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Original Article

Investment and Competitiveness of Cross-breed Beef Cattle Fattening Businesses in Indonesia

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Abstract: *The growth of cattle farming businesses in Indonesia was investigated by 1) determining the feasibility of investment in cross-breed cattle farming and 2) analysing the competitiveness of such indigenous cattle farming businesses in eastern West Java Province, Indonesia, in this study. Primary and secondary data were collected consecutively from the respondents and related institutions. Early data screening showed that the indigenous farming in the study area mainly adopts two fattening systems. System I takes 12 months per fattening period, and System II takes only six months. With a snowball sampling, 154 indigenous farmers participated in the survey, consisting of 114 farmers who adopted System I with an average of 2 cattle and 40 farmers of System II with an average of 11 cattle. Financial investment feasibility of cross-breed cattle uses the BCR, NPV, IRR, and PPC analyses, which were conducted based on a five-year investment period with a discount factor of 6% annually and included the inflation rate into the formula. Business competitiveness was assessed with the PAM method. The result showed that among the two systems adopted, System II showed signs of financial feasibility and profitability prospects rather than System I. Further results showed System II also exhibited good competitiveness. Therefore, System II was suggested to be adopted to optimize the cross-breed beef cattle fattening business. Nevertheless, this should also be supported by government policies that provide higher positive incentives for the farmers.*

Keywords: *Cross-breed cattle fattening, investment feasibility, Competitiveness.*

I. INTRODUCTION

The globalization of the agricultural sector, including cattle farming, which is an international trade commodity, poses extensive implications, especially in achieving food security, good nutrition, ending hunger, and sustainable farming. Population growth, urbanization, and income growth in emerging countries trigger an increase in global demand for animal-based foods, with the increasing cattle farming production expected to support food security (Espino et al., 2022). Cattle farming plays a crucial and direct role in food security by providing food with protein while benefiting from the local nutritional cycle, electric resources, and cattle manure production (Gerber et al., 2015). Indigenous farmers in Indonesia's rural areas produce around 90% of beef in Indonesia, while only around 10% is produced by commercial farmers (Agus dan Widi, 2018). The slow growth of beef production in Indonesia leads to a large disparity between demand and production, resulting in the increasing beef import to fill in the discrepancies. The beef consumption per capita in 2022 is 2.62 kg per year and is predicted to grow to 2.83 kg in 2025. The Indonesian government needs to import about 41.92% of the future beef consumption (Darmawan, 2021; Directorate General of Livestock and Animal Health, 2021). This condition poses a challenge and an opportunity to improve beef production and productivity, reduce imports, as well as to increase farmers' income through cattle breeding technology. Such studies in regard to the superior cross-breed cattle farming in Indonesia have been rarely conducted. Therefore, this study aims to 1) Determine the feasibility of investment in fattening business in beef cattle farming using superior cross-breed cattle and 2) Analyze the competitiveness of superior cross-breed cattle fattening kept by indigenous farmers in Indonesia. This study's findings are expected to provide information for policymakers in Indonesia and international partners in improving competitiveness and growing beef production in the future.

II. LITERATURE REVIEW

Indonesian farmers have adopted superior breeding technology and cross-breeding cattle since 1980, such as cross-breeding between local cattle with superior breeds with larger body mass through artificial insemination (Widiati et al., 2019). Cross-breeding between Peranakan Ongole (PO) with the Simmental breed from Swiss and the Limousine breed from France resulted in SimPO and LimPO cross-breeds that have larger body mass than PO breeds. Beef cattle farmers prefer the bull cross-breed to be raised in the fattening system because they are generally larger and have more homogeneous body size than PO local breed (Pribadi et al., 2021; Widiati et al., 2019; Widyas et al., 2022).

The challenge to the free trade era in ASEAN starting in 2015 has demanded all countries to improve their competitiveness by increasing their production and economic capacity to support their economic growth., including beef production. Competitiveness can be in the form of comparative and competitive advantage. A corporation gains a competitive advantage when it manufactures or possesses a good or service that its target market considers superior to that of its nearest rivals. Comparative advantage analyzes the economic benefits obtained directly for the country and society as a whole from the presence of abundant resources and the existence of public infrastructure. (Neary,2023). The concept of comparative advantage is economic feasibility, while competitive advantage is financial feasibility for a company or individual involved in an activity. Porter (Porter, 1990) shows from the results of his research that traditional comparative advantages, such as the use of abundant natural resources and labor without considering efficiency pools, have negative impacts. However, it is important that comparative advantage will determine trade direction policies so that trade between countries can be mutually beneficial.

In contrast, competitive advantage influences resource allocation, trade patterns, and trade volume, which tends to increase domestic output in all sectors. Hence, it means that Indonesia's beef production needs to improve its competitiveness to compete with other countries' ability to produce beef. Beef cattle farming also needs to meet the feasibility standard if it wants to attract investment and operate in the long term. To support this objective, the government and business people need to conduct a continuous transformation through government policies and investment that will support the industry to fulfill future needs. Lack of competitiveness in local beef cattle farming will result in a flood of imported goods from other countries with higher competitiveness.

Beef cattle farming can be implemented through three commercial systems: 1) Breeding for six-month-old weaned calves, 2) Rearing to grow weaned calves up to around 1,5 years old, and 3) Fattening of a bull for beef with around 1.5 – 2 years old cattle, and raising heifer as cows replacement (Muninggar et al., 2021). In improving beef cattle production and productivity, Indonesian farmers have adopted superior breeding technology and cross-breeding with local breeds since 1980, such as cross-breeding between Peranakan Ongole with superior breeds with larger body mass through artificial insemination (Widiati et al., 2019). This research focuses on the feasibility of investment analysis (Gittinger, 2008; Takwi, 2021) and analysis of competitiveness ((Monke. E. A. & Pearson. S. R., 1989; Reig-Martínez et al., 2008) of **cross-breed beef cattle** fattening business on indigenous farming from current policy.

III. MATERIALS AND METHODS

A) Research Location and Samples

This study was conducted in the eastern regions of West Java Province, Indonesia. The study site is located next to Indonesia's capital as the largest consumer of beef in the country (Nasrullah, 2020). The data was collected from four districts: Cirebon, Ciamis, Indramayu, and Majalengka, considering its proximity to the toll road to Jakarta, the capital city. Hence providing a large market potential for beef products from the regions. The selected regions have relatively low population density compared to other districts in the province (Nasrullah, 2020; BPS Jawa Barat, 2021). Therefore, opening the potential to develop beef cattle farming that requires farming areas for forage production. Data collection was conducted at the beginning of 2021. The population of indigenous farmers who choose the fattening business for their beef cattle farming using SimPO and LimPO breeds is a hidden population due to the absence of official records in related institutions (Widiati et al., 2019). Samples were selected based on the information from extension workers in the regions. Two indigenous farming systems are implemented in the selected regions. System I is fattening the cattle in a maximum of one year period with an average of 1-3 cattle per farmer. This system is usually applied for cattle prepared for Eid al-Adha demand. System II is fattening the cattle in a maximum of six months period and usually, farmers raise more than three cattle in this system. Snowball sampling resulted in 154 responses, with 114 respondents applying System I and 40 respondents applying System II. In line with the previous study, farmers in System II are mostly commercial farmers, which are a minority in Indonesia with around 10% of total beef cattle farmers (Agus and Widi, 2018).

B) Data Collection Method

This study collected both primary and secondary data. Primary data was collected using a questionnaire-based survey and direct interviews with respondents. The survey was assisted by extension workers' help in the study area. Secondary data was collected from related institutions, including companies in beef cattle fattening and previous findings.

C) Data Analysis

The data analysis conducted to achieve the research objectives are as follows:

a. Investment analysis in cross-breed beef cattle fattening

The first analysis stage in this study is conducting a financial analysis of the investment in cross-breed beef cattle fattening. In this context, an investment is financially feasible when it generates profits and fulfills the financial obligations

of individual or organizational investors (Gittinger, 2008; Takwi, 2021). In this context, the input that will determine the cost of business is the price of SimPo and LimPO calves, feeding cost, medication cost, labor cost, land, and capital.

The stages in investment analysis are: 1) determining the production and economic parameters based on farming management applied by farmers, (2) cash flow analysis, and (3) investment feasibility analysis for five years according to the government stipulation that requires such farmers investment to be completed in a short-term period. Cash flow is a financial report that traces all cash inflow and outflow in a business. The next analysis is investment feasibility by considering the discount factor, inflation, and the length of the investment period to determine its prospective profits and risks (Eton et al., 2015 2015; Marsudi et al., 2021). The assessment of investment feasibility was conducted using net present value (NPV), benefit-cost ratio (B/C), and internal rate of return (IRR) for the investment period (Gittinger, 2008).

The detailed investment assessment formula is as follows:

i. Net Present Value (NPV)

$$\text{NPV} = n(t=1)\frac{Bt}{(1+i)^t} - n(t=1)\frac{Ct}{(1+i)^t} = n(t=1)\frac{Bt-Ct}{(1+i)^t} \quad \text{..... (1)}$$

Notes:
Bt: profit in t-year
Ct: cost in t-year
t: total year of investment (t= 1. 2. 3…. n). might start with year 1 depending on the business characteristics
I: discount factor at t-year

ii. B/C Ratio

$$\frac{B}{C} = \frac{n(t=1)\frac{Bt-Ct}{(1+i)^t}}{n(t=1)\frac{Bt-Ct}{(1+i)^t}} \quad \text{……..…… (2)}$$

Notes:
Bt: profit in t-year
Ct: cost in t-year
t: total year of investment (t= 1. 2. 3…. n). might start with year 1 depending on the business characteristics
I: discount factor at t-year

iii. Internal Rate of Return (IRR)

$$\text{IRR} = i_1 + \frac{NPV_1}{NPV_{1-NPV_2}} \text{ x } (i_2 - i_1) \quad \text{.....(3)}$$

Notes:
i1: discount rate for positive NPV
i2: discount rate for negative NPV
NPV1: positive NPV
NPV2: negative NPV

iv. Payback Period

$$\text{Payback Period} = \text{n} + \frac{a-b}{c-b} x1year \quad \text{……..(4)}$$

Notes:
n: Last financial period cash flow before the payback period
A: Total initial investment
B: Total cash cumulative at the n-th year
c: Total cumulative cash flow at the n + 1 year

All financial analyses are conducted in Microsoft Excel 2007.

b. Competitiveness analysis for SimPo and LimPo beef cattle fattening

The second analysis in this study is conducting the competitiveness analysis on cross-breed beef cattle fattening using an economic approach. The economic aspect is a vital factor in determining the impact of public sector investment in the agricultural sector. The economic aspect determines the economic impact and efficiency of a project or economic activity

on the general economic development after considering the allocation of limited resources (Gittinger, 2008; Takwi, 2021). The competitive analysis in this study is conducted using the Policy Analysis Matric (PAM) method. The first stage of PAM is determining the input and output of cross-breed beef cattle fattening and considering the private and social prices. The input in beef cattle farming can be categorized into tradable and non-tradable inputs. The output of beef cattle farming is fattened cattle that are ready to be slaughtered. The following step is to determine the social price or the shadow price based on the cost of insurance and freight (CIF) (Reig-Martínez et al., 2008). PAM is adopted as the basis for analysis in this study (Monke. E. A. & Pearson. S. R., 1989; Reig-Martínez et al., 2008) with the calculation method explained in Table 1.

Table 1: Policy Analysis Matrix

Notes	Revenue	Cost		Profit
		Foreign Input (Tradable Input)	Domestic Input (non Tradable Input)	
Private Price	A	B	C	D
Social Price	E	F	G	H
Divergence	I	J	K	L

Notes:
A = Private Revenue
B = Private Tradable Cost
C = Private non Tradable Cost
D = Private Profit = A- (B+C)
E = Social Revenue
F = Social Tradable Cost
G = Social non Tradable Cost
H = Social Profit = E – (F + G)
I = Transfer output = A – E
J = Transfer tradable cost = B - F
K = Transfer Factor = C - G
L = Net Transfer = I – (K + J)

Notes: Revenue is total output x price
Cost is total input x price

The government policy impact can be assessed from PAM analysis (Table 1) consisting of the following indicators (Kassali et al., 2022; Monke. E. A. & Pearson. S. R., 1989; Reig-Martínez et al., 2008; Yuzaria D. & Suryadi D, 2011).

c. **Government policy impact on farming output measured using Nominal Protection Coefficient Output (NPCO):**

$$\text{NPCO} : \frac{\textit{Private Revenue}}{\textit{Social Revenue}} = \frac{A}{E} \quad \text{.......} \quad (5)$$

Decision-making criteria:
1. NPCO < 1, producers do not receive output protection from the government
2. NPCO > 1, producers receive output protection from the government

d. **Government policy impact on tradable input. Measured using Nominal Protection Coefficient Input (NPCI):**

$$\text{NPCI} : \frac{\textit{Private Tradable Cost}}{\textit{Social Tradable Cost}} = \frac{B}{F} \quad \text{.......} \quad (6)$$

Decision-making criteria:
1. NPCI < 1, producers receive input protection from the government
2. NPCI > 1, producers do not receive input protection from the government

e. **The government policy impact on input and output can be determined using:**
Net Policy Transfer (NPT)

NPT = Private Profit (D) – Social Profit (H) ………………………………….. (7)

Decision-making criteria:
1. Positive NPT indicates positive impact of government policies
2. Negative NPT indicates no positive impact of government policies

Effective Protection Coefficient (EPC)

$$\text{EPC} : \frac{\textit{Private Revenue} - \textit{Private Tradable Cost}}{\textit{Social Revenue} - \textit{Social Tradable Cost}} = \frac{A-B}{E-F} \quad \text{……………………………(8)}$$

Decision-making criteria:

1. EPC < 1, government protection over the tradable input and output for producers is not effective
2. EPC > 1, government protection over the tradable input and output for producers is effective

Profit Coefficient (PC)

$$\text{PC} = \frac{\textit{Private Profit}}{\textit{Social Profit}} = \frac{D}{H} \quad \text{………………………………………………………………..(9)}$$

Decision-making criteria:

1. PC < 1, government policy does not provide incentives for producers
2. PC > 1, government policy provides incentives for producers

Subsidy Ratio to Producers (SRP)

$$\text{SRP} = \frac{\textit{Net Transfer}}{\textit{Social Revenue}} = \frac{L}{E} \quad \text{……………………………………………………………(10)}$$

Decision-making criteria:

1. SRP < 0, producers do not receive protection from the government
2. SRP > 0, producers receive protection from the government

Next, we analyze the comparative advantage of the business based on the social price. Comparative advantage is the ability to generate performance through better resource management than its competitors. PAM analysis shows comparative advantage by determining the domestic value of domestic resource cost (DRC) as a ratio between domestic factor costs and added value for output generated from traded domestic factors cost. While competitive advantage is assessed by measuring the coefficient score for the private cost ratio (PCR). PCR is a ratio between domestic factor cost and value-added for output generated from domestic factor cost traded at the producer or private price levels. The PAM analysis refers to the analysis explained in Table 1.

f. Following the formula for DRC and PCR calculations:

$$\text{PCR} = \frac{\textit{Non Tradable Input at Private Price}(C)}{\textit{Revenue at Private price } (A) - \textit{Tradable Input at Private price } (B)} \text{………………………… (11)}$$

Decision-making criteria:

1. PCR < 1 indicates a competitive advantage in the business
2. PCR > 1 indicates no competitive advantage in the business

$$\text{DRC} = \frac{\textit{Non Tradable Input at Social Price}(C)}{\textit{Revenue at social price}(E) - \textit{Tradable Input at social price}(F)} \quad \text{……………………..,……. (12)}$$

Decision-making criteria:

1. DRC < 1 indicates comparative advantage in the business
2. DRC > 1 indicates no comparative advantage in the business

IV. RESULTS AND DISCUSSION

A) Respondent Identity

The identity of respondents is summarized in Table 2. Table 2 shows that, on average, farmers implementing system I only have two cattle, while farmers implementing System II have 11 cattle at one time. The data is in accordance with previous studies that, in general, indigenous cattle farming in Java island was on a small scale of 1-3 cattle (Widiati and Widi, 2016). Outside Java, indigenous cattle farming tends to have a similar fashion. A study in Kupang district, Nusa Tenggara Timur, Indonesia, showed that the scale for System I is around 1 - 4 cattle, while System II is around 6 - 13 cattle (Aplunggi et al., 2017). Regardless of the selection of the raising method, most of the farmers have elementary-level education with beef cattle farming experience of 5-10 years. Farmers implementing system I have longer cattle farming experience because most indigenous beef cattle farmers have between 1-3 cattle that they raise for years from one generation to another to produce calves (Widiati and Widi, 2016). Indigenous beef cattle farming in emerging countries tend to share similar attributes with their small scale and vital contribution to supporting farmers' livelihood (Dung et al., 2019).

Table 2. Characteristic Respondent

No	Characteristics	System I (n=114)		System II (n=40)	
		Total	(%)	Total	(%)
1	**Age**				
	16 - 25 years	4	3.51	0	0
	26 - 35 years	10	8.77	5	12.5
	36 - 45 years	39	34.21	10	25
	46 - 55 years	34	29.82	15	37.5
	56 - 65 years	24	21.05	9	22.5
	> 65 years	3	2.63	1	2.5
2	**Education**				
	Not completing elementary school	1	0.88	0	-
	Elementary School	77	67.54	23	57.5
	Junior Highschool	18	15.79	7	17.5
	Senior Highschool	18	15.79	7	17.5
	University/Higher education	0	0	3	7.5
3	**Side job (besides cattle farming)**				
	Food crops farmer	89	78.07	13	32.5
	Cattle farmer	9	7.89	18	45
	Others (Government and Private)	16	14.04	9	22.5
4	**Cattle farming experience**				
	1 - 5 year	36	31.58	15	37.5
	6 - 10 year	66	57.89	18	45
	11 - 15 year	10	8.77	4	10
	16 - 20 year	2	1.75	3	7.5
5	Resources (Average)				
	Number of Cattle fattening (head)	2	100	11	100
	Farming area (m2)	435	100	1460	100
	Family laborer	2	100	3	100

B) Revenue, Cost, and Net Income of Cross-Breed Beef Cattle Fattening Business

The production and economic parameters in the cross-breed beef cattle fattening business that affects its cost and revenue are 1) Cattle feeding and its price, 2) calves and its price, 3) labor cost, 4) cattle medicines, 5) selling price of fattened cattle, and 6) the increase in the selling price between calves price and fattened cattle.

These parameters are used as the basis for investment feasibility analysis. The analysis used in this study is a normative method using the mean score from System I and System II, as summarized in Table 3. Data in Table 3 shows that beef cattle raised in system I have relatively higher selling prices than those in System II. This condition occurs because most farmers who adopt this system raise cattle in small numbers for almost a year and sell them during the Eid al-Adha celebration at a higher price. However, the net income per cattle generated from System I is lower than System II, showing that System I incurred more costs than System II. Hence, it seems less efficient (Table 3). The data in Table 3 are used to prepare a cash flow with a projection for the following five years using the average inflation in West Java Province from 2016 to 2020 of 3.91% (BPS-Jawa Barat, 2021). The results of cash flow projection are used as the basis to compute the investment feasibility analysis.

Table 3. Mean score of revenue and income in SimPO and LimPO cattle fattening

Item	IDR/cattle		IDR/Year/respondent	
Revenue	**System I**	System II	**System I**	System II[*)]
Calves price	25,498,684	23,066,010	50,997,368	507,452,222
Total Revenue	**25,498,684**	**23,066,010**	**50,997,368**	**507,452,222**
Costs				
1. Fixed Cost				
Electricity	144,789	47,114	289,579	1,036,500
Labor	960,510	294,431	1,921,021	6,477,473
Cowhouse renovation	723,684	472,727	1,447,368	10,400,000
Total Fixed Cost	**1,105,300**	**341,544**	**2,210,600**	**7,513,973**
2. Variable cost				
Calves Price	14,939,035	13,562,727	29,878,070	298,380,000

Forage Price	1,519,520	1,173,854	3,039,039	25,824,795
Concentrated Fodder	2,229,527	915,709	4,459,053	20,145,600
Medicines	86,206	60,455	172,412	1,330,000
Transportation	524,561	356,818	1,049,123	7,850,000
Total Variable Costs	**20,022,533**	**16,542,291**	**40,045,066**	**353,930,395**
Capital interest (6%)	1,448,385	1,013,976	2,896,770	22,307,475
3. Total Costs	**22,576,218**	**17,897,811**	**45,152,435**	**393,751,842**
Net income	**2,922,467**	**5,168,199**	**5,844,933**	**113,700,380**

Source: *processed primary data, 2022*

Notes: *)System II has two rounds of fattening process in a year @ 6 months/period
USD exchange rate $1 = IDR 15,000.00 (BPS, 2022).

C) Investment Feasibility Criteria

Investment feasibility criteria are assessed using the generated cash flow, a discount factor of 6% following the micro-credit (KUR) interest rate investment for small businesses from the government Ilham et al., 2022. The result of the financial analysis of beef is summarized in Table 4.

Table 4. Financial investment feasibility analysis for cross-breed beef cattle fattening in System I and II (time period of 5 years, discount factor 6%/year)

Notes	System I	System II
NPV (IDR/5 years)	- 22,418,966	118,326,372
B/C ratio	0.91	1.06
IRR (%)	-	16.32%
Payback period (PP)	Payback not achieved in five years	3 years 3 months
Assessment result	Not feasible	Feasible

Source: *processed primary data 2022*

The result of the investment feasibility analysis showed that among the two raising methods, System II is feasible for farmers based on its positive NPV, B/C ratio > 1, IRR higher than discount rate of 6%, and PP of three years and three months that is lower than the investment period (Table 4). However, despite its feasibility, we should not forget that System II needs large capital with a commercial approach, as stated by previous findings (Diatmojo et al., 2012; Taek et al., 2021; Rademaker et al., 2017)

Previous studies (Mariyono, 2019; Ilham et al., 2022) showed that technology adoption could affect farmer's welfare through credit disbursement. This study finds an IRR for System II of 16.32%, indicating that even 12% loan credit will still generate profit for farmers because it is below the IRR despite lowering the profit rate. Farmer's access to credit is affected by their socio-economic condition. Farmer's opportunity to access microcredit will increase by 14.4% through intensive socialization and technological innovation ($p<0.01$) (Mariyono, 2019) because it will help farmers to understand the benefits, features, and how to access microcredit. In this study, farmers could also receive support in the form of cross-breed cattle that have larger body mass, which will bring a direct impact, especially for farmers implementing System II. However, considering the education level of farmers who mostly graduated from elementary school (Table 2), it is important to improve farmers' education through formal or non-formal education to improve the beef cattle farming production and allow farmers to manage their beef cattle farming business better, besides providing information on accessible credit scheme.

D) Competitiveness Analysis on Cross-Breed Beef Cattle Fattening Business

A policy analysis matrix (PAM) is adopted as a basis for determining the competitiveness of the beef cattle fattening business. The result of PAM analysis according to the formula in Table 1 detailing the revenue, costs, and private and social profit is exhibited in Table 5.

Table 5. Private and social profit in System I and II (IDR)

Notes	Revenue			Profit
		Tradable Cost	Domestic	
System I				
Private	22,080,702	17,931,448	3,824,657	324,596
Social	21,686,529	15,433,084	3,266,843	2,986,603
System II				
Private	23,200,000	18,168,931	2,246,055	2,785,014
Social	21,339,545	15,948,826	1,727,907	3,662,811

Source: *processed primary data 2022*

Table 5 shows that private profit for each cattle in System I is lower than in System II, due to lower domestic cost in System II (Tabel 5). System I or indigenous farmers in Indonesia often have limited land and capital, so they use larger domestic resources as their social costs, e.g., using family as labor, forage from their surroundings, and farming waste. Therefore, under explicit calculation, the business is not feasible under a certain time period. In this context, if the beef cattle fattening is directed to commercialization as applied in System II with explicit cost consideration. However, if the initial investment is higher, private profit will be more sustainable. This result aligns with the investment analysis that system I with only two cattle and the explicit costs are not feasible.

The generated profit is affected by the cultivation period, total cattle, production costs, and capital used. This aligns with (Bahta and Baker, 2015; Indrayani and Andri, 2018) that factors that affect indigenous farmers' income are the cultivation system, business scale, production cost (forage, medicine, and labor), and capital.

The following analysis of government policy impact on output is shown in the Nominal Protection Coefficient Output (NPCO) in Table 6. The analysis of government policy impact on tradable input is shown in the Nominal Protection Coefficient Input (NPCI), and its impact on the input and output is shown in the indicator Net Policy Transfer (NPT), Effective Protection Coefficient (EPC), Profit Coefficient (PC), and Subsidy Ratio to Producers (SRP). Lastly, PRC analysis is conducted to determine the competitive advantage, and DRC analysis to determine comparative advantage.

The calculation shows NPCO >1, which indicates that government policy has protected farmers against the output price by 2% above the international price in System I and 9% in System II. Both methods of implementation produce higher output prices than the international price. This poses an empirical evidence that the Indonesian government's policy in protecting the beef price in the market is quite effective as previous findings (Rouf, 2014; Widiati, 2014; Kassali et al., 2022).

Table 6. PAM result for cross-breed beef cattle fattening

Item	System I	System II	Notes
NPCO	1.02	1.09	NPCO < 1, farmers do not receive output protection from the government NPCO > 1, farmers receive output protection from the government
NPCI	1.16	1.14	NPCI < 1, farmers receive input protection from the government NPCI > 1, farmers do not receive input protection from the government
NPT	-2.662. 007	-877. 797	Positive NPT government policy has a positive impact Negative NPT, government policy has no positive impact
EPC	0.56	0.93	EPC < 1, ineffective government protection on tradable input and output for farmers EPC > 1, effective government protection on tradable input and output for farmers
PC	0.11	0.76	PC < 1, government policy does not provide incentives for farmers PC > 1, government policy provides incentives for farmers
SRP	-0.12	-0.04	SRP < 0, farmers are not protected by the government SRP > 0, farmers are protected by the government
PCR	0.92	0.45	PCR < 1, beef cattle fattening has a competitive advantage PCR > 1, beef cattle fattening has no competitive advantage
DRC	0.32	0.52	DRC < 1, beef cattle fattening has a comparative advantage DRC > 1, beef cattle fattening does not have a comparative advantage

Source: *processed primary data 2022*

The NPCI > 1 value shows that the private price of tradable domestic input is higher than its social price. This value indicates that farmers incur higher tradable input costs in System I (16%) and System II (14%) than the social price. Government policy has not brought a positive impact on beef cattle farmers assessed from the negative NPT score. A similar result is shown on the tradable input and output policies reflected in EPC < 1. This result indicates that both System I and II are not effective and do not provide incentives for farmers due to PC<1 score. This condition is supported by the result showing that farmers have not received adequate protection from the government, as reflected in the SRP < 0 score. The result of competitiveness analysis using PCR on System I and II returned a score < 1, indicating that the business has a competitive advantage. However, the PCR score for System I is closer to 1, suggesting that System I does not have a competitive advantage. System II has a better competitive advantage based on a PCR score of 0.45, meaning that to generate 1 IDR of value added on output based on private price, farmers need IDR 0.45 in domestic resources in their activities. This finding aligns with (Rouf et al., 2014; Indrayani, 2011) that PCR < 1 reflects the competitive advantage of a commodity. PCR score of < 1 is also affected by government policy regarding cattle import (Yuzaria and Suryadi, 2011). Competitive advantage can also be seen from sales that cover the production cost and serve profit for beef cattle farmers. The analysis of System I and II shows

a score of DRC < 1, which indicates that the cost for domestic resources is lower than the output-added value of beef cattle farming. Hence, it shows a comparative advantage. Beef cattle fattening exhibits economic efficiency in utilizing domestic resources because farmers only need IDR 0.32 in System I and IDR 0.52 in System II to generate IDR 1 added value. The ability to fulfill the need for beef through local products will comparatively save 68% for System I and 48% for System II of foreign exchange from import fees. Thus, the use of domestic resources in cross-breed beef cattle fattening in the country will reduce the opportunity cost sacrificed to gain foreign exchange (Yuzaria & Suryadi, 2011). However, investment is not feasible for System I. Based on the results, the beef cattle indigenous farmers business in Indonesia tends to continue but is likely not growing in the future. On the other hand, the empirical evidence in this study found that farmers with System II would have competitive and comparative advantages that can be developed further to increase beef production in the country.

V. CONCLUSION

Results of this research showed that system II, with the maintenance of 11 heads of cross-breed beef cattle for a six-month fattening period, is financially feasible and profitable for indigenous breeders in West Java, Indonesia, compared to system I, with the maintenance of only 2 heads. Moreover, system II has a better competitive advantage so that resource allocation, trade patterns, and trade volume can increase domestic beef cattle output. Therefore, system II was suggested to be adopted to optimize the cross-breed beef cattle fattening business. Nevertheless, this should also be supported by government policies that provide higher positive incentives for the farmers.

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