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Original Article

Profitability of the cow-calf operation business of local Peranakan Ongole (PO) cattle based on the cow performance and calf price

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Abstrak

Tujuan: Menentukan kinerja produksi bisnis induk-anak sapi lokal PO yang dapat memberikan keuntungan lebih baik bagi peternak.
Metode: Metode penentuan sampel secara purposive bertahap. Teknik pengambilan data dilakukan dengan metode survei melalui wawancara langsung menggunakan kuesioner yang terstruktur kepada 90 responden peternak sapi potong sampel dengan 90 ekor induk sapi lokal PO produktif di Daerah Istimewa Yogyakarta. Metode analisis untuk mengetahui kinerja produksi induk sapi menggunakan statistik deskriptif berupa rata-rata dan standar deviasi. Selanjutnya profitabilitas dihitung dalam bentuk *net cash farm income* dengan analisis *enterprise budgeting*.
Hasil: Pada kondisi saat ini usaha induk-anak sapi potong PO menghasilkan *net cash farm income* positif. Hasil analisis sensitivitas menunjukkan bahwa *calving interval* (CI) dan bobot badan anak sapi *sensitive* terhadap *net cash farm income*. *Net cash farm income* akan dapat diperoleh lebih baik dari pada kondisi saat ini, jika peternak mengadopsi teknologi yang dapat memperpendek *calving interval* sampai 13 bulan dan meningkatkan berat badan penjualan anak sapi diatas 150 kg pada umur 6 bulan. Kenaikan harga pedet sebesar 4,2% kurang sensitif terhadap peningkatan pendapatan bersih peternak.
Kesimpulan: Pengembangan usaha induk-anak sapi lokal PO pada kondisi saat ini menghasilkan *net cash farm income* positif. Peningkatan *net cash farm income* yang lebih baik daripada kondisi saat ini membutuhkan adopsi teknologi yang dapat memperpendek CI dan meningkatkan berat penjualan anak sapi. Kenaikan harga pedet yang rendah, kurang sensitif terhadap pendapatan bersih peternak.

Kata Kunci: Harga pedet; Induk-anak; Kinerja produksi; Pendapatan tunai; Sapi PO

Abstract

Objective: This study aims to determine the cow-calf operation business performance of the local PO cow that can give better profitability for farmers.
Methods: The multistage purposive sampling method was used to determine of the samples. The technique of data collection was carried out using a survey method through direct interviews using a structured questionnaire to 90 beef breeders as respondent with 90 heads of productive PO local cows in Special Region of Yogyakarta. The method of analysis to determine the production performance of cows using descriptive statistics in the form of average and standard deviation.

Furthermore, profitability is calculated in the form of net cash farm income with enterprise budgeting analysis.

Results: In the current condition, the cow calf operation (CCO) business of PO cattle generated positive net cash farm income. The results of the sensitivity analysis showed that CI and calf weight were sensitive to net cash farm income. In order to get an increase in net cash farm income that was better than the current condition, it is necessary to direct the adoption of technology to shorten the calving interval to 13 months and increase the selling body weight of calves above 150 kg at the age of 6 months.

Conclusions: The CCO business of the local PO in the current condition has positive generate income. An increase in income that is better than the current condition can be obtained through technology adoption to shorten the CI and increase the calf sale weight.

Keywords: Calf selling price; Cow-calf operation; Production performance; Net cash farm income; Local Peranakan Ongole (PO) cattle

INTRODUCTION

Indonesian society's beef consumption until 2020 cannot be met by domestic beef production, Indonesia still imported 39% of beef [1]. The increase of beef demand in Indonesia which is faster than the increase of national production has caused a gap between the demand and supply of local beef. The reliance on imported beef, both in the form of beef cattle and frozen beef, is unavoidable [1,2]. The beef self-sufficiency program regulates that beef imports cannot exceed 10% as of 2004. However, this target has never been achieved. Four issues have caused slow beef production First, almost all supplies of local beef come from small-farmer that raising 2-5 heads/farm with a low amount of capital [1,3]. Small-farmers are generally low productivity [4]. Breeders in developing countries such as Indonesia generally raise a number of small-scale livestock to generate additional income to support the basic household needs [5,6]. Efforts to improve the welfare of breeders especially in developing countries are important and have become a major concern of the world [7]. Second, the beef import policy in Indonesia is often poorly managed so that give affect the price of imported beef is generally cheaper than that of the local beef [1,2]. This will cause disruption to the local beef market and consequently, local breeders become less enthusiastic in increasing production. Consequently, the slow growth of beef production cannot keep up with the increase in the demand for beef. A similar problem has also been found in Malaysia [8]. The cheaper price of imported beef than the price of the local beef has had a significant effect on the increase in the volume of imports [9]. The impact is that the restrictions on the imports of beef and beef cattle will hinder the increase of local beef production. The increasing number of cattle slaughtering will highly reduce the cattle population [2,10]. Third, the long marketing chain of beef cattle from the breeders to the final products and to the consumers has made the profit-to-cost ratio received by breeders smaller. The breeders only get a small profit [11]. Fourth, smallholder farmers often have limited access to technology, information, and services that they need to grow.

The Indonesian government needs to increase beef cattle population and at the same time it is expected to increase beef production and farmers welfares. Small-farmers are the most vulnerable stakeholders in the beef cattle production system. Therefore, it is necessary to assist breeders in adopting technology to increase profits. Profit or net farm income for breeders is the key to increasing and continuing their business. For breeders, beef cattle performance is one important variable that affects the productivity of livestock businesses to give profits. Livestock business performance consists of technical and economic parameters [6]. In the cow-calf operation (CCO) business, technical parameters include the calving interval (CI), livestock weight gain, and mortality. As for the economic parameters, they cover the prices of output and inputs including inputs of

technology. Profit or net income consists of the revenue component minus costs [12].

Revenue in the livestock businesses depends on the livestock production performance, and the livestock production performance depends on the inputs [13]. As an illustration, in the cow-calf operation (CCO) of the local Peranakan Ongole (PO) cattle and the cattle with the technology of selective breeding of SimPO and LimPO, the SimPO and LimPO cattle show better production performance than the PO cattle in the CCO business. The highbred cattle require expensive feed and cattle. Financially, the PO cattle significantly generate greater economic incentives than the SimPO and LimPO [13]. The previous study showed that the advantages of PO cattle have an excellent adaptability to high tropical climates, resistance to heat, resistance to tick bites, and tolerance to high crude fibered feed [14]. This study aims to determine the cow-calf operation business of the local PO cattle performance to give better profitability for breeders. This study should be useful to opt for technology that must be used to achieve the CCO of the local PO cattle business performance to give better profits to smallholder farmers.

MATERIALS AND METHODS

Location and samples

The multistage purposive sampling method was used to determine the samples located in several geographic areas to make it more efficient [15]. The first step was determining three regencies with large cattle populations, namely Sleman Regency, Bantul Regency, and Gunungkidul Regency in Special Region of Yogyakarta. The second step was selecting one sub-district with a dense population of beef cattle for each regency. The sub-districts were Wonosari Sub-District (Gunungkidul Regency), Imogiri Sub-District (Bantul Regency), and Prambanan Sub-District (Sleman Regency). The 3rd step was to determine sample farmers or respondents as many as 30 respondents from each selected sub-district, so that a total 90 respondents with 90 productive PO cows as sample. The criteria for the cow sample are productive PO cows that have calved a minimum of 2 times so that CI and other performance data of cows can be obtained. In fact, there is no data of breeders population that meets these criteria, so in determining the sample used the assistance of livestock extension workers in each selected sub-district agency.

Data collection method

The cow performance in the CCO business that affects revenues and costs and that determines breeders' profits were calving interval, service per conception (S/C) to produce pregnant cows, calf price, and calf mortality [6]. Calving interval is the birth distance between one calf and the next calf from one cow. The longer the calving interval, the greater the costs for breeders, and the costs are feed for cows, labor, or both. Data of livestock breeding management, as well as input and output prices, were collected through a survey using direct interviews and semi-structured questionnaires with the respondents the cow owners. The unit of analysis was the number of cows per year per CCO business. The study was conducted from November 2018 to April 2019.

Data analysis

To determine of the Peranakan Ongole (PO) cattle performance was conducted using a descriptive statistical analysis by looking at the mean and the standard deviation (SD). The profitability of CCO business of cattle was net cash farm income using Enterprise budgeting analysis calculated from cash revenue minus cash expenses [12]. This calculation was in line with the condition of the samples in this study, where the CCO business of the local PO cattle was run by smallholder farmers with their family members as the main employees and it was self-managed. They were not paid. The calculation of "net cash farm income" can be seen as follows:

Net cash farm income (IDR/Cow/Year) = cash revenue – total cash expenses…….(1)

Cash revenue = cash revenue from calf sales weight (IDR/Cow/Year) + manure…….(2)

While, the estimation of cash revenue from calf sales (IDR/cow/year) is

$$\frac{12\ months}{CI(months)+ACS(months)}\times(1\text{-}\%\ \text{of CM})\times\text{SPC(IDR)}\ldots(3)$$

Table 1. Identities of PO Cow breeders

Variable	Average ± SD
1. PO cow breeder (n=90):	
Age (years)	55.08±11.47
Formal education (years)	7.49±1.25
Experience of cattle breeder (years)	20.67±14.31
Experience of farmer (years)	28.85±16.49
Number of family members (people)	3.90±1,05
2. Number of cows/breeder (AU)*)	
Wonosari (n=30)	2.23±1.5
Imogiri (n=30)	1.83±1.23
Prambanan (n=30)	2.63±0.85
Total	2,23±1,93
3. Agricultural area/farmer (m^2)	
Wonosari n=30)	2535 ±2250
Imogiri (n=30)	996 ±775
Prambanan (n=30)	1276±860
Total	1602,33±1295

Note*): Cow = 1 AU, bull = 1 AU, young cow = 0.5 UT, calves = 0.25 UT

Where,
CI : calving interval
ACS: age of calf sales
SPC : selling price of calf
Total Cash expenses = purchased concentrate feed and forage + livestock facilities repair and equipment + breeding expenses…….(4)

RESULTS

Identities of PO cattle breeders

The results showed that the respondent's education was 7 years or junior high school level, but he has 21 years experience of cattle raising. The cow-calf operation (CCO) of the local peranakan ongole (PO) cattle in the Special Region of Yogyakarta are carried out by smallholder farmers (breeders) with 1-4 Animal Unit (AU). Usually livestock was integrated with food crops farming, however they only have a narrow agricultural land (< 2000m2). The breeders generally only use family labor, while the average number of family members is only 4 people, that the number of productive family members who can support beef cattle business is only less than that amount and relatively low education, that is junior high school education (Table 1).

Feed resources for cattle breeders

Animal feed is the most important input for livestock business because feed will affect the growth and productivity of livestock and finally determine the income of farmers. Animal feed consists of forage which is generally not purchased and concentrate obtained by purchase. The breeders are small farmers with limited capital so that the concentrate is only given according to their capital capacity. The respondents have utilized all of types varied agricultural residues produced by farmers as shown in (Table 2). Feed for beef cattle in the research location only uses local feed, except for concentrate in the form of pollard produced by manufacturers as used by 26.67-66.67% of the respondents depending on the amount of capital they owned.

The technical and economics parameters in the CCO business

The technical parameters that affect the CCO business of the PO cattle including calving

Table 2. Types of concentrate and forage given to PO cows by respondents

Concentrate feed	n	(%)	Forage feed	n	(%)
Wonosari (n=30 Cows)			**Wonosari (n=30 cows)**		
Pollard	20	66.67	Straw	27	90
Soybean skin	0	0	Field grass	12	40
Tofu	0	0	Superior grass *)	30	100
Bran	19	63.33			
Cassava pulp	5	16.67			
Imogiri (n=30 cows)			**Imogiri (n=30 cows)**		
Pollard	8	26.67	Straw	29	96.67
Soybean skin	3	10	Field grass	17	56.67
Tofu	1	3.33	Superior grass *)	24	80
Bran	24	80			
Cassava pulp	1	3.33			
Prambanan (n=30 cows)			**Prambanan (n=30)**		
Pollard	20	66.67	Straw	30	100
Soybean skin	2	6.67	Field grass	20	66.67
Tofu	2	6.67	Superior grass *)	13	43.33
Bran	26	86.67			
Cassava pulp	1	3.33			
No Concentrate (n=90)	14	15.55			

*) Superior grass can be elephant grass, king grass, or *kolonjono*

interval, calf selling age, and calf mortality. Service per conception (S/C) and calf age show an indirect effect (Table 3). Technical and economic parameters will depend on and support each other to generate profit. Economic parameters are cattle price, concentrate feed cost and selling price of calf as reported by the respondents. Furthermore, from those parameters, could be calculated cash revenue, cash expenses, and net cash farm income which are the profitability of the CCO business of PO cattle (Table 4). Profit or net cash farm income is calculated based on formulas (1), (2), (3), and (4) as stated in the sub-chapter of research methodology. Result of this research showed that the cash revenue was 4,347,978/cow/year and cash expenses was 3,008,408/cow/year, so that net cash farm income was positive, IDR 1,339,570/cow/year, which means the farmer still gets a profit (Table 4).

Sensitivity analysis

Based on the results of this study, to determine the improvements in the performance of the CCO of PO cattle business which give better profits to breeders, a simulation or sensitivity analysis has been carried out by predicting improvements in technical parameters that cover such as shortening of the CI and increasing the selling weight of calf from the cow of the PO cattle. As for the economic parameter, it is the price of selling calf per kg live weight. The simulation results of improving the PO cattle performance toward increasing of the net cash farm income showed that the breeders will obtain better net cash farm income if there is an improvement of calving interval. An improvement in CI reaches 13 months, seems to give a better increase in net farm income (Table 5). Improvement of CI requires innovation in reproductive technology of PO cows and rearing management.

DISCUSSION

In the developing countries, crop and livestock integrated activities are generally carried out by small farmers to support the main

Table 3. The Technical Parameters of the CCO of the PO Cattle

Variables	Location	Average ± SD
CI (month)	Wonosari- Gunungkidul	16.18 ± 3.10
	Imogiri- Bantul	15.57 ± 3.43
	Prambanan- Sleman	14.80 ± 2.93
	Average	15.51 ± 3.18
S/C (times)	Wonosari- Gunungkidul	1.90 ± 0.80
	Imogiri- Bantul	2.50 ± 1.59
	Prambanan- Sleman	2.40 ± 1.40
	Average	2.27 ± 1.32
Selling age (month)	Wonosari- Gunungkidul	6.53 ± 1.01
	Imogiri- Bantul	6.87 ± 1.42
	Prambanan- Sleman	6.53 ± 1.46
	Average	6.66 ± 1.33
Calf mortality (%probability)	Wonosari- Gunungkidul	0.00 ± 0.00
	Imogiri- Bantul	3.00 ± 18.00
	Prambanan- Sleman	3.00 ± 18.00
	Average	2.00 ± 12.00

economy of rural households [5], including in Indonesia. Furthermore, he said that the education of farmers is low. According to this study, breeders have the equivalent of junior high school education but he has a long experience of raising cattle, which is 21 years, so they are expected to have a good abilities in raising cattle. Ates *et al*. [16] noted that there are constraints on smallholder farmers namely limited land size and small business scale. However, a crop-livestock farming system can overcome problems related to production efficiency and system risk because the system can optimize the use of the limited resources. Plants produce agricultural residues that can be used for forage. Livestock produce manure which can fertilize the agricultural land. Thus, crops and livestock can support each other in a CCO business. In the livestock business, animal feed consisting of forage and concentrates is an important input for the continuity of livestock business. Forage feed for small-farmers, generally they only use their own crop residues. The feed has an effect on livestock performance [17,18]. Livestock performance can be used as a technical parameter to measure the economic incentive of the livestock business [13]. Calving interval (CI), calf mortality and selling age of calf are the technical parameters for CCO business. The CI in this study (15.51 ± 3.18 months) are almost the same as those reported in a research by Ngadiyono *et al*. [19], recorded that the CI of the PO cattle is 15.25 ± 0.42 months. There is a slight difference in the standard deviation. However, Riyanto *et al*. [20] stated that the CI of the PO cattle was 14.33 ± 1.46 months, and Yulyanto *et al*. [21] stated that the CI of the PO cattle can reach 359.6 days or 12 months. The pregnancy delay after giving birth means a waste of maintenance costs, especially for feed. Ideally, a cow gives birth to a calf once a year or CI = 12 months.

The other technical parameters are calf mortality, results of this study indicate that the calf mortality performance is small, around 1-2%. This is because smallholders with 1-2 cows are very concerned about the calf which is the only expected income. Some previous researchers founded that the calf mortality was at least 5%. The technical parameters along with the economic parameters in the form of input and output prices related to the CCO business will determine the net cash farm income.

Net cash farm income for the CCO of the PO cattle at the current condition is very small, when compared with the minimum regional

Table 4. The economic parameters of the CCO business of the PO cattle

Variable	Location	Average ± SD
Price of cow/head (000IDR)	Wonosari	12,000.00 ± 2,080.28
	Imogiri	12,016.67 ± 2,350.65
	Prambanan	12,633.33 ± 2,906.39
	Average	12,216.67 ± 2,445.77
Concentrate cost/cow/year (000IDR)	Wonosari	1,354.45 ± 748.31
	Imogiri	1,502.58 ± 732.64
	Prambanan	1,719.88 ± 831.66
	Average	1,525.64 ± 770.87
Selling price of calf/head (000IDR)	Wonsari	6,933.333 ± 2,313.521
	Imogiri	6,869.565 ± 1,423.962
	Prambanan	7,593.750 ± 3,302.618
	Average	7,132.216 ± 2,346.700
Cash revenue (000IDR/ Cow/year)	*Average*	4,347.978
Cash expenses (000IDR/ Cow/year)	*Average*	3,008.408*)
Net cash farm income (000IDR/cow/ year)	*Average*	1,339.570**)

*) Cash revenue from calf sales (IDR 3,812.883) + Manure (IDR 535.095)

**) Calculated from the average performance of the technical and economic parameters and finally to be cash revenue - cash expenses

Average of exchange rate in Indonesia, 1$ = IDR 14,000 (Consumer News and Business Channel /CNBC, 2018 to 2021)

wage in the research location equivalent of $96/cow per year vs $135.7/month/labor, this condition is interesting. Why do farmers still keep their livestock even though their income is very small at the expense of their labor and capital? This is because there might be no other job opportunities for them in their village. Besides, more importantly, cow dung as manure is needed for land fertilizer to increase agricultural crop yields. They can also meet the needs of their families and increase their total farm income. The condition of smallholder farmers in this study is consonant with that reported in the previous studies.

Therefore, to support the development of CCO of PO cattle businesses, it is necessary to improve technical and economic parameters that can improve the performance of livestock production for smallholder farmers. Sensitivity analysis was carried out in this study to predict better farmer profits with changes in technical and economic parameters, of course with the assumption that technology and maintenance management improvements can be applied. Sensitivity analysis was carried out by predicting changes in the calving interval, better managing the weight of the calf sales and the selling price of the calf. The selling price of calves as found in this study is IDR 7,132,216/calf, where the price per kg of body weight is IDR 48,000.

Therefore, the estimated of calf sales weight found in this study is 148 kg at the age of about 7 months. In the simulation, it is assumed that there is an increase of price to Rp. 50,000/kg of body weight. Baliarti [22] recorded that the weaning weight of the PO calves at the age of 180 days (6 months) in Gunungkidul Regency for male calves was 155.65±14.11 kg and 154.26 kg ±13.27 for the females. However, according to Loka Penelitian Sapi Potong [23] selected superior PO cattle could produce 7-month-old weaned calves reaching a weight of 170 kg. A simulation of selling the 170 kg calves to increase the income of the farmers was conducted. The sensitivity analysis results showed that based on several simulations, breeders will obtain better net

Table 5. Sensitivity analysis of the performance improvement toward Net Cash Farm Income

No.	Sensitivity analysis of the performance improvement toward Net Cash Farm Income*)	Net Cash Farm Income (IDR/Cow/Year)	Changes in current condition (%)
1	Current condition with the CI was 15.5 months, calf sales weight of 148 kg at the age of 6.7 months old, and the price of IDR 48,000.-/kg body weight	1,339,570	0
2	An increase in the calf selling price of IDR 50,000/kg of body weight without any changes in other performances	1,667,228	24.46
3	Improvement in the CI of 13 months without any changes in other performances	1,990,921	48.62
4	Improvement in the calf sales weight of 160 kg without any changes in other performances	1,489,628	11.20
5	Improvement in the calf sales weight of 170 kg with the additional concentrate feed cost of 30%, increase in the calf selling price of IDR. 50,000/kg without any changes in other performances	1,012,572	-24.41
6	Improvement in the CI of 13 months, the calf sales weight of 170 kg with the additional concentrate feed cost of 30%, the calf selling price of IDR 50,000/kg,	2,251,900	68.11

*) Calf mortality is not calculated because it has already been considered low. Assumption, if there is improve the calf sales weight from 148 kg to 160 kg, then only improvement in maintenance management is needed, but if the calf sales weight is improved to 170 kg, it is necessary to improve maintenance and feed management with an additional cost of 30%

cash farm income if there is an improvement of calving interval. An improvement in CI reaches 13 months, seems to give a better increase in net farm income as in the results of sensitivity analysis numbers 3 and 6 in (Table 5). This condition is possible because based on the previous research, improvements in the performance of the technical parameters can be achieved [22,23]. The simulation for improving the CI of the PO cow is 13 months which is estimated to be achievable by the breeders.

Previous study showed that the advantages of PO cattle have an excellent adaptability to high tropical climates, resistance to heat, resistance to tick bites, and tolerance to high crude fibered feed [14]. It is necessary to map the availability of all suitable agricultural land for agricultural crops as a source of cattle feed. Improvement of net cash farm income for the CCO of the local PO cattle demands the adoption of technology that can shorten the Calving Interval and increase the calf sale weight at a weaning age. In addition, the government's policy on the base price for calf sales needs to be supported.

CONCLUSIONS

The CCO business development of the local PO beef cattle in the current condition give positive generate income although small. That can increase better net cash farm income than current condition needs to be directed to the adoption of the technology and maintenance management to increase the calf sale weight and shorten the CI up to 13 months. The economic parameter of the calf

price will affect to the cash revenue but it was less sensitive than the increase in calf weight. Previous study showed that the advantages of PO cattle have an excellent adaptability to high tropical climates, resistance to heat, resistance to tick bites, and tolerance to high crude fibered feed. The CCO of PO local business development can recommended in areas where sufficient and extensive agricultural land is available to produce forage for livestock.

CONFLICT OF INTEREST

The authors declare no conflict of interest with any financial organization regarding the material discussed in the manuscript. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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