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The Analysis of Semen, Livestock, Inseminator, and Feed's Factors on The Artificial Insemination's Success of Bali's Cattle in The Region of Bali Cattle Center In Jambi Province

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Abstract
The success of artificial insemination (AI) in Jambi Province based on the technical indicator was still not satisfactory. To increase the success of the artificial insemination is needed to analyze the determinant factors of the artificial insemination success. This study aimed to analyze the influence of semen, cattle, inseminator and feed's factors toward to the success of artificial insemination of Bali cattle in the region of Bali cattle center in the Jambi Province. The research method of this study was a survey where the sampling technique was Stratified Random Sampling of the highland, medium/plain and lowland areas. The sample size of this study was determined by using the iteration method. The measurement of the qualitative variable used a questionnaire in Likert questions, forms, with Scale's Summated Rating's. The analysis mode was path analysis. Partially, the factor of semen, cattle, inseminator and feed were a critical success of artificial insemination of the cattle in the Region of Bali Cattle Center in Jambi Province. The feed factor was the decisive factor that most domains (32.38%) in the success of artificial insemination of the cattle, followed by the semen factor (14.02%), and the inseminator factor (9,13%), as well as livestock factor (6.07%). For the breeder's factor, it was not determining factor in the success of artificial insemination of Bali cattle in Jambi province.
Key words:Semen, Livestock, Inseminator, Feed, Artificial Insemination

1. Introduction

The success of artificial insemination on Bali cattle in Jambi province was reported different (target and realization) in three regional of cattle' centers in Jambi Province (Animal Husbandry and Animal Health Services of Jambi Province, 2013). In the upland area (Kerinci) regency was targeted 1,850 of acceptors but the realization was 662 acceptors (35.78%) and 1,150 births was targeted but realization was around 524 (45.57%). For the plain area, such as in Tebo Regency was targeted around 2,037 acceptors but the realization was 1,304 acceptors (45.70%), and 1,640 births was targeted but realization was 983 (59.94%). Furthermore, lowland area (West Tanjung Jabung Regency) was targeted 2,609 acceptors and 1,245 births but the realization around 967 acceptors (37.06%), and 838 births (67.31%). It meant the success of artificial insemination in Jambi Province based on the technical indicators were still not satisfactory.

The success of artificial insemination implementation is determined by many factors, namely: semen, cattle, ranchers, inseminator and feed factor. The semen factor such as quality of semen (usually frozen semen are packed in straw) is depending on the production process, distribution, storage, and treatment. The Livestock factor is the most decisive factor such as the female fertility which is determined by many things, including the breed and the nutritional status. The breeder factor such as his/her knowledge is very important to determine the success of artificial insemination especially estrus detection. The estrus detection and insemination at the most appropriate time is a critical point to obtain the higher reproductive

fertility on the cattle. In accurate estrus determination will increase number of insemination per pregnancy, birth spacing with the subsequent insemination and birth interval. The Inseminator factor such as knowledge and technical insemination ability is affecting the pregnancy scoring on the cattle population in its working area. Inseminator expertise and skill in recognition of lust accuracy, appliance sanitary, handle of frozen semen, correct thawing, as well as the ability to do an artificial insemination also influence the success. The livestock management factor including feeding is also determined the success of artificial insemination (Herawati, et al, 2012). To increase the success of artificial insemination is needed to analyze the determinants of the artificial insemination success. The research results were important to formulate the optimal policies of artificial insemination's program to increase cattle population in Jambi province.

2. Materials and Methods

2.1. Research method

The method used in this study was a survey method. It was located in 3 regions where the cattle center is; 1) highland area (Kerinci Regency); 2) The plain area (Tebo Regency); and 3) The lowland area (West Tanjung Jabung Regency). This location was determined based on the Regulation of the Agriculture Minister Number: 50/Permentan /OT.140/8/2012 about the Guideline for Agricultural Regions Development.

2.2. Sampling Technique

This study used a sampling technique of Stratified Random Sampling (Al Rasyid, 1994), which consisted of 3 (three) stratums namely: the first stratum (Cattle Center in Plateau/highland area), second stratum (Cattle Center in the Middle Area), and the third Stratum (Cattle Center in the Lowland area). The sample size in this study was determined by using the iterative method (Al Rasyid, 1994). The total of sample size was calculated using the formula:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{(U'_p)^2} + 3$$

Description:

$Z_{1-\alpha}$ = The Constants that was obtained from the normal distribution table

$Z_{1-\beta}$ = The Constants that was obtained from the normal distribution table

α= The Error type I, was to accept the hypothesis that should be rejected

β= The Error type II, was to reject the hypothesis that should be accepted

ρ= The Estimated price of correlation coefficient

2.3. Validity and Instrument Reliability Test

The Measurement of qualitative variation used a questionnaire form with Likert Summated Rating Scale 'which is conducting its validity and reliability test. The Test instrument validity was conducted to determine whether the measuring developed instrument could be truly measured. Instrument validity test was conducted by correlating the score of each question with score total of the questions for each variable. If calculation result (t count) was similar to the table at significance level of 0.05 or 0.01, it means that the data were valid and feasible to use in testing the research hypothesis. When Titan lower than table at 0.05 or 0.01 of significance level, it means that the data was not valid and will not be included in the research hypothesis test (Sutawidjaya, 2000).

The Instrument reliability test is intended to determine whether the data collection tool basically showed the level of sensitivity, accuracy, stability or consistency of tool in revealing

a certain symptoms of an individual group, even it was carried out at the different times. The Instrument reliability test in its realization was using the split half method. If t count was similar to table at the significance level of 0.05 or 0.01 means these questions were reliable and if count < table at the significance level of 0.05 or 0.01 means these questions were not reliable (Sutawidjaya, 2000).

2.4. Analysis Model

The measurement scale of the obtained data was varied, namely ordinal scale and ratio scale. For the ordinal scale, the research data was conducted to transform data into an interval scale by using a Successive Interval Method (Sutawidjaya, 2000). To analyze the factors influencing the success rate of artificial insemination of the cattle was used a path analysis with a structural model, namely:

$Y_i = \rho_{YiX1} X_1 + \rho_{YiX2} X_2 + \rho_{YiX3} X_3 + \rho_{YiX4} X_4 + \rho_{YiX5} X_5 + \rho_{Yi\varepsilon i} \varepsilon_i$

Description:

Y = Successful of artificial insemination
X1 = Semen Factor
X2 = Breeder Factor
X3 = Livestock Factor
X4 = Inseminator Factor
X5 = Feed Factor
ρ_{YiX1-5} = Coefficient Line
ε = Residue Variable

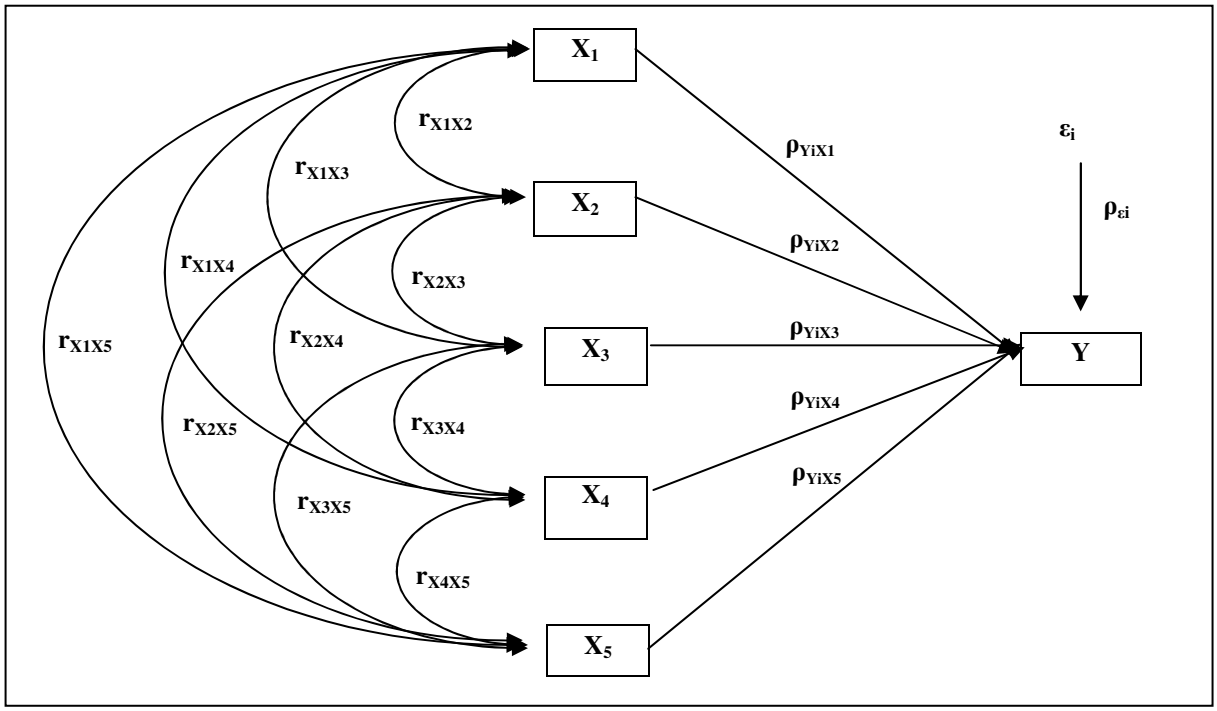

Figure 1. The Connection Structure of X_{1-5} with Y

The decisions were :

- If t count < t table, H_0 was accepted, it meant that the factors of semen, cattle, breeder, inseminator and feed simultaneously were not affecting the success of artificial insemination on the cattle in the cattle center region of Jambi Province

- If t count ≥ t table, H_0 was rejected, it meant that the factors of semen, cattle, breeder, inseminator and feed simultaneously were affecting the success of artificial insemination on the cattle in the cattle center region of Jambi Province.

If the results were significant, it would be followed by the coefficient significance testing of the line parted. To examine the line coefficient partially, the pair of hypothesis and its alternate were formulated as follows:

$$H_0 : P_{Y_i X_j} = 0$$

$$H_1 : P_{Y_i X_j} \neq 0$$

The Decisions were :

- If t count < t table, H_0 was accepted, it meant that the factors of semen, cattle, breeder, inseminator and feed partially were not affecting the success of artificial insemination on the cattle in the cattle center region of Jambi Province.
- If t count ≥ t table, H_0 was rejected, it meant that the factors of semen, cattle, breeder, inseminator and feed partially were not affecting the success of artificial insemination on the cattle in the cattle center region of Jambi Province.

3. Result

3.1. Determining Factor of the Artificial Insemination Success

Before the step of conclusion, making about the line coefficient, firstly it must be examined about the significance of its line coefficient, either simultaneously (F-test) or partial (t-test). To examine the significance of its line coefficient simultaneously, the hypotheses pair is formulated by: $H_0 : PYX_1 = PYX_2 = PYX_3 = PYX_4 = PYX_5 = 0$ and H1 at least have a $PYX_i = 0$. The F test analysis result obtained the count value = 53.545 by the significant = 0.000 which meant that H_0 was rejected and H_1 was accepted. It meant that at least there was one significant line coefficient value. These results indicated that the semen factor (X_1), breeder factor (X_2), livestock factor (X_3), inseminator factor (X_4) and feed factors (X_5) simultaneously affect the AI success. Based on the t test, it obtained the results for the five existing lines (X_1, X_2, X_3, X_4 and X_5), apparently insignificant one line was the line coefficient for breeder factor (X_2), while other four lines (semen factory = X_1), livestock factor (X_3), and inseminator factor (X_4) and feed factor (X_5) were significant. The existence of insignificant line coefficient means that the line coefficient has no meaning. Thus the insignificant line coefficient should be eliminated. A line structure change that was from the initial line structure (it was involving at least five independent variables = X_1, X_2, X_3, X_4 and X_5) became a structural form of a new line. This line only involved four independent significant variables (X_1, X_3, X_4 and X_5).

Therefore, the new line structure needed to re-calculate the line coefficients by the testing of its line simultaneously by F test. The hypothesis pair was formulated by: $H_0: PYX_1 = PYX_3 = PYX_4 = PYX_5 = 0$ and H_1 at least have a $PY_1X_i = 0$. The F test analysis result obtained the F count value = 65.008 by the significant = 0.000 which meant that H0 was rejected and H1 was accepted. The meaning of this result that there was at least one path coefficient means (significant). It meant that there was at least one significant line coefficient value. These results indicated that the semen factor (X_1), breeder factor (X_2), livestock factor (X_3), inseminator factor (X_4) and feed factor (X_5) simultaneously affect the AI success. The t test result for Y obtained about PYX_1, PYX_3, PYX_4 and PYX_5 were significant. This meant that the factors of semen, cattle, inseminator and feed were influenced by the AI success on the cattle in the Region of Cattle Center in Jambi Province.

These conditions corresponded to the opinion of Correa et al., (1996), the success of artificial insemination was influenced by several things, such as: a female cattle itself, Inseminator

skills in repositioning the semen, the timeliness of AI, a lust detection, semen handling and semen quality, especially the post-thaw motility (PTM). These five determinants of AI success, namely (i) the quality of congealed semen in the farmer level; (ii) the knowledge and awareness of farmers in lust detection; (iii) body condition score (BCS) of the cattle; (iv) the health of livestock, particularly that was related to the reproductive organ; as well as (v) the skills and attitudes of the inseminator, and the timeliness of AI (BIB 2011; Diwyanto, 2012; Caraviella et al., 2006).

Path analysis Mode for the success of AI can be described in a path diagram in Figure 2.

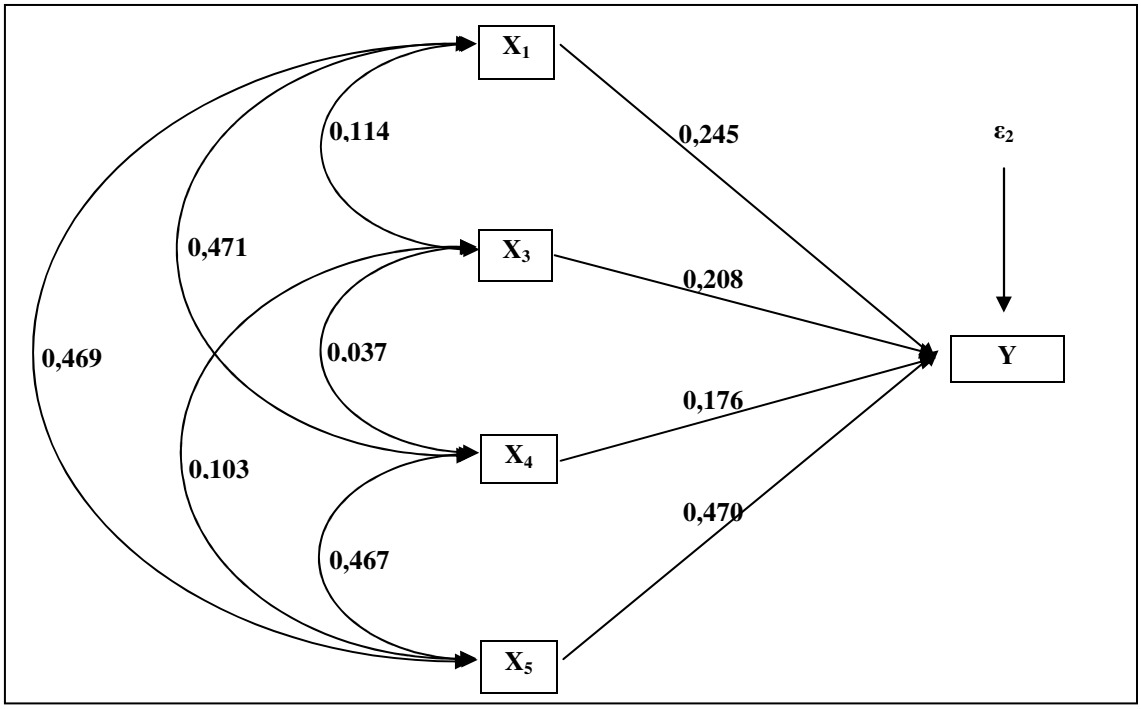

Figure 2. Line Variable Diagram of X_1, X_3, X_4 and X_5 against Y

Description:

Y = Successful of artificial insemination
X_1 = Semen Factor
X_2 = Breeder Factor
X_3 = Livestock Factor
X_4 = Inseminator Factor
X_5 = Feed Factor
ρ_{YiX1-5} = Coefficient Line
ε = residue Variable

Table 1.The Direct and Indirect Effect of AI success on Cattle in The Region of Cattle Center in Jambi Province

Variable Endogen	*Direct Causal Effects*	*Total Causal Effects through variable*				*Total Causal Effects*
		X_1	X_3	X_4	X_5	
X_1	6,003	0,000	0,581	2,031	5,401	14,015
X_3	4,326	0,581	0,000	0,135	1,026	6,069
X_4	3,098	2,031	0,135	0,000	3,863	9,127
X_5	22,090	5,401	1,026	3,863	0,000	32,380
	The Total Causal Effects of AI Success					61,591

Description:
X_1 = Semen Factor (spermatozoa motility)
X_3 = Livestock Factor (body condition score)
X_4 = Inseminator Factor (experience, knowledge, technical skills)
X_5 = Feed Factor (The Sufficiency fodder)

3.2. Semen Factor

The calculation results of the path analysis model obtained the value of the semen factors influenced against the AI success was 14.01%. It meant that the success of AI on the cattle in a region of Cattle's Center in Jambi province was determined about 14.01% from the semen factor; especially the spermatozoa motility or sperm live and moved forward/progression. Line coefficient for the semen factor was positive, it meant that the cattle semen quality as greater as the percentage of live spermatozoa and moved forward/progression, so that the AI success was higher. Conversely, as shoddy as the cattle semen quality or live spermatozoa moved forward/progression or as small as the percentage of live spermatozoa and move forward/progression, so that the AI success of the cattle was lower in the Region of Cattle Center in Jambi Province.

This study was in line with the idea of Rosita et al (2013) who stated that one of affected factors of AI success was the motility of spermatozoa. According to Susilawati (2011), on the field implementation, because of several reasons such as long distance, poor handling and lack of N_2 liquid during the trip to the farmers, the quality of the frozen semen (PTM) which was actually having been appropriated to the ISO standard can only go down. It was feared as the one cause of the AI failure. The frozen semen factor affected the success of AI program. If straw was not saved in the container or flask containing the liquid nitrogen for a long time, inflexible spermatozoa, or when the thawing (melting back) semen was not in accordance with the applicable requirements (Adikarta and Listianawati, 2001. According to Rosita et al (2013), one affected factor of the AI success was the spermatozoa motility. Indonesian National Standard (INS) mentioned that the sperm concentration as much as 25 million with the 40% motility and abnormality about < 20%. While the sperm cells in the volume mini straw about 0.25 ml was 30 million per straw (Susilawati, 2013). According to Bearden et al. (2004) the cattle sperm motility value ranges between 70-80%.

3.3. Livestock factor

The calculation result of the path analysis model obtained the value of influenced factors such as livestock body condition score on the AI success was 6.07%. It means that the AI success of the cattle in the region of Cattle Center in Jambi province as amount as 6.07% from livestock factor such as cattles body condition score. Line coefficient for the livestock factor was positive; it meant that as good as the cattle body condition score, the success of AI was higher. Conversely, as bad as the cattle's body condition score, as lower as the success of AI on the cattle in the Region of Cattle Center in Jambi Province.

The findings of this study supported by the research of Lalman et al., 1997 who concluded that the cattle body condition score at the calving time has the greatest effect on the pregnancy rate. According to Spitzer, et al., (1995) the body condition score (BCS) at the time of calving/birth and at the beginning of the breeding season was the most important indicator of the reproductive performance.

3.4. Inseminator Factors

Path analysis models had provided the value for inseminator factors against the success of AI was 9.13%. The values informed that the success of AI on the cattle in the region of Cattle

Center in Jambi province was amount 9.13% of the inseminator factors such as experience, knowledge, technical skills and straw inseminator management. Actually for the inseminator factor, the coefficient of its line was positive, it means as good as the experience, knowledge, technical skills and straw inseminator management, the success of AI was high. Conversely, as bad as the experience, knowledge, technical skills and management inseminator straw, the success of AI was low on the cattle in the region of Cattle Center in Jambi province.

The results of this study supported by the Herath et al., (2012)who concluded that the inseminate expertise in implementing of this AI was one of the five critical success factors of AI. According to Ismanto (2003), the expertise and inseminator skills in the recognition accuracy of lust, sanitary appliance, handling of the frozen semen, the right thawing, and the ability to implement the AI would determine AI success. It was added by Anzar et al (2003), the inseminator skill in AI implementation on cattle highly influenced the pregnancy rate such as the estrus detection period. AI services were very critical to get a high pregnancy rate. Similar to Rivera et al, (2005) statement that increasing conception rate can be achieved with the right determination of the lust period by the inseminator and ranchers. Human Research factor has also affected the success of the AI program; the inseminator ability to detect the estrus from the female at the very beginning to be inseminated, frozen semen deposition in the female reproductive organ, as well as the handling of post-AI (Jalius, 2011; Affandhy et al, 2006).

3.5. Feed Factor

The calculation result of the path analysis model obtained the value of the feed factor such as the adequacy of feed influenced to the success of AI was around 32.38%. The value has a meaning in form of AI success in cattle in the region of Cattle Center in Jambi Province was about 32.38% from the feed factor in the form of the feed adequacy. The line coefficient value of the feed factor was positive, it meant as enough as the offered feed, the AI success was high. Conversely as lack as the offered feed, the AI success was low in cattle in the region of Cattle Center in Jambi province.

The study's finding was reinforced by the Jaenudin and Hafez (2000) who stated that the conception rates can be influenced by the quality of the given feed to livestock. The cattle feedless qualified feed between the postnatal period until the implementation of AI caused low fertility and increased early embryonic death. According to Udin (2012), the condition of the cattle's mother that was inseminated has an important role in the AI success rate. High pregnancy rate was obtained on the cattle was given by the extra good quality food. According to Umiyasih and Anggraeny (2007), the development of reproductive organs during the growth period and physiological status of livestock must be considered where malnutrition could cause the ovaries malfunction, the pregnancy failure and infertility.

The season factor became one of the determining factors of the feed availability. It caused to the fluctuation in the verdant forage availability and is always happening periodically where its shortage during the dry season. The quantity, quality, and continuity of verdant forage were not guaranteed throughout the year, so that it causes the cattle cannot produced optimal (Widiati, 2003). Winugroho et al., (1998) stated that the availability of verdant forage was influenced by the climate and patterns of food crops, during the dry season the verdant forage production decreased.

3.6. Breeders factor

In this study, the knowledge breeders about the livestock reproduction and the ranchers' ability to detect the estrus were determined. The knowledge and skills improvement of the farmers regarding to the farm management might improve the livestock population. The one

was the management of reproduction about estrus detection and proper mating period (Parera, 2011). The breeder's role in determining the proper mating period would determine the success of a pregnancy time in a complete. Determining the in appropriate mating period caused the complete could occur in two until three times per copulate.

The t test analysis showed that the significant results was about 0.060, meant insignificant because its significance was larger than that of $\alpha = 0.05$. This result has a meaning that the level of knowledge about livestock reproductive and the ability to detect the estrus was unreal affected on the AI success on the cattle in the region of Cattle Center in Jambi province. It meant that the breeder factors do not include in the path analysis model. This fact informed that the knowledge level about livestock reproductive and the ranchers' ability to detect the estrus do not affect the AI success on the cattle in the region of Cattle Center in Jambi province.

This result was in contrary to some previous opinions. The accuracy of lust detection and on time report from breeders to the inseminator, distance, location, facilities and field conditions would largely influence the success of Artificial Insemination. The Inseminator and ranchers were the spearheading of the AI implementation as well as the responsible party for the success or failure program in the field (Hastuti et al., 2008). AI success was not only determined by the appropriateness of the lowest detection by the inseminator, but also by the livestock owners in lust detection (Caraviello et al., 2006). Other breeder factors also affected the AI success was interval between lust detected and reported to the inseminator. Sometimes farmers did not directly report the lust cattle to the inseminator to implement AI, whereas the interval of lust and ovulation time on the cattle is limited (Toelihere, 1993).

The human factor or breeder was a crucial factor in the success of an AI program, because it has a central role in the activity of AI service. The breeder motivation to join the program or new activities were influenced by the social and economic factors such as education, experience, and the amount of the cattle ownership. These factors would affect its maintenance management and at the end to the household income (Goddess and Nurtini, 2008).

4. Conclusion

1. Simultaneously, the factors of semen, ranchers, cattle, inseminator and feed were a critical success factor of an Artificial Insemination on the cattle in a Region of Jambi province Cattle's Center, but partially the factors of cattle, inseminator and feed as determining factor of an Artificial Insemination's success of the cattle in a region of Jambi province cattle's center.
2. The feed factor was the decisive factor that most domains (32.38%) in the success of artificial insemination of the cattle, followed by the semen factor (14.02%), and the inseminator factor (9,13%), as well as livestock factor (6.07%). For the breeder's factor, it was not determining factor in the success of artificial insemination of Bali cattle in Jambi province.

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