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Research Paper

Smart Agribusiness through Analysis of Balinese Cattle Fattening Using Alternative Feed in Palembang, Indonesia

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Abstract
The development of cattle fattening is one of the efforts to fulfill the increasing demand for meat, in line with the growth of the human population. In addition, cattle fattening also provides significant economic opportunities for farmers and business actors in the livestock sector. One important aspect in this regard is feed management, which can have a major effect on the growth and health of livestock. Therefore, this study aimed to (a) analyze the initial weight of cattle, length of fattening time, daily weight gain, and (b) assess the feed cost, selling price, as well as income before and after fattening. A descriptive qualitative method was used to explain the feasibility of cattle fattening business grouped based on four feeding patterns namely (a) grass, (b) grass and tofu pulp, (c) grass, tofu pulp, and sweet potato skin, as well as (d) grass, tofu pulp, sweet potato skin and molasses in Palembang, Indonesia. Furthermore, purposive sampling was used with 100 cattle as the population, divided into four different diet groups. Data analysis was conducted using mean differences to evaluate the impact of the four feed alternatives on the measured variables. The results showed that there were significant differences in income, with molasses generating the highest income per kilogram (kg) of beef. In the feasibility analysis, molasses showed good feasibility with an R/C Ratio of 1.56, implying that cattle fattening business by applying molasses feed alternative could be considered as a viable investment. The results provided practical insights for cattle fatteners, assisting in decision-making regarding optimal feed patterns to increase income and business viability.

Keywords
Cattle fattening, Feed Alternatives, Business Feasibility

1. INTRODUCTION

The livestock sector is renowned for its important contributions to life and economic development in Indonesia, including the provision of animal protein as an essential agricultural commodity. Meat, sourced from various business scales includes large and small livestock as well as poultry. Large livestock including cattle play an important role as a producer of meat with good quality and quantity (Sahala, 2016). Cattle, specifically beef, serves as one of the resources that produce food in the form of meat, with a high economic value in Indonesia. However, domestic beef production has not been able to fulfill the demand due to low population and productivity levels. The low population is partly because most cattle are raised by small-scale farmers with limited land and capital (Suryadi and Suryani, 2018).

The potential of Balinese cattle as meat producers has not been optimally used through improved husbandry management. Local cattle have several advantages, including high adaptability to the environment, ability to use low-quality feed, and good reproductive capacity. A cow or group of cattle can produce a variety of needs, specifically as food in the form of meat. Beef is a commodity widely consumed due to its rich nutrients, acting as a crucial source of animal protein for the community. It is the second largest contributor (15.5%) after chicken to national meat consumption. The number is expected to increase consistently in line with the growing population, as well as rising incomes, and awareness of balanced nutrition. The national cattle population has continued to grow. Data from the Central Statistics Agency (BPS) in 2018 stated that over the past five years, the beef cattle population experienced an average growth of 1.54%/year, but the increase has not been able to fulfill domestic demand. According to Bustanul Arifin, beef consumption has grown by 8.10%/year. Growth in urban areas is about 2.91%, but the rate in rural areas is more rapid, at 10.7% (Indonesian Central Bureau of Statistics, 2022).

The imbalance of production and demand led to an increase in prices to IDR 115,780 in 2017, from IDR 66,329 in 2010. To fulfill the shortage, the government imports meat and feeder cattle as well as balances the market when price fluctuations occur. In 2010-2017, the import volume of meat and feeder cattle grew by 73.46 thousand tonnes or 6.2% and 168.15 tonnes or around 18.05%, respectively (UN Comtrade, 2018). The increase in import volume caused the trade deficit to increase to 115.78 thousand tonnes (2017) from 90.51 thousand tonnes (2010) (Indonesian Central Bureau of Statistics, 2022).

The persistent rise in beef prices, particularly leading up to Eid, where the annual increase can reach up to 15% to 40%, presents a promising opportunity for farmers and fattening products. Livestock farming, given availability and recognition in the community, proves to be a lucrative venture for those intending to empower farmers in Palembang City. Despite the challenges, the prospect of raising beef cattle in Indonesia remains wide open for a long time due to the increasing demand, driven by economic growth, nutritional awareness, and a growing population. However, this increase in beef demand must be followed by a sufficient cattle population.

The scarcity of beef in Palembang City has led to a surge in prices, primarily attributed to reduced cattle exports from Australia. This decrease is a consequence of the effort to replenish the cattle population in the country. Australia, being the second largest cattle exporter globally plays a significant role in influencing beef availability. Additionally, the spread of Foot and Mouth Disease (FMD) contributes to scarcity by causing weight loss and cattle death. To support the agribusiness of animal husbandry and cattle fattening in Palembang City in line with expectations, special attention from the government, specifically the Livestock Service Office is needed. Guidance for farmers is also required on how to improve skills in animal husbandry and enhance the quality of human resources. Farmers need to also be informed about the latest conditions in the livestock business to avoid losses due to cattle disease, thereby promoting the continuity of Agribusiness development.

The production chain significantly influences satisfactory results and one of the most important aspects of production management is the selection of good feed from the perspective of optimal growth and costs. For cattle to produce optimal products, feed needs must be fulfilled in terms of quality and quantity. Several types of feed are available for cattle, including grass or forage fodder which determines quality and production. Feed, defined as the food or intake given to farm animals or pets is a very important factor in cultivation activities in the livestock sector. Therefore, the selection of the right animal feed determines the success of the livestock business.

Despite the long-standing presence of cattle farming, the surge in beef imports, and the increasing demand necessitate strategic analysis to develop new and appropriate local cattle to compete with capital-intensive farmers and imported meat. In this context, the development of local cattle business in Pak HJ requires an appropriate strategy in dealing with the existing problems, namely the failure of cattle to eat only grass. Several feed alternatives derived from waste products include tofu and corn pulp, yam skin, as well as bran. This study aimed to analyze the differences in four feeding patterns for fattening cattle in Palembang City, with a focus on the initial weight, length of fattening time, feed cost, daily weight gain, as well as selling price after fattening. To achieve this goal, a review of previous literature was conducted for a comprehensive examination.

One approach to fostering sustainable beef cattle farming and enhancing the economic well-being of farmers is identifying the most appropriate strategy for further development. This motivation underlies the study "Business Analysis of Cattle Fattening Using Alternative Feed" conducted by Indrayani and Andri (2018) to determine the income and efficiency of the beef cattle business in the Berkarya II Youth group. The study area was selected deliberately to be Kendit Village, Kendit District, Situbondo Regency, while the methodology used was the quantitative descriptive method. Sampling in this study was carried out by census, and data analysis was performed with Income Analysis and B/C Ratio Analysis. Based on the results, the income of beef cattle business obtained from the difference between the revenue and the total production cost was IDR 133,254,843.00 for 1 year between January 2016 - January 2017. The income analysis showed that the beef cattle business was financially profitable. With total production costs of IDR 720,825,157, the Net B/C Ratio obtained was 0,19, which was < 1, indicating that the business was inefficient and not feasible.

A study was conducted by Prasongko et al. (2018) to determine the feasibility of developing a beef cattle fattening business based on the market, technical, management, environmental, financial, and business sensitivity aspects. The descriptive method was used with a case study technique, while the study area was determined deliberately to be the farm of H. Wakimin, Plesungan Village, Gondangrejo District, Karanganyar Regency. Primary and secondary data were used and data analysis of market, technical, management, and environmental aspects was carried out using descriptive methods. The analysis of financial aspect data used the feasibility criteria Payback period, NPV, IRR, Net B/C, Gross B/C, and sensitivity analysis. The results showed that (1) the development of beef cattle fattening business in H. Wakimin farm based on market, technical, management, and environmental aspects was feasible. (2) Analysis of financial aspects indicated feasibility with a project life of 10 years, a discount rate of 12%, and an inflation rate of 5.14%/year. NPV value was IDR 237,165,474.00, IRR value was 44.53%, net B/C was 2.83, Gross B/C was 1.06, and PP reached 2.91 years. (3) Sensitivity analysis showed that the maximum limit of decreasing the target

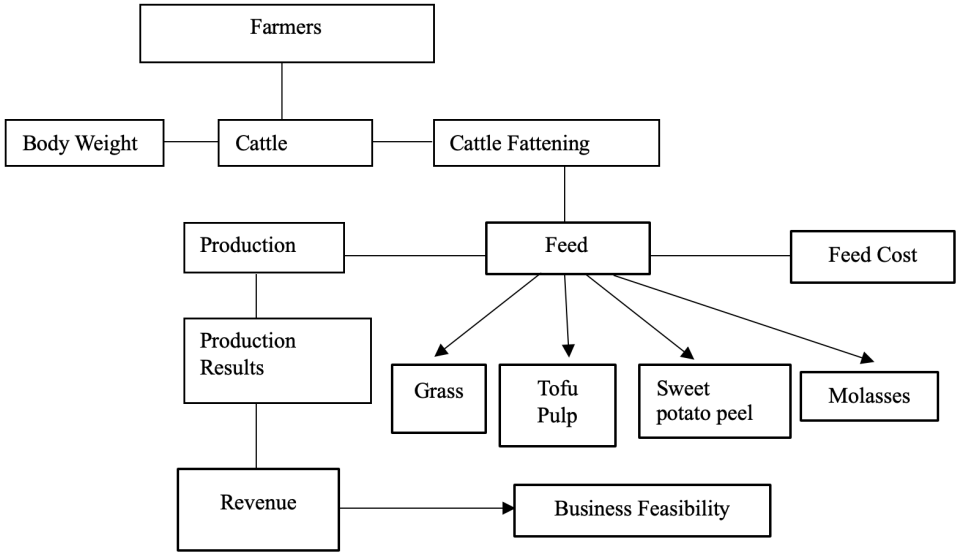

Figure 1. Diagrammatic Approach Model

Daily Weight Gain (PBBH) of cattle was 133 16% or a minimum PBBH of 0.84 kg/day. Meanwhile, the maximum limit of increase in cattle feeder price was 11% or IDR 44,400/kg live weight with the assumption that other costs were fixed in Palembang City.

The framework for analyzing cattle fattening business using feed alternatives at Pak Haji Stables, Palembang City, showed that the initial stage comprised a description of the initial condition of the cattle before adopting feed alternatives. This entailed collecting data on the cattle used as subjects, including information on initial weight, age, sex, health, and previous feeding history. This initial analysis would provide a clear picture of the initial condition of the cattle and offer insight into the changes that occur during the fattening period. The next step was to compare feed costs across different alternatives, in this stage, a thorough analysis of the costs associated with procuring, storing, and serving the different types of feed used in the study was conducted. This cost data would be used to compare the efficiency and economy of each feed alternative. Finally, a comparison of cattle weight gain, fattening business income, and feasibility of the various feed alternatives was performed. This entailed measuring the weight gain of the cattle, calculating the revenue generated from the sale, as well as evaluating the feasibility and profitability of the enterprise by considering various risk and return on capital factors.

2. EXPERIMENTAL SECTION

2.1 Method

This study used the descriptive qualitative method which explained the initial condition of the cattle fattening process based on the type, initial weight and age, and feasibility of the fattening business grouped based on four feeding patterns namely (1) grass, (2) grass and tofu pulp, (3) grass, tofu pulp, and sweet potato skin, as well as (4) grass, tofu pulp, sweet potato skin, and molasses in Palembang City.

2.2 Area

This study was conducted in Palembang City, spanning three months starting from the preparation of the proposal to the field data survey. A case-study method was used in the investigation of cattle fattening business in Lorong Pendidikan No. 77, Sukajaya Village, Sukarame District.

2.3 Data Collection

The samples used in this study were recruited using a purposive sampling method, namely by selecting samples with a specific purpose. A population of 25 cattle each year with 4 different feeding patterns was selected, totaling 100 cows.

2.4 Data Analysis

This study analyzed the initial condition of the cattle fattening process based on the type, initial weight, and age of cattle. The feasibility of the business was tested in line with the feeding pattern, namely (1) grass, (2) grass and tofu pulp, (3) tofu pulp, grass, and yam skin, and (4) tofu pulp, grass, yam skin, and molasses. Qualitative analysis techniques used descriptive statistical methods, and to measure the feasibility of cattle fattening business, RCR was used as a comparison between revenue and costs with the formula:

$$RCR = \frac{TR}{TC} \quad (1)$$

Table 1. Distributions of Feeding Patterns by Cattle Type

Cattle Feeding Pattern	Cattle Type		Total
	Bali	Bali Super	
Grass	8 Cow	0 Cow	8
	32.0%	0.0%	32.0%
Tofu Pulp	4 Cow	0 Cow	4
	16.0%	0.0%	16.0%
Sweet Potato Skin	0 Cow	4 Cow	4
	0.0%	16.0%	16.0%
Molasses	0 Cow	9 Cow	9
	0.0%	36.0%	36.0%
Total	12 Cow	13 Cow	25
	48.0%	52.0%	100.0%

Table 2. Distributions of Feeding Patterns by Cattle Age

Cattle Feeding Pattern	Age (Year)		Total
	1-1.5	1.6-2	
Grass	2 Cow	6 Cow	8
	8.0%	24.0%	32.0%
Tofu Pulp	1 Cow	3 Cow	4
	4.0%	12.0%	16.0%
Sweet Potato Skin	1 Cow	3 Cow	4
	4.0%	12.0%	16.0%
Molasses	1 Cow	8 Cow	9
	4.0%	32.0%	36.0%
Total	5 Cow	20 Cow	25
	20.0%	80.0%	100.0%

Where:
RCR = Return Cost of Ratio
TR = Total Revenue
TR = Y x Py
TC = FC + VC
Decision criteria:
R/C > 1, the cattle fattening business is profitable
R/C < 1, cattle fattening business is losing
R/C = 1, cattle fattening business breaks even (no profit/no loss)

3. RESULT AND DISCUSSION

An initial descriptive overview of the feeding pattern based on the type, age, and weight of the cattle is provided in Table 1. This shows an overview of the distribution of cattle feeding patterns based on the type (Bali and Bali Super) and feed provided (Grass, Tofu Pulp, Sweet Potato Skin, and Molasses). In this study, the total population of observed cattle was 25 head, consisting of 12 Bali and 13 Bali Super cattle.

Grass is one of the types of feed most consumed by cattle, contributing to 32.0% of the total feeding pattern. Although Bali Super did not eat grass, these cattle showed a significant tendency to consume the type of feed. In contrast, Molasses was identified as the most dominant feed, contributing to 36.0% of the total feeding pattern, with Bali Super cattle showing a higher preference than Bali cattle. Tofu pulp and sweet potato skin contributed relatively equally to the cattle feeding pattern, each accounting for 16.0%. At the level of cattle types, it was evident that Bali and Bali Super tended to consume tofu pulp and sweet potato skin in almost equal proportions.

Table 2 shows a comprehensive overview of the feeding patterns among cattle, categorized by the respective age groups, including those aged 1 year and above (1-1.5 years) and between 1.6 and 2 years (1.6-2 years). Based on the results, grass was identified as a crucial component, constituting 32.0% of the overall feeding pattern. Cattle aged 1.6-2 years showed a significant inclination toward grass, contributing 24.0% of the total consumption. Even among cattle aged 1-1.5 years, there was a discernible contribution of 8.0%. This indicates a prevalent preference for grass, particularly among the younger age group.

Tofu pulp played a significant role, contributing 16.0% to the overall distribution. The younger age group (1.6-2 years) demonstrated a higher preference, constituting 12.0% of the total consumption. Cattle aged 1-1.5 years contributed a smaller portion at 4.0%, suggesting a specific preference for tofu pulp among younger cattle. Sweet potato skin added to the feeding diversity, contributing to 16.0% of the overall pattern. Similar to tofu pulp, the younger age group (1.6-2 years) demonstrated a higher preference, constituting 12.0% of the total. Cattle aged 1-1.5 years contribute 4.0%, indicating a distinct preference for sweet potato skin among younger cattle.

Molasses was identified as the dominant feed, constituting 36.0% of the total feeding pattern. Cattle aged 1.6-2 years demonstrated the highest preference, contributing 32.0% to the overall distribution, and even among those aged 1-1.5 years, there was a significant contribution of 4.0%, suggesting molasses to be a favored feed, specifically among the younger age group. In terms of total consumption, cattle aged 1.6-2 years led with 20 heads, while those aged 1-1.5 years contributed 5 heads. The younger age group represented 80.0% of the total, signifying a higher consumption rate in this category.

Table 3 shows the intricate feeding patterns among cattle, categorized by the respective weight brackets, including 91-97 kg, 98-104 kg, and 105-110 kg. Based on the results, grass was identified to play a prominent role in feeding preferences, contributing significantly to the overall pattern at 32.0%. Cattle in the 91-97 kg category demonstrated a

Table 3. Distribution of feeding pattern by Cattle Age

Cattle Feeding Pattern	91-97	98-104	105-110	Total
Grass	5 Cow20.0%	1 Cow4.0%	2 Cow 8.0%	8 32.0%
Tofu Pulp	2 Cow 8.0%	0 Cow0.0%	2 Cow 8.0%	4 16.0%
Sweet Potato Skin	1 Cow 4.0%	0 Cow0.0%	3 Cow12.0%	4 16.0%
Molasses	2 Cow 8.0%	1 Cow4.0%	6 Cow24.0%	9 36.0%
Total	10 Cow 40%	2 Cow 8%	13 Cow 52%	25100.0%

strong inclination towards grass, constituting a substantial 20.0% of the total consumption. There was also a discernible preference among cattle in the 105-110 kg range, contributing an additional 8.0%. Furthermore, tofu pulp played a significant role, accounting for 16.0% of the overall feeding pattern. A balanced affinity was observed across weight categories, with both the 91-97 kg and 105-110 kg groups showing an equal penchant, each contributing 8.0%.

Sweet potato skin contributed to 16.0% of the overall feeding pattern, with cattle in the 105-110 kg range demonstrating a substantial preference, accounting for 12.0% of the total. Molasses was identified to have dominance estimated at 36.0% of the total feeding pattern. Cattle in the 105-110 kg range showcased the highest affinity for Molasses, contributing a significant 24.0% to the overall feeding pattern. Furthermore, in terms of consumption, cattle in the 105-110 kg led with 13 heads, followed by the 91-97 kg range with 10 heads, and the 98-104 kg range which contributed 2 heads.

Table 4 provides a detailed overview of the average weight gain observed in cattle fed with various feed alternatives.

Table 4. Average Weight Gain from Various Feed Alternatives

No	Cattle Feeding Pattern	Before (kg)	After (kg)	Difference (kg)
1	Grass	100	241.6	141.6
2	Tofu Pulp	101.36	264.88	163.52
3	Sweet Potato Skin	101.68	291.96	190.28
4	Molasses	102.88	312.28	209.4

Cattle fed with grass experienced a significant weight gain, with an average difference of 141.6 kg, indicating that grass was a substantive contributor to the overall weight gain. Tofu pulp was identified as a significant feed alternative, resulting in a substantial weight gain. Cattle fed with tofu pulp had an average difference of 163.52 kg, surpassing the weight gain observed with grass. Sweet potato skin proved to be a potent feed alternative, contributing to a substantial weight gain in cattle. The average difference recorded was 190.28 kg, indicating that sweet potato skin was effective in promoting a substantial increase in cattle weight. Furthermore, molasses was found to be the most effective feed alternative in terms of weight gain. Cattle fed with molasses demonstrated the highest average weight gain among the options presented in the table, with a difference of 209.4 kg. This suggests that molasses is the most effective feed alternative for promoting substantial weight gain, followed by sweet potato skin, tofu pulp, and grass. Table 5 presents a comprehensive view of the financial dynamics associated with different feed alternatives for cattle, considering revenue, total cost, and resulting income.

Table 5. Average Costs, Revenue, and Income of Various Feed Alternatives

No	Cattle Feeding Pattern	Revenue (IDR)/25 Cows	Total Cost (IDR)/25 Cows	Income (IDR)/25 Cows
1	Grass	413,740,000	356,603,000	57,137,000
2	Tofu Pulp	447,489,000	365,046,000	82,443,000
3	Sweet Potato Skin	510,930,000	360,976,000	149,954,000
4	Molasses	546,490,000	350,491,000	195,999,000

Cattle fed with grass generated a revenue of IDR 413,740,000 and after accounting for the total cost of IDR 356,603,000, the resulting income was IDR 57,137,000. Grass, while having lower revenue, also incurs lower costs, leading to a positive income. The use of tofu pulp as a feed alternative yielded a revenue of IDR 447,489,000 and after subtracting the total cost of IDR 365,046,000, the income was IDR 82,443,000. Tofu pulp demonstrated a balance between revenue generation and associated costs. Cattle fed with sweet potato skin generated a substantial revenue of IDR 510,930,000. Despite incurring a total cost of IDR 360,976,000, the resulting income was IDR 149,954,000. Sweet potato skin was identified as a feed option with a higher income potential, while molasses had the highest revenue of IDR 546,490,000. Despite having the highest total cost of IDR 350,491,000, the resulting income was substantial at IDR 195,999,000. This suggests that molasses is

Table 6. R/C Ratio Results using *Grass*

No.	Description	Cost (IDR/kg)
1	Revenue	413,740,000
2	Total Cost	356,603,000
3	R/C Ratio	1.16

This means that cattle fattening using grass is a viable business venture because the R/C Ratio value > 1 is 1.16.

Table 7. RC Ratio Results Using Tofu Residue

No.	Description	Cost (IDR/kg)
1	Revenue	447,489,000
2	Total Cost	365,046,000
3	R/C Ratio	1.23

This means that cattle fattening using tofu residue is a viable business venture because the R/C Ratio value > 1 is 1.23.

an effective feed alternative in terms of revenue generation. The results showed that the cattle fattening business using grass feed achieved a gratifying financial performance, as evident in the R/C Ratio results.

During the specified period, the revenue generated by the business reached IDR.413,740,000, while the total costs associated with the use of grass feed amounted to IDR.356, 603,000. The calculated R/C Ratio yielded 1.16. The R/C Ratio exceeding 1 implied that each unit of cost invested in the business yielded approximately 1.16 units of revenue. In other words, the cattle fattening business using grass feed demonstrated positive profitability, where the income generated surpassed the costs incurred.

The cattle fattening business using tofu residue as feed achieved a substantial level of financial success, as reflected in the calculated R/C Ratio. In the specified period, the revenue generated by the business reached IDR447,489,000, while the total costs associated with the use of tofu residue as feed amounted to IDR365,046,000. The resulting R/C Ratio, calculated to be 1.23, signified that for every unit of cost invested in the business, approximately 1.23 units of revenue were generated. In essence, the R/C Ratio exceeding 1 indicated that the cattle fattening business relying on tofu residue as feed was capable of generating positive profits, where the income obtained surpassed the costs incurred.

Table 8. RC Ratio Results Using Sweet Potato Peel

No.	Description	Cost (IDR/kg)
1	Revenue	510,930,000
2	Total Cost	360,976,000
3	R/C Ratio	1.42

This means that cattle fattening using sweet potato peel is a viable business venture because the R/C Ratio value > 1 is 1.42.

The cattle fattening business using sweet potato peel as feed achieved a substantial level of success, particularly from a financial standpoint, as reflected in the R/C Ratio results. During the specified period, the revenue generated by the business amounted to IDR510,930,000, while the total costs incurred for the use of sweet potato peel as feed were IDR360,976,000. The calculated R/C Ratio (1.42) exceeding 1.0 suggested that each unit of cost invested in the business yielded approximately 1.42 units of revenue. This indicated a high level of profitability, where the income generated significantly surpassed the costs incurred.

Table 9. RC Ratio Results Using Molasses

No.	Description	Cost (IDR/kg)
1	Revenue	546,490,000
2	Total Cost	350,491,000
3	R/C Ratio	1.56

This means that cattle fattening using molasses is a viable business venture because the R/C Ratio value > 1 is 1.56.

The cattle fattening business using molasses as feed achieved a significant level of success, particularly in terms of financial performance, as reflected in the R/C Ratio results. During the specific period, the revenue generated by this enterprise reached IDR 546,490,000, while the total costs incurred for the use of molasses as feed amounted to IDR 350,491,000. The calculated R/C Ratio (1.56) exceeding 1.0 suggested that each unit of cost invested in the business yielded approximately 1.56 units of revenue. This indicated an exceptionally high level of profitability, where the income generated surpassed the costs incurred.

In the dynamic cattle fattening business, the selection of feeding strategies was identified as the key determinant of financial success. In the initial stages, the decision to use grass as the primary feed laid a stable foundation, indicating consistent profitability but not reaching the full potential. The transition to using tofu waste as feed marked a critical step in enhancing operational efficiency, reflected by the increased R/C Ratio reaching 1.23. However, the pinnacle of transformation occurred when sweet potato skins were used, resulting in a significant surge in profitability with an R/C Ratio reaching 1.42. Based on the results, the innovative feed selection had substantial positive impacts, establishing a robust foundation for growth and sustainability. The highest financial performance was reached through the strategic decision to use molasses as feed, achieving not only stability but also showcasing immense growth potential with the R/C Ratio of 1.56. The innovation in feed strategies proved that adaptation and the courage to explore new avenues can make a significant difference in

attaining financial success in terms of cattle fattening. In general, this study reflects how prudent policies in feed management can serve as the key to achieving substantial levels of success.

4. CONCLUSION

In conclusion, there was a significant difference in the income generated from the application of four feed alternatives in cattle fattening. The highest income was obtained from the application of molasses, followed by tofu bagasse, sweet potato skin, and grass feed. The molasses feed alternative yielded a higher average income per kg of beef. Business feasibility analysis using molasses showed a good level of feasibility with an R/C Ratio of 1.56, indicating that the business was viable. Therefore, the use of molasses should be prioritized to maximize income and business viability. Further evaluation of risk management, feed availability, and other factors that may affect the long-term success of the cattle fattening enterprise is required. Continuous monitoring of markets and production costs is also crucial to optimize business outcomes and ensure operational sustainability.

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