FINANCIAL FEASIBILITY OF INVESTING IN SMALLHOLDER COW-CALF COOPERATIVES IN BALURAN NATIONAL PARK

Kelayakan Finansial Investasi pada Koperasi Usaha Pembibitan Sapi di Taman Nasional Baluran

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ABSTRACT

Livestock grazing is a major driver of human-wildlife conflict in conservation areas. Currently, it is estimated that 3000 heads of cattle illegally grazing within Baluran National Park (BNP) in East Java. The recent research has suggested the potential of livestock system intensification to reduce land-use and conflict through conservation priorities. The research goal was to investigate the financial feasibility of starting intensive cow-calf cooperatives by smallholders in the BNP area. Data were collected using Farm surveys in a Criterion sampling design. Optimal herd management plans were generated using whole farm Linear Programming and financial feasibility was assessed using Discounted cash-flow analysis and debt-servicing capabilities. Investment lifetime was set at 15 years and four alternative varieties of cattle were taken from Bali, Peranakan Ongole, Limousin and Simmental. Results show that investing in all varieties represents a positive investment opportunity. Bali cattle obtaining the highest NPV ($53.769), IRR (14,25%) and B/C ratio (1,13). Farmer income can be increased by 163% by combining additional Off-farm labor. However, debt-servicing capabilities of cow-calf cooperative activities showed that the loan principal can only be repaid in the 10th year instead of the maximum eight years set by the government cow-calf credit scheme. We urge the government to reconsider either the grace period or the repayment time of the credit scheme to better fit the cash-flow characteristics of cow-calf enterprises.

Keywords : *cash-flow analysis; human-wildlife conflict; linear programming; livestock grazing*

INTISARI

Penggembalaan ternak adalah salah satu pendorong terbesar dari konflik antara masyarakat dan satwa liar di kawasan alam. Pada saat ini, 3000 ekor sapi diperkirakan digembalakan liar di dalam Taman Nasional Baluran (BNP) di Jawa Timur. Penelitian terkini telah menunjuk potensi dari mengintensifikan sistem ternak untuk mengkurangi kebutuhan lahan dan konflik dengan prioritas konservasi. Tujuan penelitian ini adalah untuk mengetahui kelayakan finansial dari memulaikan koperasi pembibitan sapi oleh petani di daerah BNP. Datanya dikumpul melalui survei petani (Farm surveys) dalam kerangka Criterion Sampling. Perencanaan kegiatan koperasi secara optimal diperoleh melalui whole farm Linear Programming dan kelayakan finansial diselidiki melalui analisis Discounted cash-flow serta analisis Debt-servicing. Jangka investasi ditetapkan pada 15 tahun dan investasinya dibandingkan untuk

empat jenis sapi yang berbeda, yaitu sapi Bali, Peranakan Ongole, Limousin dan Simmental. Hasil penelitian menunjuk bahwa investasinya layak untuk semua jenis sapi, tetapi dengan sapi Bali yang menghasilkan nilai NPV ($53.769), IRR (14,25%) dan rasio B/C (1,13) terbesar. Pendapatan petani dapat meningkat sebanyak 163% melalui kombinasi dengan pendapatan luar koperasi. Namun, biaya prinsipal dari pinjaman yang dibutuhkan hanya dapat dibayar kembali pada tahun ke-10, daripada batas maksimal 8 tahun yang ditetapkan oleh skema kredit usaha pembibitan sapi dari pemerintah. Kami mendesak pada pemerintah Indonesia untuk mempertimbangkan kembali masa tenggang atau waktu pelunasan skema kredit usaha pembibitan sapi agar lebih sesuai dengan karakteristik arus kas usaha pembibitan sapi.

Kata kunci: *analisis arus kas, konflik manusia-satwa liar, linear programming, penggembalaan ternak*

INTRODUCTION

Rural governments around the world are faced with challenges on how to best allocate and use available lands, especially in balancing the interests of nature conservation with expanding agriculture (Green *et al.,* 2005). One of the main locations where conflicts take place is around protected areas such as National Parks (NP). Issues around these areas primarily revolve around the levels of exploitation allowed within and around park boundaries (Andrade & Rhodes, 2012; Fiallo & Jacobson, 1995). Livestock grazing has been a major driver of conflict in NP areas (Fleischner, 1994; Infield & Namara, 2001; Fischer, 2009; Waweru & Oleleboo, 2013). Negative impacts of overgrazing include loss of biodiversity, disruption of the nutrient cycling and changes in the biophysical characteristics of the soil (Fleischner, 1994; Dorrough *et al.,* 2007; Howland *et al,* 2014). In the Baluran NP (BNP) area in East Java, there are currently an estimated 3000 heads of cattle illegally grazing within park boundaries.

The cattle belong to two villages. The first is the village of Karang Teko located on the park's border and the second village, Merak, is an enclave of settlers who entered the park in 1975 as employees for a plantation company that, in a conterversial case, had obtained a 25-year plantation exploitation permit from the Ministry of Internal Affairs (SK. 16/HGU/DA/1975), even though the right to grant exploitation rights and reborder protected areas did not lie with the Ministry of Internal Affairs, but with the Ministry of Agriculture.

Despite continous protests from the Ministry of Agriculture, the permit was never revoked and exploitation continued untill its expiration in the year 2000. However, new conflict soon started as former employees claimed ownership rights to the accession areas. They reportedly rented and bought land from the permit-holder with the hope of gaining ownership once the permit expired, although it is not

known whether the employees were aware these constructions are illegal under permit regulations, or that they were duped into it by the permit holder (Wianti, 2014).

The enclave has grown since and currently numbers over 320 families, who are still reliant on government funded Direct Cash-Assistance (BLT) and free rice distributions (Raskin) to meet their needs (Wianti, 2014). Considering that former old-order political and industry collusion are largely at the root of the problem, the current government takes a humanistic approach towards the settlers in Merak. Why the Karang Teko villagers on the border of the protected area are not prohibited from grazing their cattle in the national park is unknown.

Direct competition between the grazing cattle from both communities and wildlife has contributed to population declines in several highly threathened and protected species. The most notable example of this is the Banteng (*Bos javanicus*), whose population numbers have dwindled from 150-200 pre-settlement down to less than 25 individuals in 2014 (Hakim *et al.,* 2015). Next to this, settlers have been involved in the illegal hunting of Banteng and other protected species such as Javan Rusa (*Rusa timorensis*), as well as bird-trapping, feeding into the rampant illegal bird trade on Java (Eaton *et al.,* 2015).

Recent research has indicated the potential of intensification of livestock systems to spare lands and thereby reduce conflict with conservation priorities (Lapola *et al.,* 2014; Cohn *et al.,* 2014). In BNP such an intensification would entail a transition from smallholder grazing on BNP's savannah areas to intensive livestock keeping in village areas. Potential funding to realize such a transition has recently become available through a new government created credit scheme (KUPS) to support national beef self-sufficiency goals, which is specifically aimed at the creation of medium scaled cow-calf businesses by smallholders (Ilham & Saliem, 2016; Winarso & Basuno, 2013). However, it is unknown whether such an investment would be financially feasible and, if feasible, how the cooperative might be optimally managed by the smallholders.

This research aimed to investigate the financial feasibility of investing in intensive cow-calf cooperatives by livestock smallholders from the BNP area based on optimal herd management. In doing so, a second aim was to present a potential solution to the current conflict that benefits both the villagers from an economic perspective, National Park authorities from a conservation perspective and the central goverment in achieving national policy goals.

METHODS

Data was collected in the field from 19 December 2016 – 01 January 2017. Farm surveys were used to collect

Figure 1. Location of Baluran National Park (BNP) on the North-Eastern tip of Java Island, Indonesia. Basemap from National Geographic, ESRI (2017).

information on the ownership status and total number of heads of cattle owned per farmer in the village of Karang Teko and in the Merak enclave. The aim was to sample 50 respondents in each location using criterion sampling (Suri, 2011), as the uncertainty regarding the total number of livestock-keeping households and their precise locations for both villages did not allow a representative sample size to be determined *a priori,* nor random sampling to be implemented in the field.

As part of the smallholders in the BNP area rear cattle for external investors on a split-profit basis, only those farmers that had full ownership of all or part of their cattle were included.

The value of cattle owned was estimated based on weight in kilograms, determined by measuring the heart girth and body length (Pater, 2007; Heinrichs *et al.,* 1992) (Equation 1). The average value of the cattle owned per farmer was used as a proxy for available investment capital.

(1) Cattle weight estimation

$$w_{kg} = \frac{H^2 * L}{300} * 0{,}45359237$$

Where W_{kg} is weight in kg, equal to heart girth square (H^2) in inches multiplied by body length *(L)* inches, divided by 300 and multiplied by the ratio of pound to kilogram. Secondary data relating to the operational and investment costs, were obtained from the East-Java Livestock Extension Office or DINAS Peternakan JATIM in Surabaya. The maximum limit for the number of members per planned cooperative was set at 10 members and 50 heads of breeding cows in an intensive colony system.

Firstly, optimal herd management and resulting cooperative farm returns were analyzed for four differrent types of cattle in a multi-year whole farm Linear Programming model. The objective function of the LP model was set at maximizing farm surplus (income minus variable costs and depreciation) (Gomes,

Table 1. Activities and Constraints Included in The Base Model For The Whole Farm Linear Programmming Model.

Activity	Objective Function Description	Requires (R) / Provides (P) Coefficients
BUYFF	Cost of Buying 1unit of Fresh Feed (Ricestraw, Grasses)	(P) 1 unit for Fresh Feed Stock
BUYCF	Cost of Buying 1unit of Concentrate Feed	(P) 1 unit for Concentrate Feed Stock
BRDCOW	Costs associated with keeping Breeding Cows	(R) Feed and Capital, (P) Calves and Manure
BREPHFR	Costs associated with buying and keeping a Replacement Heifer	(R) Feed and Capital, (P) Breeding Cows, Calves and Manure
REPHFR	Costs associated with rearing Replacement Heifer from own Calves	(R) Female Calves, Feed and Capital (P) Breeding Cows, Calves and Manure
WHFR	Revenue from selling a Heifer Calf at weaning	(R) Female calves, (P) Manure
WSTR	Revenue from selling a Steer Calf at weaning	(R) Male Calves, (P) Manure
YHFR	Revenue from selling a Heifer Calf at 1 year of age	(R) Female Calves, Feed and Capital, (P) Manure
YSTR	Revenue from selling a Steer Calf at 1 year of age	(R) Female Calves, Feed and Capital, (P) Manure
MHFR	Revenue from selling a Heifer Calf at 1.5 years of age	(R) Male Calves, Feed and Capital, (P) Manure
MSTR	Revenue from selling a Steer Calf at 1.5 years of age	(R) Male Calves, Feed and Capital, (P) Manure
CULLCOW	Revenue from Culled Breeding Cows	(R) Breeding Cows
MANUSELL	Revenue from selling 1 unit of Manure as Fertilizer	(R) 1 unit from Manure Stock
DPRCTN	Cost of Depreciation of Buildings and Machinery	(R) 1 unit of Depreciation
Constraint	**Constraint description**	**Constraint value**
STKFF	Stock of Fresh Feed (Ricestraw, Grasses)	≥0
STKCF	Stock of Concentrate Feed	≥0
MiBC	Minimum number of Breeding Cow	≥40
MxBC	Maximum number of Breeding Cows	≤50
MxRHFR	Maximun number of Replacement Heifers	≤9
FeCALF	Female Calf Stock	≥0
MaCALF	Male Calf Stock	≥0
COWCULL	Cull-Cow Stock	≥0
RCOW	Replacement Cow Stock	≥0
STKMNR	Manure Stock	≥0
LABOR	Annual Available Labor (Working Days)	≤29200
MinDPRC	Minimum units of Depreciation Paid	≥1

1991). The types of cattle considered were the Limousin, Peranakan Ongole (PO), Simmental and Bali variety, with the differrent feed requirements, weight and reproductive characteristics accounted for (Paune *et al.,* 2014; Astuti, 2004; Martojo, 2003; Cundiff *et al.,* 1993). Investment lifespan was set at 15 years.

The base model included 14 activities and 12 constraints. Culling rate for the breeding cows was set at 15%, and with an estimated annual loss of 3% of the cattle, replacement rate was set at 18%. Within the model, feed was bought locally from farmers around the cooperative instead of producing it on privately owned land and transferring it to the cattle feed (e.g. Gomes, 1991). This to support the local economy and increase societal acceptance towards the existence of a newly created medium-scaled cow-calf cooperative in the area. The linear model was analyzed using LiPS version 1.11.1.

The financial feasibility for the optimal herd development plans in the LP model was analyzed in detail using a monthly based discounted cash-flow analysis, including debt-servicing capabilities (Obst *et al.,* 2007). The investment was deemed financially feasible if the net present value of proceeds minus costs over the investment's lifespan > 0 (Eqn 2), and if the net cash proceeds accrued over the investment loan repayment period minus taxes and interest were larger than the intitial capital borrowed.

(**2**) Net Present Value estimation

$$\mathrm{NPV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0$$

Where T is the economic lifespan of the investment, C_t is the net cash-flow in year t, r is the discount factor and C_0 represents the initial investment. The discount factor was set at 10%, the current prime commercial lending rate at Indonesia's three largest banks, Bank Negara Indonesia (BNI), Bank Rakyat Indonesia (BRI) and Bank Mandiri.

Tax rate was set at 1%, which is the rate set by the Indonesian government for businesses with an annual revenue of less than IDR 4.8 billion ($360.000). The loan repayment period of the governments cow-calf KUPS credit scheme is 6 years with an additional 24 month grace-period. Benefit / Cost ratio of the investment was calculated by dividing the sum of the present values of cash inflows by the sum of the present values of cash outflows. Next to this, the percentage of cash inflows allocated to fresh and concentrate feed cost was assessed. Feed cost can make up to 50% of operational costs in livestock enterprises and are therefore likely to explain variation in performance between cattle varieties (Holmgren & Dillon, 2015).

Finally, the potential amount of off-farm income cooperative members can generate through unschooled labor outside of the cooperative was estimated, based on required labor in the optimal farm plans. Pay rate was set at Rp. 6.250 per hour, which is the average income per hour for villagers in Baluran National Park if calculated back from average annual income (Rp. 15.010.500) to a working

month consisting of 25 days of eight hours (Anggraeni, 2015).

RESULTS AND DISCUSSION

Estimated investment costs for buildings and land was Rp. 541.000.000 and annual depreciation equal to Rp. 42.766.667. Respondent characteristics for both villages are listed in Table 2.

Of the alternative types of cattle considered, keeping the Simmental variety resulted in the largest farm surplus over the 15 year investment period (Fig. 2). For all cattle varieties, the optimal herd development plan included only bought replacement heifers and no replacement heifers reared from own calves. Next to this, all calves are sold at age 1.5 years and none at 7 months or 1 year of age (Table 3).

The optimal herd development plan of the Limousin cattle was equal to that of the Simmental variety, however with a slightly lower revenue value (Calves sold: Rp. 14.222.123.025; Cows Culled: Rp. 3.104.640.000). The number of calves produced and sold in the optimal herd development plan for the P.O. and Bali variety were considerably lower at 676 and 495 individuals, representing a revenue value of Rp. 6.617.923.308 and Rp. 5.061.960, respectively. The number of cows culled for the P.O. and Bali variety was similar to that for the Simmental and Limousin varieties with 175 and 173 individuals, however their revenue values were lower (P.O.: Rp. 2.646.000.000; Bali: Rp. 1.888.814.000).

Table 2. Respondent and Cattle Characteristics Used to Determine Available Investment Capital Per Farmer.

	Karang Teko	Merak
Number of respondents	49	50
Number of cattle reared	7,75	3,22
Number of cattle owned privately	2,10	1,32
Number of cattle measured	53	54
Average cattle weight (Kg)	329,52	390,71
Average value per head (Rp.)	15.631.786	17.972.469
Available investment capital (Rp.)	32.826.750	23.723.659

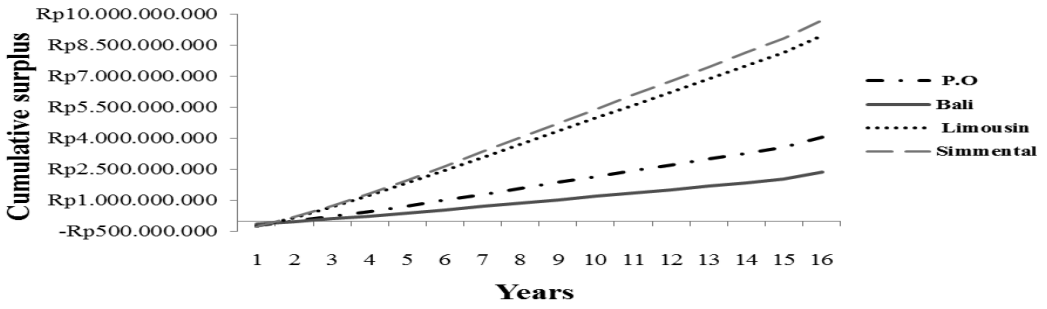

Figure 2. Cumulative Farm Surplus Generated Over the 15 Year Investment Period Through Optimal Herd Management of The Four Cattle Types.

Table 3. Optimal Herd Development of Simmental Cow-Calf Cooperative Based on Whole Farm Linear Program.

Year	N. Breeding Cows	N. bought Rep. Heifers	N. Calves produced	N. Calves sold at 1.5 years	N. Cull-Cows
0	40	0	0	0	0
1	40	9	43	0	6
2	43	9	46	35	7
3	46	9	48	46	7
4	48	9	50	48	7
5	50	9	52	50	9
6	50	9	52	52	9
7	50	9	52	52	9
8	50	9	52	52	9
9	50	9	52	52	9
10	50	9	52	52	9
11	50	9	52	52	9
12	50	9	52	52	9
13	50	9	52	52	9
14	50	9	52	52	9
15	50	9	52	52	50
16	0	0	0	52	9
17	0	0	0	8	0
Total Calves Sold and Cows Culled			759	759	176
Total Revenue Value (Rp.)			-	14.924.422.689	3.299.155.200

Table 4. NPV, IRR and B/C ratio for investing in cow-calf cooperatives for the four cattle varieties, the percentage of cash inflows allocated to the differrent cost items and % of cash flows that become net positive cash flow. Discount factor *r* in calculating NPV was equal to 10%, the prime lending rate in Indonesia.

Cattle variety	NPV	IRR	B/C ratio	% cash inflow becoming positive net cash flow	% cash inflow allocated to fresh feed	% cash inflow allocated to concentrate feed	% cash inflow for non-feed
Bali	698.997.575	14,15%	1,130	34%	7%	22%	37%
P.O.	453.113.200	12,57%	1,070	28%	9%	30%	33%
Simmental	177.561.820	11,03%	1,021	20%	12%	38%	30%
Limousin	155.562.454	10,91%	1,019	20%	12%	37%	31%

Discounted cash-flow analysis resulted in positive NPV's, IRR and B/C ratio indicators for all cattle varieties considered, with the Bali variety performing best and the Limousin variety performing the worst (Table 4). This indicates that without taking tax and capital loan repayment into account, the investment would be feasible for all varieties. The Simmental and Limousin variety had to allocate a relatively higher amount of cash inflows towards covering feed costs compared to the Bali and P.O. cattle. The differrent cattle varieties differred considerably in the time required for cash inflows to exceed cash outflows and generate positive net

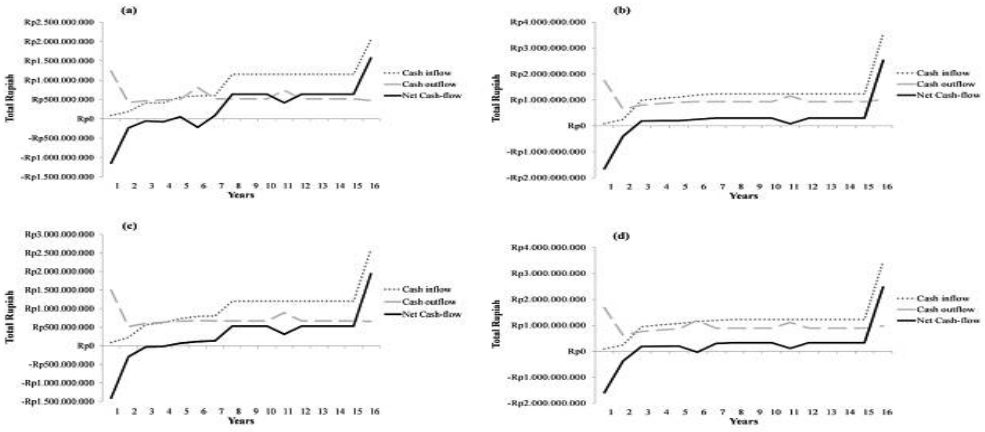

Figure 3. Cash flow developments of cow-calf cooperatives for the different cattle varieties (a) Bali cattle (b) Simmental cattle (c) P.O. cattle (d) Limousin cattle. Solid black line indicates Net cash flow, dotted black line Cash inflow and grey broken line Cash outflow for the duration of the investment.

Table 5. Debt servicing capabilities for investing in Bali, P.O. Simmental and Limousin cow-calf cooperatives in Karang Teko and net value accrued per member. Year in which net accumulated cash-flows after tax exceed loan principal is highlighted in bold.

	Bali	P.O.	Simmental	Limousin
Peak debt	Rp. 1.350.672.240	Rp. 1.424.745.963	Rp. 1.724.927.621	Rp. 1.424.745.963
Capital loan	Rp. 2.000.000.000	Rp. 2.000.000.000	Rp. 2.000.000.000	Rp. 2.000.000.000
Interest 5%	Rp. 100.000.000	Rp. 100.000.000	Rp. 100.000.000	Rp. 100.000.000
Net accumulated cash flow after tax (1%)				
Year				
0	Rp. 530.511.116	Rp. 818.717.276	Rp. 575.167.116	Rp. 545.186.916
1	Rp. 67.962.955	Rp. 423.763.204	Rp. 75.072.380	Rp. 63.052.146
2	Rp. 194.566.093	Rp. 292.132.159	Rp. 161.971.218	Rp. 141.323.141
3	Rp. 334.780.560	Rp. 175.254.037	Rp. 259.395.594	Rp. 230.178.390
4	Rp. 476.227.505	Rp. 143.560.007	Rp. 355.995.260	Rp. 325.835.444
5	Rp. 673.120.442	Rp. 156.085.414	Rp. 507.086.320	Rp. 186.553.275
6	Rp. 1.016.797.600	Rp. 286.719.162	Rp. 804.961.642	Rp. 478.710.971
7	Rp. 1.360.474.778	Rp. 812.280.925	Rp. 1.102.863.964	Rp. 803.846.216
8	Rp. 1.704.151.956	Rp. 1.337.842.689	Rp. 1.400.712.286	Rp. 1.128.981.461
9	Rp. 2.047.829.134	Rp. 1.863.404.452	Rp. 1.698.587.608	Rp. 1.454.116.707
10	Rp. 2.172.716.312	Rp. 2.170.176.216	Rp. 1.777.672.929	Rp. 1.560.461.952
11	Rp. 2.516.393.490	Rp. 2.695.737.980	Rp. 2.075.548.251	Rp. 1.884.597.197
12	Rp. 2.860.070.669	Rp. 3.221.299.743	Rp. 2.373.423.573	Rp. 2.210.732.443
13	Rp. 3.203.747.847	Rp. 3.746.861.507	Rp. 2.671.298.895	Rp. 2.535.867.688
14	Rp. 3.547.425.025	Rp. 4.722.423.270	Rp. 2.969.174.217	Rp. 2.861.002.933
15	Rp. 6.071.306.111	Rp. 6.191.154.364	Rp. 5.469.857.003	Rp. 5.307.534.630
Minus principal	Rp. 4.071.306.111	Rp. 4.191.154.364	Rp. 3.496.857.003	Rp. 3.307.534.630
Per member	Rp. 407.130.611	Rp. 419.115.436	Rp. 349.685.700	Rp. 330.753.463.

Table 6. Debt servicing capabilities for investing in Bali, P.O. Simmental and Limousin cow-calf cooperatives in Merak and net value accrued per member. Year in which net accumulated cash-flows after tax exceed loan principal is highlighted in bold.

	Bali	P.O.	Simmental	Limousin
Peak debt	Rp. 1.441.703.150	Rp. 1.614.751.353	Rp. 1.815.958.531	Rp. 1.730.199.781
Capital loan	Rp. 2.500.000.000	Rp. 2.500.000.000	Rp. 2.500.000.000	Rp. 2.500.000.000
Interest 5%	Rp. 125.000.000	Rp. 125.000.000	Rp. 125.000.000	Rp. 125.000.000
Net accumulated cash flow after tax (1%)				
Year				
0	Rp. 914.480.206	Rp. 1.189.838.366	Rp. 959.136.206	Rp. 929.156.006
1	Rp. 451.932.045	Rp. 742.119.854	Rp. 434.041.470	Rp. 422.021.236
2	Rp. 578.535.183	Rp. 557.724.369	Rp. 495.940.308	Rp. 475.292.231
3	Rp. 718.749.650	Rp. 385.248.647	Rp. 568.364.684	Rp. 539.147.480
4	Rp. 860.196.595	Rp. 297.141.105	Rp. 639.964.350	Rp. 609.804.534
5	Rp. 1.057.089.512	Rp. 252.131.113	Rp. 766.055.410	Rp. 445.522.365
6	Rp. 1.400.766.690	Rp. 349.668.517	Rp. 1.063.930.732	Rp. 737.680.000
7	Rp. 1.744.443.868	Rp. 842.133.937	Rp. 1.361.806.054	Rp. 1.062.815.306
8	Rp. 2.088.121.046	Rp. 1334.599.357	Rp. 1.659.681.376	Rp. 1.387.950.551
9	Rp. 2.431.798.224	Rp. 1.826.064.777	Rp. 1.957.556.698	Rp. 1.713.085.797
10	Rp. 2.556.685.402	Rp. 2.100.740.197	Rp. 2.036.642.019	Rp. 1.819.431.042
11	Rp. 2.900.362.580	Rp. 2.593.205.617	Rp. 2.334.517.341	Rp. 2.144.566.287
12	Rp. 3.244.039.759	Rp. 3.085.671.037	Rp. 2.632.392.663	Rp. 2.469.701.533
13	Rp. 3.587.716.937	Rp. 3.578.136.457	Rp. 2.930.267.985	Rp. 2.794.836.778
14	Rp. 3.931.394.115	Rp. 4.070.601.877	Rp. 3.228.143.307	Rp. 3.119.972.023
15	Rp. 6.455.275.201	Rp. 5.956.236.627	Rp. 5.728.826.093	Rp. 5.566.503.720
Minus principal	Rp. 3.955.275.201	Rp. 3.456.236.627	Rp. 3.228.826.093	Rp. 3.066.503.720
Per member	Rp. 395.527.520	Rp. 345.623.663	Rp. 322.882.609	Rp. 306.650.372

Table 7. Potential of Off-farm income that can be earned by farmers investing in cow-calf cooperatives for the four differrent cattle varieties.

	Bali	Simmental	P.O.	Limousin
	Potential Off-farm income	Potential Off-farm income	Potential Off-farm income	Potential Off-farm income
Year				
0	Rp. 144.160.000	Rp. 144.160.000	Rp. 144.160.000	Rp. 144.160.000
1	Rp. 138.887.000	Rp. 136.678.300	Rp. 137.379.800	Rp. 136.539.350
2	Rp. 138.206.600	Rp. 135.862.650	Rp. 136.607.100	Rp. 135.715.250
3	Rp. 137.526.200	Rp. 135.047.050	Rp. 135.834.450	Rp. 134.891.150
4	Rp. 137.072.600	Rp. 134.503.300	Rp. 135.319.350	Rp. 134.341.700
5	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
6	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
7	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
8	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
9	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
10	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
11	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
12	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
13	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
14	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
15	Rp. 136.619.050	Rp. 133.959.550	Rp. 134.804.250	Rp. 133.792.300
Total	Rp. 2.198.661.950	Rp. 2.159.806.350	Rp. 2.172.147.450	Rp. 2.157.362.750
Per member	Rp. 219.866.195	Rp. 215.980.635	Rp. 217.214.745	Rp. 215.736.275

Table 8. Potential Off-farm and On-farm income gained per member by investing in cow-calf cooperatives in Karang Teko (K) and Merak (M).

	Bali	P.O.	Simmental	Limousin
Total 15yr On- Farm (K)	Rp. 452.630.991	Rp. 419.115.436	Rp. 349.685.700	Rp. 330.753.463
Total 15yr Off- Farm (K)	Rp. 219.866.195	Rp. 217.214.745	Rp. 215.980.635	Rp. 215.736.275
Total 15yr On- Farm (M)	Rp. 478.528.900	Rp. 345.623.663	Rp. 322.882.609	Rp. 306.650.372
Total 15yr Off- Farm (M)	Rp. 219.866.195	Rp. 217.214.745	Rp. 215.980.635	Rp. 215.736.275
Average annual	Rp. 45.696.409	Rp. 39.972.286	Rp. 36.815.653	Rp. 35.629.212

cash flows before tax and interest (Fig 3.a-b). Investing in the Simmental variety produced the most stable cash flow and the Bali variety the most unstable cash flow.

Debt-servicing capabilities of the capital loans showed that net accumulated cash-flows after tax and interest remained positive for all varieties considered in both Merak and Karang Teko. However the principal could only be repaid in year 9 and 10 for the Bali and Simmental variety, year 10 and 11 for the P.O. variety and year 12 and 13 Limousin variety (Tables 5-6).

The planned ten cooperative members represent 24.000 hours of availlable anual labor. Total annual labor required for running the cooperative was an average of 2280 hours per year for all four cattle varieties, or 228 hours per member. The amount of hours availlable to work Off-farm by cooperative farmers was 21.720 hours, resulting in a potential average annual Off-farm income of Rp. 135.750.000, or Rp. 13.575.000 per member (Table 7).

Combining the potential income accrued from On-farm and Off-farm activities over the 15 year period resulted in the Bali cattle providing farmers the highest value, with relatively little differrence compared to P.O. cattle (Table 8). Averaging the annual On- and Off-farm income gained between cattle varieties, gave a value of Rp. 39.528.390. This represents a net increase of Rp. 24.517.890, or 163% compared to the Rp. 15.010.500 annual income of Baluran villagers reported by Anggreani (2015).

The higher amounts of calves produced and sold by the Simmental and Limousin variety in the optimal Whole Farm Linear Program (Table 3) compared to Bali and P.O. cattle, can be explained by their much higher reproductive success.

The coefficients for these parameters in the whole farm Linear Programming model were based on availlable literature. For the Bali variety, Paune *et al.,* (2014) found calving rates of 75% using artificial insemination and Jelantik *et al.,* (2008), report an average calf mortality of 17,9%. This means that net birth and survival to weaning of Bali cattle is only 57,1%. During the same research, Paune *et al.,*(2014), found a much higher calving rate for P.O. cattle at 88,1% and with a reported calf mortality of 9% as reported by Wirdahayati

et al., (2000), results in a 79,1% net birth and survival to weaning. These numbers are considerably lower than the net birth and survival to weaning reported by Cundiff *et al.,* (1993) for Limousin and Simmental cattle at 90,8% and 88,8% respectively.

Scientific literature on the performance of Limousin and Simmental cattle in Indonesia were not available however, and this makes it difficult to assess whether their reproductive performance would be as high in the dry and hot conditions characterizing the Baluran area. Vice-versa, the calving rate and calf mortality of especially the Bali variety seems exceptionally poor and might be related more to sub-optimal cattle rearing in the specific researches mentioned; with improved cattle management much better results could potentially be achieved for this variety in Baluran.

Contrary to the farm surpluses obtained by the Whole Farm Linear Program, it were the Bali and P.O. variety that performed the best and the Simmental and Limousin variety that performed the least in the Discounted cash flow analysis (Table 4). This is mainly because of two factors. Firstly the Linear program only included fixed costs in the form of depreciation of equipment and buildings, which favours those cattle types generating large amounts of revenue per item sold such as Limousin and Simmental calves.

Secondly, all costs and benefits obtained from maintaining breeding cows and replacement heifers and rearing calves untill 1.5 years of age were brought back to a single year in the Linear Program and were not discounted. Spreading these items out over their respective time frames resulted in unfeasible solutions as cattle needed to be shifted between multiple years, sometimes placing three times the demand (raising replacement heifer year 1-3) on what is a single supply, i.e. a single replacement heifer obtained from a single heifer calf.

In the cash flow analysis these items (calves, replacement heifers) are spread out over their respective time schedules and discounted, thus providing a much more detailed view of actual costs and benefits obtained. Results show that because of their much higher cost of concentrate feed (Table 4), the Simmental and Limousin variety convert much less cash inflows into positive net cash flows, hence accruing less capital over time. Linear Programs are therefore useful in generating optimal herd development plans, but are not practical in forecasting actual net returns for cow-calf enterprises.

Informal talks with members of the East Javan Livestock Extension Office indicated that the government's cow-calf KUPS credit scheme for farmer groups is still little used, despite the easy access to capital it provides. This might have to do with the unrealistic loan repayment period of six years plus a 24 month grace

period. Although operational cash-flows can support the required interest payments (Table 5-6), a considerable amount of debt in the form of the loan's principal is required to cover initial investment in buildings and cattle and maintain positive accumulated cash flows during the first two years of operation in which no returns are made yet.

Although our research shows that starting intensive cow-calf cooperatives is a feasible option to resolve the current grazing problem in BNP from a financial perspective, this does not necessarily mean it is the optimal solution from a social perspective. Any move towards potentially implementing this plan should continue with full support of village representatives, to avoid the forcing of measures on communities that favour conservation, but which eventually fail due to a lack of support (e.g. Madden, 2004; Benneth & Dearden, 2014).

National Park authorities are currently looking into starting an integrated agricultural system within the former concession area Merak, where the manure from intensively held cattle colonies might be used as organic fertilizer for fields of chili and dragon fruit, who seem exceptionally well suited to grow in the area due to the extended dry season. The fresh feed for the cattle is grown around these fields and the products marketed as ecologically friendly and conservation supportive agriculture (Rademaker, 2017). However, the economic benefits of such a system have not been investigated yet and it is unknown how the cooperatives as described in this research might fit into such a system.

CONCLUSIONS AND SUGGESTION

Our results show that starting cow-calf cooperatives by small-holders in the Baluran area represents a positive investment opportunity. Firstly, the whole-farm Linear Program showed the Simmental cattle as the variety with the highest production and returns. However, detailed cash-flow analysis showed that the Bali variety generates the highest NPV, IRR and B/C ratio of all four cattle varieties considered. Investing in cow-calf cooperatives provides farmers with the potential to increase their income by 163% through additional Off-farm labor. However, debt-servicing capabilities of cow-calf activities showed the loan principal can only be repaid in the 10th year of operations instead of the maximum 8 year period set by the government. We urge the government to reconsider either the interest rate or the grace period of the credit scheme to better fit the cash-flow characteristics of cow-calf enterprises.

Future research should investigate the social support for starting cow-calf cooperatives among the local communities currently grazing their cattle in BNP. Next

to this, the economic benefits of integrated conservation supportive agricultural systems that National Park authorities would like to develop should be assessed.

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