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Sensitivity of Dairy Cattle Development in Pujon District, Malang Regency

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Abstract

Milk that is produced by dairy cows was currently not able to meet the needs of Indonesian, so it is necessary to develop small-scale dairy cattle business. This study aims to analyze feasibility and sensitivity of dairy cattle business development in the District of Pujon, Malang Regency. Research location was determined by purposively under consideration that this area was a center of dairy cattle business. Business feasibility was measured by commonly used parameters and sensitivity to changes in milk prices and feed prices. The results showed that dairy cattle business in the District of Pujon Malang Regency was profitable in terms of financial aspects so it was feasible to be developed. Sensitivity analysis shows that the dairy cattle business is still feasible to be developed even though feed price increases by 5% and milk price decreases by 5%.

Keywords: Dairy cattle, feasibility study, financial, sensitivity

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Introduction

Dairy farms are part of livestock sub-sector that produces dairy commodities to meet Indonesian demand, especially animal protein. Currently dairy cattle farms in Indonesia are mostly dominated by smallholder farms with varying business scales, but most of scale of business is small, three to five cows per farmer with conventional maintenance systems. Dairy farming is main livelihood of most farmers, but in reality, income of this business is relatively low. Nevertheless, according to Pudjiastuti (2015), small businesses in agriculture still play an important role in the national economy.

Dairy farming business has been developing since ancient times, but farmers only consider it as an additional business that is considered as savings, which can be sold at any time. Cattle have complementary characteristics to crop farming as a main livelihood. Dairy milk is one type of food that has a high nutritional content and is very much needed for human growth and development. Cow's milk is still the main source of world community milk consumption and also raw material for various dairy products.

Nurtini (2011) states that dairy farming business in Indonesia is divided into two types: small-scale dairy farming business and dairy farming company. Santosa (2012) distinguishes it into four types based on business operations and farmer income levels. Most of milk produced in this country comes from small-scale dairy farming business. Contribution of small-scale dairy cattle business to national milk production is 90%. According to Adi et al. (2005), some of advantages of raising dairy cattle compared to other livestock businesses are: 1) business of dairy cattle is a permanent business; 2) fixed income guarantee; 3) permanent use of labor; 4) using various available forages or agricultural residues as animal feed; 5) soil fertility can be maintained.

Small-scale dairy cattle business in Indonesia is still subsistence and has not yet reached an economically oriented business. Low productivity of livestock was caused by lack of capital, as well as farmers' knowledge/skills on aspects of reproduction, feeding, post-harvest yield management, milking, environmental sanitation and disease prevention. Increase in milk prices cannot be used as a benchmark that benefits of dairy farmers have increased. Farmer's profit was influenced by feed price, because cost of feed can reach 62.5% of total production cost (Yusdja, 2005). Rusdiana and Sejati (2009) said that in agribusiness of dairy cows, farmers not only maintain lactation and dry cows, but also dairy cows that were not yet producing. Non-productive dairy cow consists of calves and virgin cow. In management, cost of maintaining non-productive dairy cows will be a burden of dairy cows that are in production.

At present, fresh domestic milk can only meet 30 percent of total demand, remaining 70 percent must be imported from various countries such as Australia and New Zealand. According to Pudjiastuti et al. (2013); Pudjiastuti (2014); Pudjiastuti and Kembauw (2018), import dependence will have a negative impact on the performance of the national economy. Low domestic fresh milk supply is due to the low productivity of cattle (8-12 liters/cow /day) compared to foreign countries that have reached 20 liters/ capita/day, the condition of the scale of business of farmers is not yet economical (2-3 cows/households) farmers have less capital, so that this business becomes inefficient and the income is

relatively low, and dairy products other than cattle (goat milk, buffalo milk and wild horse milk) are not yet popular.

Small-scale dairy cattle business in Pujon District is still carried out traditionally and does not pay attention to various aspects of the business, so that the business is less advanced. Efforts to increase the productivity need to encouraging various business factors such as improving quality of human resources, business zoo-technical, socio-economic, institutional and business environment, so that the business can continue and provide guaranteed business prospects. This study aims to analyze the feasibility and sensitivity of the development of small-scale dairy cattle business in Pujon District based on financial aspects.

Research Method

Research Locations

The study was conducted in a community dairy farmer located in the District of Pujon, Malang Regency. This location was chosen because it is a center of small-scale dairy cattle business.

Sampling Method

Population in this study were all small-scale dairy cattle businesses in District of Pujon, Malang Regency. Determination of sample using stratified random sampling method because of heterogeneous scale of business, namely the medium dairy farming business (5-8 tails) and small scale under number of ownership (1-4 tails). Number of samples selected was 95 dairy farmers.

Method of collecting data

Data used consists of primary data and secondary data. Primary data obtained from interviews, observations and direct recording of situation in the field regarding dairy cattle business using a list of questions. Secondary data was obtained through analysis of documents relevant to this study, namely Central Statistics Agency, Directorate General of Animal Husbandry and Animal Health and other literature.

Data analysis

Financial feasibility analysis was done by calculating following parameters.

Gross Benefit Cost Ratio (Gross B/C)

Gross B/C is a comparison between receipt of benefits from an investment (gross benefit) and costs incurred (gross cost). Gross costs are derived from capital costs or initial investment costs and operating and maintenance costs, while gross benefits come from total value of production and the residual value of the investment (Kadariah, 2001). Gross B/C is formulated as:

$$Gross\ B/C = \frac{\sum_{t=0}^{n} \frac{R_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+i)^t}} \quad (1)$$

where:
Gross B/C: Gross Benefit Cost Ratio

Rt : Revenue in t year

Ct : Cost in t year

i : Interest rates

t : Year

Assessment criteria:

If Gross B/C > 1, the business is feasible.

Gross B/C < 1, the business is not feasible.

Gross B/C = 1, the business is break-even.

Net Benefit Cost Ratio (Net B/C)

Net B/C is a comparison between net benefits that have been disproved positively with net benefits that have been negatively discounted (Kadariah, 2001). Net B/C formula as:

$$Net\ B/C = \frac{\sum_{t=0}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+i)^t}} \quad (2)$$

where:

Net B/C: Net benefit cost ratio

Assessment criteria:

If Net B / C > 1, the business is feasible.

Net B / C < 1, the business is not feasible.

Net B / C = 1, the business is break-even

Payback Period (PP)

PP is investment appraisal of a project based on payment of investment costs based on net benefits. PP is mathematically formulated as follows:

$$PP = \frac{K_0}{A_b}\ x\ 1\ tahun \quad (3)$$

$$PP = \frac{K_0}{A_b} \; x \; 1 \; tahun \qquad (3)$$

where:

PP: Payback period

K_0: Initial investment

A_b: Benefits obtained each period

Assessment criteria:

If PP < business economic life, the business is feasible.

PP > business economic life, the business is not feasible.

Net Present Value (NPV)

NPV is the difference between present value of benefits or revenue and present value of costs or expenses. To account NPV, a discount rate must be set that is used to calculate them (Kadariah, 2001). NPV is formulated as:

$$NPV = \sum_{t=1}^{n} \frac{Bt-Ct}{(1-i)^t} \qquad (4)$$

where:

Bt : Net year benefit or receipt t

Ct : Cost or cost in year t

n : Economic age

i : Interest rates

Assessment criteria:

If NPV > 0, the business is feasible.

NPV < 0, the business is not feasible.

NPV = 0, the business is break-even.

Internal Rate of Return (IRR)

IRR is a discount rate that will produce the same amount of present value as the amount of project investment. IRR is formulated as:

$$IRR = i_1 + \left[\frac{NPV_1}{NPV_1 - NPV_2}\right](i_2 - i_t) \qquad (5)$$

where:

NPV1: positive NPV

NPV2: negative NPV

i_1 : discount rate that produces a positive NPV

i_2 : discount rate that produces a negative NPV (Kadariah, 2001)

Assessment criteria:

If IRR > i, the business is feasible.

IRR < i, the business is not feasible.

IRR = i, the business is break-even.

Sensitivity Analysis

Sensitivity analysis is done by calculating possibility of a decrease in production, a decrease in selling prices and an increase in production costs. These aspects will cause business to no longer be profitable or not worth trying. Sensitivity rate is calculated through formula:

$$\text{Sensitivity rate} = \frac{\left|\frac{X_1 - X_0}{X}\right| x\ 100\%}{\left|\frac{Y_1 - Y_0}{Y}\right| x\ 100\%} \quad (6)$$

where:

X_1 : NPV or IRR or Net B/C or Gross B/C or PP after change

X_0 : NPVor IRR or Net B/C or Gross B/C or PP before change

X : average change in NPV or IRR or Net B/C or Gross B/C or PP

Y_1 : grass feed cost or milk sales volume after change

Y_0 : grass feed cost or milk sales volume before change

$\overline{Y}$: average change in cost of grass feed or milk sales volume

Sensitivity rate criteria:

If sensitivity rate > 1, the business is sensitive to change.

sensitivity rate < 1, the business is not sensitive to change.

Results and Discussion

Feasibility Analysis of Small-scale Dairy Cattle Business

a. Financial aspect

Investment Cost

Investment costs for dairy cow business include cages and equipment as well as livestock purchasing costs. Livestock need a cage that serves as a shelter, to avoid influences that are considered less beneficial such as heat and rain. Economic age of a cage of cow was assumed to be seven years, with cost of establishing a stable for a cow was IDR 2,500,000.

Operating costs

Operational costs in the dairy cow business are related to expenses for ruminants, concentrate, other feed (bran, tofu etc.), medicines, vitamins and vaseline. Feed given to dairy cows consists of ruminants and concentrate feed. Ruminants provided by farmers is a type of field grass, natural grass (mixed) and elephant grass (Pennisetum purpureum). Grasses were obtained from their own land. Even though farmers already have land planted with grass, deficiencies in ruminants still occur in dry season. Amount of ruminants given by farmers was 50 kg/cow/day at a price of IDR 400/kg; concentrate feed was 10 kg/cow/day at a price of IDR 3,200/kg.

Efforts to increase the farmer's net income can be done by reducing costs, especially on feed costs. This is based on the fact in the field that the composition of the largest expenditure is contributed by the cost of feed (ration).

Cashflow

Revenue is calculated from this business consist of selling milk and cow faces. Revenue increases every year until optimal limit was eight years.

Total costs is all expenses for the purchase of feeder cattle, cage making, equipment, provision of concentrate and forage for productive cows and medicines. Net income as total revenue minus total costs, calculated under assumption that total costs were spent for seven years with a lactation period of seven times. Investment was needed to purchase feeds, cage making, equipment purchases and feeding consisting of concentrate and grass.

Net income received by farmers continues to increase along with increasing number of livestock kept. Net income per cow received by farmers was considered still not enough to cover costs in the first year. Thus income only from milk, without an increase in assets in the form of sales of calves (calves) will not produce a positive business balance at beginning.

Cash flow consist of cash outflow and cash inflow as a result of dairy cattle business activities in one period. Cash flow per cow is presented in Table 1.

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Table 1. Cash Flow of Dairy Cattle Business (IDR/cow)

No	Description	Year						
		0	1	2	3	4	5	6
1	Fixed Cost							
	Pregnant cow	7443609	7443609	7443609	7443609	7443609	7443609	
	Cage	1033835	1033835	1033835	1033835	1033835	1033835	1033835
	Rent of land	578947	578947	578947	578947	578947	578947	578947
	Dairy buckets	41228	41228	41228	41228	41228	41228	41228
	Strainer	4123	4123	4123	4123	4123	4123	4123
	Hoe	5772	5772	5772	5772	5772	5772	5772
	Scrubbing brush	825	825	825	825	825	825	825
	Milkcan	166667	166667	166667	166667	166667	166667	166667
	Drinking bucket	4825	4825	4825	4825	4825	4825	4825
	Water hose	8333	8333	8333	8333	8333	8333	8333
	Electricity	754484	754484	754484	754484	754484	754484	754484
	Water	499958	499958	499958	499958	499958	499958	499958
	UN Tax	90000	90000	90000	90000	90000	90000	90000
	Fuel	3600000	3600000	3600000	3600000	3600000	3600000	3600000
	Labor	10800000	10800000	10800000	10800000	10800000	10800000	10800000
	Total (1)	25032605	25032605	25032605	25032605	25032605	25032605	17588996
2	Variable Cost							
	Ruminant	555789	555789	555789	555789	555789	555789	0
	Consentrate	889263	889263	889263	889263	889263	889263	0
	Vaseline	723684	723684	723684	723684	723684	723684	0
	Medicine	1736842	1736842	1736842	1736842	1736842	1736842	0
	Total (2)	3905579	3905579	3905579	3905579	3905579	3905579	0
3	Total Cost (1+2)	28938184	28938184	28938184	28938184	28938184	28938184	17588996
4	Revenue							
	Milk	0	47763158	57315789	66868421	57315789	47763158	0
	Fertilizer	0	4168421	4168421	4168421	4168421	4168421	0
	Old cow	0	0	0	0	0	0	43421053
	Total (4)	-	51931579	61484211	71036842	61484211	51931579	43421053
5	Profit (4-3)	-	22993395	32546027	42098658	32546027	22993395	25832057
	R/C	-	1,8	2,1	2,5	2,1	1,8	2,5
	B/C	-	1,0	1,1	1,5	1,1	1,0	1,5

Source: Primary data 2019, processed

Based on Table 1, R/C ratio and B/C ratio each year was > 1, so that dairy cattle business was profitable in short term. After cash flow, feasibility analysis was carried out using Gross B/C, Net B/C investment criteria, Payback Period (PP), NPV, and IRR. Project duration was set for seven years (Table 2).

Table 2. NPV, IRR, Net B/C, Gross B/C and Payback Period Dairy Cattle Business

Year	Benefit	Total Cost	Net Benefit	df 7%	NPV 7%	df 20%	NPV 20%	df 100%	NPV 100%
0		28938184	- 28938184	1.00000	- 28938184	1.00000	- 28938184	1.00000	28938184
1	51931579	28938184	22993395	0.93458	21489154	0.83333	19161162	0.50000	11496697
2	61484211	28938184	32546027	0.87344	28426960	0.69444	22601407	0.25000	8136507
3	71036842	28938184	42098658	0.81629	34365045	0.57870	24362649	0.12500	5262332
4	61484211	28938184	32546027	0.76289	24829208	0.48225	15695422	0.06250	2034127
5	51931579	28938184	22993395	0.71299	16393973	0.40188	9240530	0.03125	718544
6	43421053	17588996	25832057	0.66634	17212990	0.33489	8651104	0.01563	403626
∑	341289474	191218100	150071374		113779146		70774090		- 886351
IRR		99.28							
PP		1 year 10 months							
Gros B/C		1.78							
Net B/C		0.80							

Source: Primary data 2019, processed

b. Gross B/C

Gross B/C is a comparison between receipt of benefits from an investment (gross benefit) and gross cost. Based on Table 2, it was known that Gross B/C was 1.78 which indicates that dairy cattle are feasible.

c. Net B/C

Net B/C is a comparison between net receipts and overall costs that have been discounted. Net B/C of dairy cattle business of 0.8 shows that business is feasible.

d. Payback Period (PP)

PP is an investment appraisal of a project based on payment of investment costs based on net benefits of a project. PP the business was 1 year and 10 months, meaning that return on all investment costs in business will return after one year and ten months. Thus the payback period is shorter than the economic life of the business, so the dairy cattle business is declared feasible.

e. Net Present Value (NPV)

NPV is difference between present value of benefits or revenues and present value of costs or expenses. Based on Table 2, NPV was IDR 113,779,146, so that dairy cattle were feasible.

f. Internal Rate of Return (IRR)

IRR is a discount rate that will equate the present value of revenue with the present value of investment. IRR shows the project's ability to generate returns on business costs.

Based on Table 2, IRR was 99.28% . It means that the business was feasible, because IRR > interest rate (7%).

Financial analysis with investment criteria Gross B/C ratio, Net B/C ratio, Payback Periods, NPV, IRR, on small-scale dairy cattle business in Pujon District Malang Regency resulted in a decision that this business was feasible. This finding was in accordance with the results of Kusnoto et al. (2013); Bor (2014); Utari et al. (2016); Chandra et al. (2016) and Halid et al. (2017) that cattle business is very profitable.

Sensitivity Analysis of Dairy Cattle Business

Sensitivity analysis was done by calculating in feed prices increase by 5% and a decrease in selling price of milk by 5%.

a. Sensitivity Analysis with Feed Price Increase of 5%

There are many factors that make a livestock business feasible or not and most sensitive are feed and milk prices. Farmers are price takers in price of milk. Unlike case for feed, feeding is a control from farmers. Results of sensitivity analysis of dairy cattle businesses to a 5% increase in feed prices are presented in Table 3.

Table 3. Sensitivity Analisys toward Feed Price Increase by 5%

Year	Benefit	Total Cost	Net Benefit	df 7%	NPV 7%	df 20%	NPV 20%	df 100%	NPV 100%
0		29010437	-29010437	1.00000	- 29010437	1.00000	- 29010437	1.00000	- 29010437
1	51931579	29010437	22921142	0.93458	21421628	0.83333	19100952	0.50000	11460571
2	61484211	29010437	32473774	0.87344	28363852	0.69444	22551232	0.25000	8118443
3	71036842	29010437	42026405	0.81629	34306066	0.57870	24320837	0.12500	5253301
4	61484211	29010437	32473774	0.76289	24774087	0.48225	15660578	0.06250	2029611
5	51931579	29010437	22921142	0.71299	16342458	0.40188	9211493	0.03125	16286
6	43421053	17661249	25759804	0.66634	17164845	0.33489	8626906	0.01563	02497
NPV					113362498		70461561		- 1029728
IRR	99.2								

Source: Primary data 2019, processed

Dairy cattle business was not sensitive to an increase in animal feed by 5%. NPV with a 5% increase in feed prices was IDR113,362,498, while IRR was 99.2%. Thus, dairy cattle business is still feasible despite feed price increase by 5%.

b. Sensitivity Analysis with a 5% Decline in Milk Price

Sensitivity analysis of dairy cattle businesses to a decrease in price of milk by 5% are presented in Table 4.

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Table 4. Sensitivity Analysis towards Decrease of Price Milk by 5%

Year	Benefit	Total Cost	Net Benefit	df 7%	NPV 7%	df 20%	NPV 20%	df 100%	NPV 100%
0		28938184	- 28938184	1.00000	- 28938184	1.00000	- 28938184	1.00000	- 28938184
1	49543421	28938184	20605237	0.93458	19257231	0.83333	17171031	0.50000	10302619
2	58618421	28938184	29680237	0.87344	25923869	0.69444	20611276	0.25000	7420059
3	67693421	28938184	38755237	0.81629	31635818	0.57870	22427799	0.12500	4844405
4	58618421	28938184	29680237	0.76289	22642911	0.48225	14313386	0.06250	1855015
5	49543421	28938184	20605237	0.71299	14691249	0.40188	8280783	0.03125	43914
6	43421053	17588996	25832057	0.66634	17212990	0.33489	8651104	0.01563	03626
NPV					102425883		62517194		- 3468547
IRR	97.0								

Source: Primary data 2019, processed

Based on Table 4, it is known that dairy cattle business is not sensitive to a decrease in price of milk by 5%. This is based on NPV of IDR 102,425,883 and IRR of 97.0%. This means, that dairy cattle business is still feasible despite a decline in price of milk by 5%.

Analysis of feasibility and sensitivity of small-scale dairy farming business in Pujon District shows that this business was feasible. However, until now farmers in Pujon District only get income from selling fresh milk. Therefore, it is necessary to make businesses plan that can increase farmers' income apart from selling fresh milk. There are several important aspects that have not been done by farmers in Pujon District: 1) do not take into account labor costs because livestock are self-maintained, 2) ruminants feed is obtained by farmers on their own land, so cost of ruminant feed is not counted as expenses by farmers. To reduce a risk of loss due to livestock death, farmers can register their livestock as participants of Cattle Business Insurance. Payment of insurance premiums by IDR 40,000 per year, if e insured animal dies, farmer gets compensation about IDR 10,000,000.

Conclusion

Based on the financial feasibility analysis of small-scale dairy cattle business, Gross B/C was 1.78; Net B/C was 0.80; payback period for 1 year 10 months; NPV was IDR 113,779,146 given interest rate of 7%, an IRR was 99.28% (higher than interest rate). Small-scale dairy farming business was feasible to be developed.

Sensitivity analysis of dairy cattle businesses to an decrease in milk price by 5% shows an NPV by IDR 102,425,883 and IRR by 97%. Dairy cattle business was still feasible to be developed despite a decline in price of milk by 5%. If there was an increase in animal feed by 5%, dairy cattle business was also feasible to be developed based on NPV of IDR 113,362,498 and IRR of 99.2%.

The results of this study are a good signal for anyone who wants to invest in a small-scale dairy farming business because the return on capital is quite large.

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