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Income Assessment of Beef Cattle Farming and Measurement of The Customer Satisfaction Index (CSI) on Farmer's Satisfaction Level

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ABSTRACT

This study evaluated cattle farmer's satisfaction with government support programs and compared incomes between farmers using artificial insemination (AI) and natural breeding in Liliriaja District, South Sulawesi. Using a quantitative descriptive approach, data were collected through structured questionnaires and interviews with 150 purposively selected cattle farmers. The Customer Satisfaction Index (CSI) method assessed four main indicators: technical service quality, IB availability, income generation, and production yield. The results showed a moderate level of satisfaction (CSI = 73.78%), with the highest score for AI availability (WS = 1.089) due to its critical role in genetic improvement. However, the income support program had the lowest satisfaction (WS = 0.621), highlighting gaps in subsidy accessibility and market linkages. Economically, IB calves generated higher income (IDR 8,500,000/head) compared to natural mating (IDR 6,500,000/head), despite IB requiring higher feed costs. This study underscores the need for policy improvements, including reviving subsidy programs, technical training, and optimal implementation of IB to improve farmers' welfare and sustainable livestock productivity.

Keywords: *Farmer Satisfaction, Income Analysis, Government Policy*

INTRODUCTION

Beef cattle farming has a strategic role in supporting food security and increasing farmers' household income. As stated by (Indrayani and Andri, 2018), the success of a livestock business is strongly influenced by managerial management and the socio-economic conditions of farmers. Economic analysis in the cattle business is important to assess the feasibility of the business and become the basis for formulating strategies to increase productivity and cost efficiency. Nationally, the government has implemented various programs to support this sector, such as UPSUS SIWAB (2017-2019), and continued with SIKOMANDAN since 2020. These programs focus on using artificial insemination (IB) to accelerate genetic improvement and increase beef cattle production (Putri Kartika Widiyaningsih, Zulfanita, and Faruq Iskandar, 2023). However, with the discontinuation or reduction in the intensity of the SIKOMANDAN program, new challenges arise at the field level, especially regarding the sustainability of subsidy support, frozen semen distribution, and technical assistance. In this context, it is important to assess the effectiveness of government services post-program, as well as their impact on farmers' satisfaction and income levels, to inform the redesign of livestock sector policies. on the other hand, more discussion is needed on the economic implications of using IB compared to natural breeding, to inform a more adaptive and efficient subsidy model.

Although several previous studies have examined this topic, the innovation of IB technology from accumulative income is better than natural breeding beef cattle but the cost of production in cattle using IB is greater than natural breeding. Moreover, the high cost of IB semen reduces the interest of farmers to follow the

artificial insemination program in their cattle (Sofiyanto, A., Tatipikalawan, J. M., and Jesajas, H, 2024). This is confirmed (Surianto, 2016) that IB technology increases productivity if supported by good management in minimizing the high cost of cattle. This contradiction shows that the effectiveness of IB cannot be seen in isolation, but must be analyzed in the context of policy support, farmer readiness, and local conditions. This research seeks to fill this gap by providing a data-driven evaluation of farmer satisfaction levels and an income analysis of the use of IB and natural breeding technology innovations.

This research also responds to the need for policy-relevant studies, particularly related to the reformulation of the IB subsidy model, technical training, and market access. The findings of this research are expected to provide concrete input for local and central governments in developing strategies to strengthen smallholder livestock farming that are more sustainable and competitive. The main objective of business activities, including the beef cattle sector, is to maximize profits. In economic principles, profit is calculated as the difference between total revenue (TR = Total Revenue) and total cost (TC = Total Cost). Therefore, profit is determined by two main components, namely the amount of revenue earned and how efficiently costs can be reduced during the production process. Furthermore, changes in profit are strongly influenced by the difference between marginal revenue (MR = Marginal Revenue) and marginal cost (MC = Marginal Cost). If each additional unit of production generates more marginal revenue than marginal cost, then profit will increase. Conversely, if the marginal cost exceeds marginal revenue, profit will decrease. The optimal point is reached when MR = MC, which is the condition of maximum production efficiency. In the context of government programs such as artificial insemination (IB), if implemented effectively, the direct benefits received by farmers are not only in the form of increased income due to the sale of higher-weight calves and better selling prices, but also in terms of cost efficiency. For example, the utilization of superior males through IB allows farmers to obtain better genetic quality without having to raise their males, which will certainly increase the burden of feed and maintenance costs. On the other hand, increased reproductive success also shortens the production cycle, so the number of calves per year can increase, which in turn increases total revenue. In addition, IB programs accompanied by government subsidies for insemination costs, frozen semen distribution, and technical counseling can reduce the variable costs that must be borne by farmers.

The technical training and mentoring that accompany the program also improve farmers' knowledge in reproductive management and animal health, resulting in sustainable productivity improvements. If all these components run harmoniously, then farmers will experience a real increase in profit margins. Thus, from a microeconomic perspective, the IB program has the potential to significantly leverage the efficiency and productivity of livestock enterprises, which in turn increases the net profit value and improves the welfare of farmers at the grassroots level. If the change in revenue is greater than the change in cost of each output, the profit received will increase, and vice versa if the change in revenue is smaller than the change in cost. Profit will be maximized if the change in profit is equal to zero, that is if the change in revenue is equal to the change in cost (Imran, S., and Indriani, R., 2022).

The government has consistently implemented sustainable programs aimed at improving the welfare of beef cattle farmers, especially through increasing cattle body weight which has implications for increasing the volume of beef production. One of the strategic initiatives that has been implemented is the Special Efforts for Mandatory Breeding Cattle (UPSUS SIWAB) program in 2017-2019 (Andi Syastiawan, Ahmad Ramdhan, and Sitti Nurani., 2019) and the continuation of the SIKOMANDAN program starting in 2020. Despite the change in the name of the government program activities, the focus is on the use of artificial insemination methods as a solution to the limited number of bulls ready to mate naturally (Putri et al, 2023). This program is not only intended as a technical alternative but also as a scientific approach to accelerate the improvement of the genetic quality of beef cattle and support the efficiency of livestock reproduction nationally.

The implementation of the government program to increase beef cattle income with IB as the main instrument in the program provides various benefits, not only limited to increasing the pregnancy rate, but also makes a significant contribution in increasing the body weight of beef cattle (Sirajuddin, S. N., Siregar, A. R., Sessu, A. T., Haeruddin, & Syastiawan, A., 2020). With a more optimal body weight, the quality and quantity of meat production also increases, thus creating added value for farmers. This indirectly supports the economic growth of the livestock sector, strengthens national food security, and reduces dependence on meat imports. Through the application of reproductive technology, it is expected that smallholder farms can grow sustainably and competitively amid global challenges (Rusdiana Soeharsono and Soeharsono, 2018).

Farmer satisfaction reflects the level of acceptance and positive perception of farmers towards the quality of artificial insemination (IB) services received by their livestock. This satisfaction is an important indicator in assessing the success of the reproductive services program because it is directly related to the commitment and long-term involvement of farmers in the development of a sustainable breeding system. High levels of farmer satisfaction not only encourage the improvement of beef cattle genetic quality but also strengthen the collaborative relationship between farmers and service providers, creating a productive, adaptive, and progressive livestock

business climate. If this satisfaction can be consistently maintained and improved, it will create breeder loyalty, which is the foundation for the success of the IB program on a national scale (Hulopi, C., Pateda, Y., and Sahara, L. O., 2023). The impact of government programs has a real effect on increasing the income of beef cattle breeders, artificial insemination technology innovation contributes to the achievement of food self-sufficiency targets which is the government's goal.

Several previous studies have shown that government policy interventions provide a positive impetus to the development of beef cattle farming, both on a regional and national scale. However, information obtained from farmers and extension workers in the field shows that after flagship programs such as the Special Efforts for Mandatory Breeding Cows (UPSUS SIWAB) and State Commodity Buffalo Cattle (SIKOMANDAN) were no longer running, several follow-up activities directly related to strengthening the livestock sector began to decline in implementation, even the results of preliminary interview observations in the field between researchers and farmers some programs have stopped which causes farmers to adopt the use of IB technology directed to independent costs without subsidies from the government. Some farmers are worried about the fluctuating additional costs for purchasing IB semen and the decline in stakeholder support for beef cattle farmers. This situation is of concern to researchers as an urgency to conduct a study that assesses farmers' perceptions of the support provided by the government, which in this case is analyzed by the Customer Satisfaction Index (CSI) method. In addition, this study also analyzed the comparative income of beef cattle farmers who use artificial insemination (IB) technology and those who still rely on natural mating methods. The results of the analysis are expected to be input in formulating a more adaptive and sustainable beef cattle farming development policy on the needs in the field.

RESEARCH METHODS

Research Sites

This study uses a quantitative descriptive approach to analyze the difference in income between beef cattle farmers who use Artificial Insemination (IB) technology and those who still apply the natural mating system (non-IB). The purpose of this study was to determine the comparison of beef cattle farmers' income through the application of artificial insemination and natural mating to farmers' income and profits as well as to measure farmers' satisfaction with government program support for beef cattle in Liliriaja District, Soppeng Regency, the research implementation time ranged from January to March.

Data Types

The types of data used in this study are primary and secondary data. Primary data was obtained directly from farmers through interviews and observations in the field using structured questionnaires, while secondary data was obtained from relevant agencies such as local government and livestock farmer groups as well as relevant literature and documentation.

Data Collection Techniques

Data collection techniques were conducted through in-depth interviews and questionnaires to beef cattle farmers who became research respondents. Direct observation was also conducted to ensure the accuracy of the data provided, especially in observing aspects of livestock maintenance and resource management.

Sampling Method

Respondents in this study were selected by purposive sampling, which is intentionally based on certain criteria. The criteria used were farmers who have been in the beef cattle business for at least one year and have experience in the use of artificial insemination (IB) and natural mating technology. This approach allows researchers to obtain data from subjects who have knowledge and experience relevant to the research topic, particularly in evaluating service quality and the impact of government programs on farmers' income and satisfaction. However, purposive sampling has limitations. This method potentially excludes farmers who are marginalized or who do not yet have access to (IB) technology, such as small-scale farmers, those in remote areas, or farmers with low socio-economic backgrounds.

This limitation is recognized as a potential bias that may affect the generalizability of the findings. Nonetheless, the purposive method was considered appropriate for this study, which was to explore perceptions and analyze income based on direct experience in using two beef cattle reproductive systems. In other words, the selection of respondents focuses on farmers who have experienced both IB and natural breeding services in real terms, to provide deeper, contextual, and focused information on policy evaluation and the effectiveness of its

implementation in the field.

Data Analysis

Data analysis techniques used livestock business income analysis with the approach of the difference between total revenue and total production costs during one cycle of calf rearing until ready to sell within one year. The main variable measurement consists of revenue (from calf sales and manure, although in practice manure is not actively traded), production costs (including feed, medicine, cage maintenance, and artificial insemination), and profit as the difference between the two (Apri Utama, R., Rohmah, A. N., and Rahman, R. Y., 2024). Measurement of farmer satisfaction with government program support was conducted by collecting data through a survey technique using a closed questionnaire structured on a 1-5 point Likert scale to measure satisfaction levels.

$$\textbf{Factor Weight (WS)} = \frac{\textbf{Indicator importance score}}{\sum\textbf{All important policy indicator scores}}$$

The Likert scale includes: **1** = Very Poor, **2** = Poor, **3** = Fair, **4** = Good, **5** = Very Good Analysis of farmer satisfaction with government program support, using the CSI method: Perform calculations to obtain the Weigh Factor (WF) value. The weight factor can be obtained through the following calculation: Each respondent gives a score to indicators of program importance that are very important and needed to support the performance and satisfaction of sustainable beef cattle farmers. The perception of respondents or cattle farmers is measured using a Likert scale of **1** = Not important, **2** = Less important, **3** = Fair, **4** = Important, **and 5** = Very important. Calculate the multiplication between the Mean Satisfaction Score (MSS) and Weighted Factor (WF) to get the Weighted Score (WS) value with a maximum value of **1**, with the formula.

$$\textbf{WS = SPM x WF}$$

WS = The final value of the weighted measurement of farmer satisfaction with government programs, **MSS** = The average value of farmer perceptions of each measurement indicator using a Likert scale of 1-5, while **WF** = The weight given to show how important government programs are according to respondents or researchers with measurements using a Likert scale. Calculating the **Weighted Average (WA)** value, by showing the entire Weighted Score (WS) along with all indicators and services owned. Calculating the **Customer Satisfaction Index (CSI**) value with the Weight Average (WA) value divided by the maximum scale **(Highest Scale / HS / Likert Scale 5)** multiplied by 100%, with the following formula:

$$\textbf{CSI} = \frac{\textbf{WA}}{\textbf{HS}} \textbf{ x 100}$$

Overall, the criteria for the highest level of satisfaction is if the value of the farmer satisfaction index (CSI) is 100%, as this satisfaction index ranges from 0 - 100 percent. This scale range formula (RS) is used to create a linear scale from numerical numbers, which is obtained using the formula:

$$\textbf{RS} = \frac{\textbf{x-y}}{\textbf{b}}$$

Where **x** = highest score, **y** = lowest score, and **b** = number of classes or categories to be created. The range of the farmer satisfaction scale used in this study is 25% which is obtained from

$$\textbf{RS} = \frac{\textbf{100\% - 0\%}}{\textbf{4}} \textbf{ = 25\%}$$

Table 1. The Range of The Beef Cattle Farmer Satisfaction Scale is as follows

Farmer satisfaction scale	Criteria
0% < CSI ≤ 25%	Not satisfied
26% < CSI ≤ 50	Enough.
51% < CSI ≤ 75	Satisfied
76% < CSI ≤ 100	Very Satisfied

Evaluation of cattle farmers' satisfaction was conducted to analyze farmers' perceptions of four main indicators of government services that support beef cattle farmers, both through artificial insemination and natural breeding. The two main aspects that are the focus of measurement are government services **(X)** which describe the real experience of farmers in receiving assistance in the field, and government policy needs **(Y)** which reflect the rules or regulations governing service mechanisms and programs that are right on target and opinions that develop. To determine the level of importance of each indicator, a Weight Factor **(WF)** is calculated based on the total policy value of each indicator, and then normalized so that the number reaches 1. Next, the service value **(X)** is multiplied by the **WF** to obtain the **Weighted Score (WS)**, which reflects the relative contribution of each indicator to farmer satisfaction.

The Customer Satisfaction Index **(CSI)** is then calculated by comparing the total WS to the maximum achievable scale. This method allows the government to assess the effectiveness of the service while identifying areas for improvement so that the resulting policies can be more responsive to the real needs of farmers in the field. With this approach, it is expected that there will be an improvement in service quality and more targeted regulations. Overall farmer satisfaction as a percentage of satisfaction is expected to be a benchmark for further research, it is expected that the adoption of information from the government as support and the achievement of food self-sufficiency targets. Income Formula for Artificially Inseminated and Natural Breeding Cattle:

Revenue = Total Revenue - Total Cost of Production

Where the total revenue is the sales value of the main product (calves) + the sales value of by-products (manure) while the total production cost is fixed costs (cage depreciation) + variable costs (feed, medicines, labor, artificial insemination costs, and natural mating), this is by the opinion **(**Retna et al, 2021**)**. Total revenue is the sales value of the main product (calves) + sales value of by-products (manure) while total production costs are fixed costs (cage depreciation) + variable costs (feed, medicines, labor, artificial insemination costs, and natural mating), this is by the opinion (Retna et al, 2021).

RESULTS AND DISCUSSION

Evaluation of cattle farmers' satisfaction was conducted to analyze farmers' perceptions of four main indicators of government services that support beef cattle farmers, both through artificial insemination and natural breeding. The two main aspects that are the focus of measurement are government services **(X)** which describe the real experience of farmers in receiving assistance in the field, and government policy needs **(Y)** which reflect the rules or regulations governing service mechanisms and programs that are right on target and opinions that develop. In measuring government services **(X)** and government policy needs, researchers surveyed by filling out a questionnaire on farmers using a 1-5 Likert scale assessment of each question indicator related to services and the importance of government policies.

To determine the level of importance of each indicator, a Weight Factor **(WF)** was calculated based on the total policy value of each indicator, and then normalized so that the number reached 1. Next, the service value **(X)** was multiplied by the WF to get the Weighted Score **(WS)**, which reflects the relative contribution of each indicator to farmer satisfaction. The Customer Satisfaction Index (CSI) is then calculated by comparing the total **(WS)** to the maximum achievable scale. This method allows the government to assess the effectiveness of the service while identifying areas for improvement so that the resulting policies can be more responsive to the real needs of farmers in the field. With this approach, it is expected that there will be an improvement in service quality and more targeted regulations. Overall farmer satisfaction as a percentage of satisfaction is expected to be a benchmark for further research, it is expected that the adoption of information from the government as support and the achievement of food self-sufficiency targets.

Table 2. Analysis of farmer satisfaction using the Customer Satisfaction Index (CSI) method

No.	Indicators	Services (X)	Policy (Y)	WF (X*WF)	WS	Percent
1	Technical service quality	3,90	4,26	0,25	0,98	
2	Artificial Insemination Availability	3,96	4,63	0,27	1,08	
3	Increased revenue (IB subsidies, medicines, and animal markets)	2,93	4,70	0,21	0,62	
4	Production and Reproduction	3,86	4,33	0,25	0,99	
	Total	3,66	4,48	Max = 1.00	3,68	73,7%

Source: Primary Data Processed, 2025.

The table above shows government services to farmers, from four indicators using a Likert scale of 1-5. The quality of technical services includes sub-indicators of responsiveness of field officers, timeliness of IB and natural mating services, clarity of information in the form of counseling, government programs, and control of livestock diseases on a Likert scale of 3.90 rounded to 4 with a satisfaction level of "GOOD" from the average calculation of respondents in Liliriaja District. Although the satisfaction rate is very good, it is still very wide because some respondents who have access to livestock pens still very difficult to get responsive services, timeliness of IB, and clarity of information, and also the number of field officers has not been able to meet every village in Liliriaja Sub-district.

The service indicator of IB availability is at 3.96 or 4 on the Likert scale, farmer satisfaction is in the 'GOOD' category and is the highest satisfaction index of the four service indicators, while the questionnaire sub-indicators are the availability of frozen semen, the accuracy of pregnancy diagnosis and IB success. In this service, the availability of frozen semen when needed rarely experiences shortages because the adoption of IB innovation by breeders is the main choice compared to natural breeding which has experienced a decline in males. The alternative use of IB tends to be adopted by farmers because the results of IB are very good in increasing meat weight productivity, but not without obstacles.

What is often expressed by farmers is that not all IB injections result in successful pregnancy due to the poor quality of frozen semen and the determination of injections when the cows are in heat, making it difficult to detect signs of cows in heat. Indicators of services to increase farmers' income in the form of subsidies for the use of IB, medicines, and animal markets with the lowest satisfaction scale. The average result of respondents from the Likert scale measurement shows 2.93 with the category 'ENOUGH' because government programs such as UPSUS SIWAB and SIKOMANDAN are no longer running and have an impact on increasing the costs of breeding farmers such as the implementation of IB independently, the cost of expensive drugs and the lack of animal markets as a marketing tool for breeders for buying and selling transactions. Production and reproduction results showed farmer satisfaction at 3.86 or rounded up on a Likert scale of 4 in the 'GOOD' category. Despite this, some sub-indicators such as improving seedling quality, calf growth, and reproductive success still need to be improved as there is some suboptimal calf growth due to the birth of deformed and stunted calves. Most of these problems occur in cows that mate naturally.

Government policy support or regulation is a matter of concern for farmers because, from the research findings, each indicator of importance is above the Likert scale 4 or 'IMPORTANT', which shows the results of interviews with farmers the need for government programs in the form of subsidies to minimize beef cattle breeding costs. The most dominant complaint was the need for regulations or supporting programs such as UPSUS SIWAB and SIKOMANDAN, at which time the IB subsidy program to farmers was very useful in reducing breeding costs. Farmers complained that the cost of IB was fully borne by the farmer. From the data table on the importance of supporting increased income, the highest score on the Likert scale was 4.70, close to the maximum score of 5 points. This indicator is very important for farmers, with the hope that future government programs can take sides and improve the welfare of farmers. The quality of technical service support, IB availability, production, and reproduction are important to receive support from the government because these indicators are the main components in beef cattle breeding. This is by previous research on the perception of good artificial insemination that produces quality beef cattle with the help of government programs (Darwis and Zulfikar, 2021).

Based on the data obtained, the Weighting Factor (WF) indicates the relative importance of each indicator in influencing cattle farmer satisfaction. The highest WF value is found in the Artificial Insemination (AI) availability indicator of 0.275, indicating that this aspect is considered most important by farmers. This is in line with the high policy value (Y=4.63), which reflects that government regulations and support in the provision of IB greatly affect service quality. Meanwhile, the income generation indicator had the lowest WF (0.212), despite

the high importance of policy support (Y = 4.7). This indicates that although subsidies and animal market assistance are important, farmers prioritize direct technical services such as IB and mentoring.

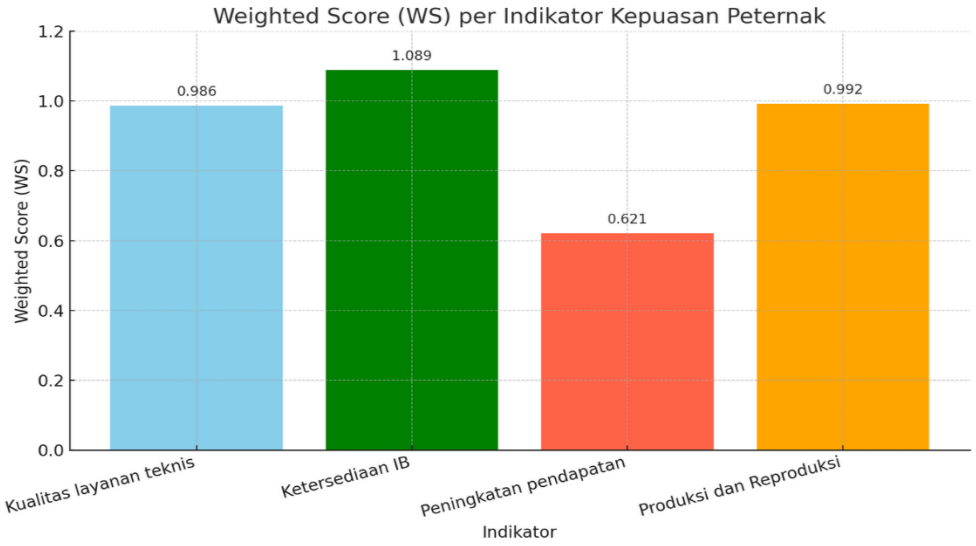

***Figure 1**:* Weighting Score Chart of Each Indicator Processed, 2025.

The indicator chart (WS) illustrates the real contribution of each indicator to the Breeder Satisfaction Index after taking into account its weight. The availability of the artificial insemination indicator contributed the highest (WS = 1.089), followed by production and reproduction results (WS = 0.992) and technical service quality (WS = 0.987). Availability of Artificial Insemination (WS = 1.089) being the indicator with the highest value, reflects that farmers highly value the availability of frozen semen and the success of IB. This indicates the technical success of the IB program in the field. Production and Reproduction (WS = 0.992) Coming in second, indicating that the impact on reproductive outcomes and calf quality is also positively perceived by farmers. Quality of Technical Services (WS = 0.986) Although slightly below the production indicator, this value is still high. This includes responsiveness of field officers, clarity of counseling, and accuracy of service. Income Increase (WS = 0.621) is the indicator with the lowest value. Although important to farmers (Y = 4.70), realization on the ground is very low. This reflects serious problems in access to subsidies, medicines, and animal markets.

The total indicator score (3.689) was compared to the maximum score (5.00), resulting in a CSI of 73.78%, which falls into the moderate category. These results indicate that although most government services have been running well, especially in terms of the availability of artificial insemination and technical support, there is still room for improvement, especially in terms of income and reproductive efficiency and the results of this research approach to the measurement results (CSI) of customer satisfaction with the quality of BNI Medan State University services using the Customer Satisfaction Index method, resulting in 66%, indicating that customers feel adequate to the services of Bank Negara Indonesia Medan State University (Dian, S., Siahaan, N., and Agustini, F., 2021).

Future policy recommendations can focus on increasing access to subsidies, strengthening technical assistance, and optimizing reproduction results to achieve higher levels of satisfaction. The policy implications in this study emphasize that the availability of IB services is a dominant factor in shaping farmer satisfaction, so the government needs to ensure equitable distribution of semen and inseminators. Of the four indicators analyzed in measuring breeder satisfaction using the *Customer Satisfaction Index (CSI)* method, the income increase indicator recorded the lowest service value (X) of 2.93 on a Likert scale of 1-5, and a Weighted Score (WS) of 0.621, which is the lowest value among all indicators. This indicator has the highest level of policy importance (Y = 4.70), which indicates that farmers expect government support in the form of subsidies, access to medicines, and market facilities, but the realization of services in the field is far from expectations.

This stark gap between expectations (high) and perceptions of services (low) indicates a failure of policy implementation. Many farmers complain that the subsidies for artificial insemination (AI), drugs, and marketing support that were provided in the past are no longer available, leaving them to cover all production costs themselves. This is particularly burdensome for smallholders, who often have limited access to finance and market information.

The profit obtained by farmers is the main indicator in measuring the level of income obtained from their business activities, especially in the beef cattle farming sector (Apri Utama et al., 2024). In the context of economic

analysis of livestock business, income is a very important component because it is directly related to the ability of farmers to meet their living needs and develop the scale of their livestock business. Income is calculated as the difference between the total revenue from the sale of livestock and the production costs incurred during the maintenance process, both in the reproductive system through Artificial Insemination (IB) and natural mating (INKA). Based on the results of research conducted in Liliriaja District, Soppeng Regency, it is known that the potential for additional income from by-products, such as cow dung, has not been economically maximized by farmers. Most farmers only use the waste as organic fertilizer for personal farming needs, so it has not directly contributed to income in the form of rupiah value.

The components of production costs in the analyzed livestock businesses include two categories, namely fixed costs and variable costs. Fixed costs are calculated from cage depreciation, while variable costs consist of expenditures on feed (including concentrates, salt, and bran), medicines, labor, and artificial insemination services. In practice, most respondents use animal feed in the form of elephant grass obtained independently from nature or private yards, thus incurring no additional costs. Similarly, in terms of labor, where the work of raising livestock is done by their family members without monetary reward, so it is not calculated in the total production cost, all costs associated with the implementation of artificial insemination, including supporting operations, have been covered by the government. This refers to a policy (Muda, 2022) that exempts artificial insemination fees to encourage increased productivity and efficiency of livestock reproduction nationwide.

Table 3. Income of Beef Cattle from Artificial Insemination and Natural Breeding in Liliriaja Subdistrict

No.	Description	IB	Natural Mating
1	Reception		
	Livestock sales	IDR 8,500,000,-	IDR 6,500,000
	Manure sales	*	*
	Total Revenue	IDR 8,500,000,-	IDR 6,500,000,-
2	Production Cost		
	Feed (Bran, concentrate, and salt)	IDR 300,000,-	IDR 150,000,-
	IB fee	*	*
	Cost of medicines	IDR 150,000,-	IDR 150,000,-
	Labor	*	*
	Cage repair	IDR 250,000,-	IDR 250,000,-
	Total withdrawal	IDR 700,000,-	IDR 550,000
Revenue (1-2)		IDR 7,800.00,-	IDR 5,950,000

Source: Processed Primary Data, 2025.

Based on primary data obtained through field research sampling in beef cattle farms that have implemented artificial insemination and natural mating at least in the last 1 year, it is known that the total cost of raising beef cattle calves for one year is different between farmers who use artificial insemination technology and farmers who do not use this technology (natural mating). Farmers who apply artificial insemination technology incur maintenance costs of Rp 700,000 per head per year, while farmers who use natural mating incur lower costs of Rp 550,000 per head per year. This difference is largely due to the higher feed requirements of artificially inseminated calves, as well as faster growth and superior genetic quality.

The high feed requirement of artificially inseminated calves is closely related to the farmer's strategy for promoting optimal growth. Supplementary feed such as concentrates, bran, and salt are given intensively to support maximum body weight growth and muscle development. Meanwhile, naturally bred cattle tend to be reared with simpler feeding patterns, resulting in relatively lower cost requirements. However, the provision of medicines, such as vitamins, vaccinations, and deworming, is done equally in both artificially and naturally bred cattle. This reflects farmers' awareness of the importance of livestock health in maintaining productivity and immunity. In terms of labor, most farmers who were respondents in this study did not incur additional costs because the maintenance process was carried out by their family members. Therefore, labor costs are not calculated in the production cost structure. This shows that family involvement in livestock activities is still very dominant, especially in rural areas. Although there are differences in expenditure structure, the difference in production costs between artificial insemination and natural breeding methods is relatively small but has a significant impact on production yields and the quality of livestock products.

In terms of revenue, there is a significant difference between the sale of calves from artificial insemination and natural breeding. Calves from artificial insemination have an average selling value of IDR 8,500,000 per head, while those from natural breeding only reach IDR 6,500,000 per head (Phun, O. C. M., Rorimpandey, B., Manese, M. A. V, & Umboh, S. J. K**,.** 2020). The high selling value of artificially inseminated calves is due to the use of superior males, such as Simental, Brahman, and Limousin breeds, which are known for their high meat quality

and faster growth rates. The combination of genetic quality and good feed management causes artificially inseminated calves to be more desirable to the market and have higher competitiveness. The difference in income can be explained through various factors that affect the effectiveness of IB technology in the field. Farmers' experience in managing livestock, technical ability in applying artificial insemination, availability of supporting facilities, and ability to provide quality feed are important variables that determine the success of artificial insemination. In the context of smallholder farming, most farmers still rely on traditional systems, both in feed management and reproductive management, so the application of modern technology has not fully provided significant benefits (Rusdiana et al, 2018). This shows that the success of technology is not only determined by its application but also by the readiness of human resources and other supporting systems.

In addition, dependence on production inputs such as supplementary feed and drugs in artificial insemination systems tends to be higher. As a result, production costs increase disproportionately for farmers who do not have access to production efficiency and profitable markets. On the other hand, farmers who still use natural breeding benefit from minimal expenditure on insemination, as well as efficient use of local resources such as forage available in the yard or the wild. Under certain conditions, traditional systems practiced with consistency and experience can yield competitive results, especially if farmers can maintain production efficiency. In light of these findings, it is imperative that the government and related parties not only encourage the use of technology, but also provide technical assistance, training in livestock business management, and access to inputs and fair markets. The application of technologies such as artificial insemination will be more effective if applied holistically, i.e. in line with the capacity building of farmers and the improvement of the overall livestock business system (Putri et al, 2020).

Therefore, an integrative approach that combines technology, local wisdom, and farmer empowerment is the main key to creating a productive and sustainable beef cattle business. The results of this study are in line with the findings of (Sakti, 2019) where the income of Balinese cattle farmers who do not use artificial insemination is slightly higher than farmers who use artificial insemination. This suggests that other factors such as farmer experience, mating cost efficiency, and skills in technology application also affect income levels. However, the results of this study also support the statement (Surianto, 2016) that Artificial Insemination technology has a positive impact on increasing productivity and income potential, especially if supported by optimal husbandry management and the use of high-quality genetic livestock.

CONCLUSION

Based on the results of the Customer Satisfaction Index (CSI) analysis of government services to beef cattle farmers in the Liliriaja Subdistrict, it can be concluded that the overall level of farmer satisfaction falls into the moderately satisfied category (73.78%). The indicator of the availability of artificial insemination (IB) occupies the highest position in the contribution of satisfaction (WS=1.089), followed by production and reproduction results (WS=0.992) and the quality of technical services (WS=0.987). However, the aspect of income generation showed the lowest contribution (WS=0.621), despite being considered very important by farmers (Y=4.7). This indicates that although the subsidy program and animal market assistance are considered important, their implementation has not been optimal in improving farmers' welfare. In terms of economic analysis, the implementation of artificial insemination (IB) results in higher income (IDR 7,800,000/head/year) compared to natural mating (IDR 5,950,000/head/year), despite the higher cost of maintenance. The advantages of IB lie in the genetic quality and faster growth of livestock, thus increasing the selling value. However, the success of IB is highly dependent on technical support, such as the availability of quality frozen semen, timeliness of insemination, and officer assistance. On the other hand, natural mating remains in demand due to its lower production costs and is not dependent on the availability of technology.

Priority policy recommendations include revitalizing subsidies in an inclusive format to revive the IB, feed, and medicine subsidy programs through a voucher-based approach or direct incentives to farmers who meet productivity criteria, to ease the burden of production costs and expand the adoption of IB. Expansion of Standardized and Field-based IB Training Provide intensive training for farmers on estrus detection, reproductive management, and cycle recording, as well as capacity building for local inseminators to make the IB process more accurate and effective. Development of local livestock markets and connected supply chains re-establish village-based livestock markets and support farmers' access to digital marketing networks or direct partnerships with abattoirs to increase livestock value and shorten distribution chains. Overcoming Barriers to IB Adoption To increase the success of IB, several obstacles must be addressed, including challenges in estrus detection: The need to provide simple tools such as heat detectors and training in visual observation, frozen semen quality: Ensure quality standards through laboratory supervision and efficient distribution logistics, dependency on officers: Empowering breeders with independent skills to be more responsive in scheduling insemination. With these

strategic measures, the artificial insemination program will not only be a biologically superior technology but also economically viable and socially inclusive, promoting sustainable and highly competitive smallholder livestock growth.

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