0.05. By comparing the value of Hung Hung (significant) with the following probability values. The trung value of each regression coefficient can be seen from the SPSS calculations in the following table:

Model	T	Sig
(Constant)	2.887	.005
Intensity of outreach	1.418	.161
Knowledge level	.971	.335
Skill	.820	.416
IB fees	2.233	.029
Source: Processed primary data, 2022.		

Table 7: Partial Test Results (t-test)

In this calculation the significance is 0.005 Since the probability value (significance level) is 0.000, which is less than 0.05, it can be concluded that H1 is accepted. This indicates that the constant variable has a significant influence on the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency.

4.5. The Influence of Extension Intensity (X1) on the Level of Adoption of IB Technology

The intensity of counseling received regarding. An innovation is something that can influence the adoption process of an innovation. Farmers/breeders with regular counseling intensity will have higher knowledge, skills and motivation in adopting an innovation compared to farmers/breeders who rarely receive counseling. The higher the frequency of extension, the higher the success of the agricultural extension delivered [8]. Who stated that one thing that influences the adoption of innovation is the intensity of outreach.

Based on the research findings, the extension intensity variable has a t-count of 1.418, which is less than the t-table value of 1.999,

and a significance value of 0.161, which is greater than 0.05. Therefore, it can be concluded that the extension intensity factor does not have a positive and significant effect on the adoption level of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency. This happens because outreach activities in Peace Village are rare. carried out and generally only the heads of farmer groups take part in extension activities, so that the majority of farmers/ breeders in Damai Village do not receive the latest information on developments in the world of agriculture. So, the low intensity of counseling received by farmers/breeders has an impact on levels breeder knowledge, attitudes and skills towards a new technology. Agricultural extension workers are agents for changing farmer behavior, namely encouraging farmers to change their behavior to become farmers with better abilities and able to make their own decisions, which is next. can develop its business scale in a better direction [9]. States that farmer behavior consists of elements of knowledge, attitudes and skills that form character [10].

4.6. The Influence of Knowledge Level (X2) on the Level of Adoption of IB Technology

Knowledge is one of the driving factors for farmers in adopting new technology. Farmers/breeders who know the benefits, methods, objectives and risks in implementing new technology tend to be more interested in trying to apply the new technology [11]. Stated that the knowledge that breeders have about artificial insemination will make it easier to understand each component of artificial insemination activities. Thus, encouraging breeders to be more interested in adopting technology.

Based on the research results, the knowledge level variable has a t-count of 0.971, which is less than the t-table value of 1.999, and a significance value of 0.335, which is greater than 0.05. Therefore, it can be concluded that the knowledge level factor does not have a positive or significant effect on the adoption of artificial insemination technology among beef cattle farmers in Damai Village, Tanralili District, Maros Regency. This outcome may be attributed to the generally low level of breeder knowledge regarding artificial insemination in the village. Most respondents in this study gave low scores when assessed on their knowledge about the technology.

This finding contrasts with the study conducted by , which showed that knowledge, along with motivation and cost, significantly influenced the adoption of artificial insemination technology [12]. In their study, breeders demonstrated a good understanding of estrus signs, insemination equipment, and successful insemination procedures. This suggests that the respondents in Syatra et al.'s research had a higher level of knowledge compared to the breeders in Damai Village.

4.7. The Influence of Skills (X3) on the Level of Adoption of IB Technology

Skills are the abilities possessed by breeders in terms of applying artificial insemination technology. The farmer's skill in detecting heat and reporting it to the inseminator is a very important factor to pay attention to [13].

Based on the research results, the skill factor has a t-count of 0.820, which is less than the t-table value of 1.999, and a significance value of 0.416, which is greater than 0.05. Therefore, it can be concluded that the skill factor does not have a positive or significant effect on the adoption of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency.This happens because. Farmers' skills regarding artificial insemination technology in Damai Village are still very low, where the farmers/breeders sampled in this study generally do not know the correct time for ai and do not know the characteristics of livestock that are in heat.

The results of this research are also the same as the results of research by, the influence and relationship between breeder behavior. In terms of the adoption of artificial insemination, the skills of breeders do not have a significant impact on the adoption level. However, it is observed that there is a positive relationship between the breeder's skills and the adoption level of artificial insemination. This means that as the breeder's skills in artificial insemination improve, the likelihood of adopting this technology also increases are higher, it will increase breeder adoption.

4.8. Effect of IB Costs (X4) on the Level of Adoption of IB Technology

Costs of artificial insemination are costs that must be issued by breeders to use injectable mating or artificial insemination on their cubs. The cost of insemination is something that breeders consider most because breeders need additional costs for their breeding activities. The cost of artificial insemination is the amount that farmers must pay to use inseminator services in livestock development through artificial insemination technology.

Based on the findings of the research, it can be stated that the cost factor of artificial insemination has a t-value of 2.233, which exceeds the critical value of 1.999, and a significance value of 0.029, which is less than 0.05. This indicates that the cost of artificial insemination has a positive and significant impact on the adoption of artificial insemination technology among beef cattle breeders in Damai Village, Tanralili District, Maros Regency. This suggests that as the cost of AI decreases, the willingness of breeders to adopt AI technology increases. These findings are consistent with the research conducted by, which explored the influence of knowledge, motivation, and AI costs on the adoption of AI technology. Their study also concluded that AI costs have a positive and significant effect on the adoption of the technology, where the cost of artificial insemination has a positive and significant effect on the adoption of AI technology and states that the cost of AI for implementation Artificial insemination is something that is considered by breeders and the breeder's ability to allocate these funds is relative vary.

Stated that breeders felt the application of artificial insemination. Beef cattle require greater costs than natural mating, including costs for carrying out artificial insemination, facilities and artificial insemination infrastructure and the readiness of inseminator

personnel, all of which require large costs. The cost of artificial insemination will usually increase if several artificial inseminations have to be carried out until pregnancy occurs.

5. Conclusion

In the discussion of this study, the conclusion that can be drawn is that, based on the joint (simultaneous) test, the factors of counseling intensity, level of knowledge, skills, and the cost of artificial insemination all have a significant influence on the adoption of artificial insemination technology [14,15]. However, when considering the individual (partial) test, it was found that the intensity of extension, the level of knowledge, and skills did not have a significant effect on the adoption of artificial insemination technology. Only the cost of artificial insemination showed a significant influence on the level of adoption of AI technology among beef cattle farmers in Damai Village, Tanralili District, Maros Regency.

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