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Evaluation of Factors Affecting Farmers' Calves Rearing Decision in West Java by Participatory System Analysis Approach

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ABSTRACT

This research aimed to determine factors affecting farmers' calves rearing decision and further determine which of the factors were categorized as the critical elements on the practice as well. A qualitative method was used in this research, where beef and dairy cattle farmer groups, dairy cooperative staffs, and regional department of livestock and animal health staffs were questioned as the source of information and data collection. The research area covered Tasikmalaya and Kuningan District for beef cattle rearing, while for the dairy cattle rearing covered Bandung and West Bandung District. The obtained data were then analyzed through Participatory System Analysis (PSA) approach. The results showed that factors which affect farmer's dairy calves rearing decision were high-cost production, long rearing time, calves rearing status as a secondary income source, and reared calves' quality. Furthermore, the results of this research also showed that the critical elements the decision were calves rearing status as secondary income and calves' quality.

Keywords: Beef cattle, Calf, Dairy cattle

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Introduction

Livestock products, especially beef, have become a political commodity regarding its fluctuating prices, in which urge the government to intervene to solve the pricing problem. Beef price remained at more than Rp100.000/kg still even when market operations by the government have been done (Kementerian Industri dan Perdagangan Jawa Barat, 2016). The condition thus indicates that beef commodity is categorized as elastic goods, in which an increase of the beef price will be responded with a decrease on consumer's meat consumption, or in another even though beef price remains high, it would still be bought by the consumer but in a lower volume (Rusdi and Suparta, 2016; Handayani *et al.*, 2016). Only 70% of the beef demands are fulfilled by local livestock farmers, while the remaining 30% were still fulfilled through import, whether in the form of calves or beef (Rusastra, 2014). On the other hand, the government had implemented import limitation policy for calves and frozen beef in 2011. The implementation of the policy was then followed by a massive slaughter of local cattle, including productive cows and dairy cattle, caused by the increase of beef price triggered by beef scarcity. A further impact will be on the continuous exploitation of local cattle, resulting in

beef stock depletion in the future. Moreover, the impact of the beef import limitation policy will harm the beef market and ignites a negative reaction from consumers (Pulungan, 2014).

One of the efforts to suppress negative impacts of massive local cattle slaughtering is through cattle breeding practice, in which aimed to save local germplasms from extinction. Farmers have been practicing cattle breeding to produce desired calves. The practice would provide additional income for the farmers, yet it is still rarely done by small scale-farmers due to the high production cost. It should be noted that in Indonesia, most of the cattle farmers are small-scale farmers which only raised around 1-4 cattle (Nurtini dan Anggriani, 2014). The condition is further aggravated by the condition that most farmers still consider stock replacement is less beneficial compared to buy pregnant heifers directly. The common factor for farmers in choosing pregnant heifers is solely based on the heifers' exterior body, without knowing its milk producing capacity and rearing history. This resulted in a high risk of bad decision making, such as buying low-quality cows and calves, buying cows and calves with low productivity, and in the end, the decision harm farmers themselves (Supartini dan Darmawan, 2014; Mahyudin *et al.*, 1997).

Calves are young cattle born by both beef cows or dairy cows, usually defined as newly born cow until weaning period. For dairy calves, the weaning age is around 3 months old while for beef calves it could reach up to 6 months (Soekardono *et al.*, 2009; Hadijati, 1995). Calves are commonly selected for bull or cow replacement or known as replacement stock. It has been a common practice for livestock farmers in Indonesia to select their own replacement stock for unproductive bull or cows.

The calves' mortality rate in Indonesia is relatively high, reached around 5 to 26% (Toharmat, 2009; Kusuma *et al.*, 2017). The critical period in calves' mortality is during the birthing process to the weaning age or around 3 months old, mainly caused by diarrhea from the improper feed, noting that calves' rumen is not ready yet to consume low-quality feed. Calves' weaning for dairy calves can be started from one-month age to reduce the feed cost during calves rearing, but it also held a high risk of mortality due to disease, abortion, defect, navel inflammation, pneumonia, worm infection, in-born prolapses uteri and weak (Sodiq, 2011; Thau, 2004; Yusmichad *et al.*, 1995).

There are a lot of dairy farmers, especially in West Java, who tend to avoid calves rearing regarding the high production cost of the practice (Firman *et al.*, 2010). They prefer selling their dairy calves to obtain additional income. The different condition is shown in beef cattle farmers, who raised their beef calves as the produced beef cattle will depend on the calves rearing management. Generally, beef cattle farmers in West Java prefer Simmental or Limousin breed, and calves from other breeds are rarely reared.

The farmers' decision phenomenon to rear their calves has become a distinctive problem to the beef and dairy industry in West Java, especially considering that this province is the center for national dairy cows' development. According to Ditjen PKH (2016), West Java province has the highest dairy cows, raised around 26% (135,345) dairy cows nationally, but only raised 444,999 beef cattle or 2.89% of the national beef cattle.

This researched aimed to determine factors affecting farmers' decision to rear their calves, and what of the factors are the critical elements in the decision making, with the current hypothesis showed that it is mainly affected by economic factors. Participatory System Analysis (PSA) approach was done to determine the affecting factors and its critical elements to the decision making. PSA method promotes an

approach to participants, aimed to obtain facts and information through Focus Group Discussion (FGD) to the matters related to dairy calves rearing.

Materials and Methods

This research was done from October to November 2015 in Cibimbing Sub-district (Kuningan District) and Cipatujah Sub-district (Tasikmalaya District) for beef cattle, while for dairy cows was done in Pangalengan Sub-district (Bandung District) and Lembang Sub-district (West Bandung District). The research area was selected from purposive sampling, regarding that Tasikmalaya District has a high beef cattle population (12.30%) in West Java, while Kuningan District is adjacent to Central Java Province with 6.03% of the beef cattle population in West Java (Dinas Peternakan Jawa Barat, 2015). West Bandung District and Bandung District are the centers of dairy farms in West Java, with each has 29.06% and 32.32% of dairy cows in West Java (Table 1).

A qualitative method was used in this research, based on the natural conditions of research objects, without any experimentation from researchers as the key instrument (Sugiyono, 2009). The data was collected by Participatory System Approach (PSA) from participants or informants. The informants were selected by accidental sampling based on ease of access.

Forum group discussion (FGD) on beef calves rearing with PSA approach was done in the Department of Livestock, Fisheries, and Marine Tasikmalaya District office by inviting the leader and secretary of Tani Jaya Tasikmalaya and Giri Karya Kuningan farmers group, and also a Department of Livestock, Fisheries, and Marine representative staff from Tasikmalaya and Kuningan office. The similar FGD with PSA approach for dairy calves rearing was done in the Department of Livestock and Fisheries Bandung District office by inviting the leader and secretary of Cibodas and Los Cimaung farmer groups, a Department of Agriculture, Plantation, Livestock, and Fisheries representative staff from West Bandung and Bandung office, and a representative from Dairy Cooperatives in North Bandung (KPSBU) and Livestock Farmers Cooperative in South Bandung (KPBS).

Participatory System Analysis (PSA) is a focused discussion method to find the important factors or critical elements from a project based

Table 1. Research area

Commodities	Research area		Reasons
	District	Sub-district	
Beef Cattle	Kuningan	Cibimbing	High beef cattle migration
	Tasikmalaya	Cipatujah	Highest beef cattle population
Dairy Cattle	Bandung	Pangalengan	Highest dairy cattle population
	West Bandung	Lembang	Highest dairy cattle population

on the background, knowledge, experiences, and specialties of each participant (Herweg and Steiner, 2002). This method is divided into 4 (four) steps, as described below: 1) The first step is determining the factors and its definition by the informants, followed by factors selection and determination done by all participants, 2) The second step is determining the relation between factors, aimed to observe the correlation between one factor to the other (Table 2). 3) The relationship power was scored based on the following criteria: (a) Value of 2 indicate a strong relationship; (b) Value of 1 indicate a medium relationship; (c) Value of 0.5 indicate a weak relationship; and (d) Value of 0.1 indicate a very weak relationship, 4) The third step is factor analysis based on Table 2, aimed to understand the active ratio and degree of interrelation. The active ratio was measured by dividing AS with PS(AS/PS), and the degree of interrelation was determined by AS-PS on each factor, 5) The final step is to determine the result of activity ratio and degree of interrelation measurement, presented in the form of quadrant graphs, divided into 4 quadrant parts, which were Symptom, Buffer, Critical Elements, and Motor/Lever. Symptom quadrant represents which factors were strongly affected by the other and did not have the power to alter the system. Buffer quadrant represents which factors were not affected or affecting other factors. Critical Elements quadrant represent which factors accelerate and catalyze the system, thus should be understood in detail as it can be changed over time and yields a side effect to the system. Motor/Lever quadrant represent which of the predicted factors can affect other factors.

Result and Discussion

Beef and dairy calves rearing potential in the research area

Tasikmalaya District has the highest beef cattle farming potential in West Java, raised up to 52,363 (11.75%) beef cattle, while Kuningan District had about 25,675 (6.03%) beef cattle population in 2015. (BPS Jawa Barat, 2016). West Bandung and Bandung District each had the highest dairy cow population, reaching 37,622 (32.32%) and 33,824 (29.06%) dairy cows respectively. Both West Bandung and Bandung District are the centers of dairy cow farming, thus, in theory, dairy cow population should be

increased in the area. However, there was a decrease in the dairy cow population, affected by the implementation of calves and beef import limitation policy in 2011. The policy caused an increase in the beef price, triggering massive productive cow slaughters in both areas as the high beef price offered a promising benefit for the farmers.

Based on the data from cooperatives and livestock departments on each research area, the calves' production potential is presented in Figure 1. It can be seen that the total produced calves from all areas were 19,251 calves, where Tasikmalaya District produced the highest calves (9,976 calves). This indicates that calves' production potentials in West Java are relatively high.

Factors affecting farmers' beef and dairy calves rearing decision

The first step in the PSA method is determining which factors affect calves rearing decision of the farmer. Each informant wrote out several factors based on their experiences and knowledge during PSA, and then several factors which really affect the decision were selected and determined. The determined factors were (1) its status as secondary income source (2) land limitation, regarding that the majority of cattle farmers utilized their own yard for cattle rearing which only able to accommodates around 1-3 cows; (3) forage limitation, which burden farmers during dry season, as carrying capacity become low and forage availability become limited, foster farmers to seek alternatives such as leucaena and calliandra leaves or banana stems; (4) high sale value, which represent farmers' expectation of cattle prices after calves rearing; and (5) easy rearing practice, noting that beef calves rearing is considered easier as its weaning period started from 6-7 months old. Another opinion stated that beef calves rearing was also affected by its breed, where limousine and Simmental breeds are favored (Susanti *et al.*, 2015).

Factors which affect dairy calves rearing decision include (1) high production cost, regarding that calves rearing required relatively high cost without providing any income during rearing period; (2) dairy calves rearing required relatively long time, around 15-24 months until it can be milked (Awan *et al.*, 2016); (3) selling dairy calves directly could provide secondary income to

Table 2. Power scoring between factors' relationship

Factors	A	B	C	D	etc	Active sum (AS)	The degree of interrelation (AS-PS)
A	■						
B		■					
C			■				
D				■			
Etc					■		
Passive sum (PS)							
Active ratio (AS/PS)							

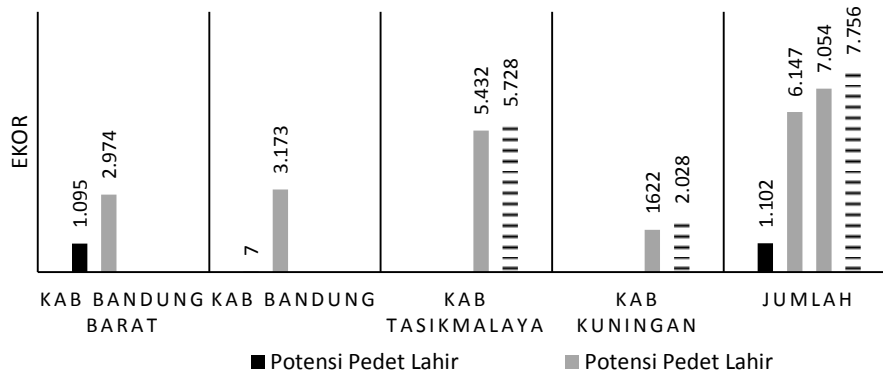


Figure 1. Calves' production potential in the research area in 2014
 (Source: RAT KPBSU report (2015); SKPD Department of Livestock, Fisheries, and Marine in Tasikmalaya District (2015); and Department of Agriculture, Livestock, and Fisheries in Kuningan District (2015).

the farmers compared to rearing until milking period; and (4) dairy calves' quality breed from a good quality cows with good milking records, thus expected to yield high milk production (Galuh *et al.*, 2014; Supartini dan Darmawan, 2014; Mahyudin *et al.*, 1997).

Critical elements in calves rearing

Calves rearing practice between beef calves and dairy calves done by the farmers were relatively different. Most of the dairy farmers reared female calves for replacement stock, while beef farmers reared male calves to be sold after reaching a certain age. Based on factors selection as described before, relationship power between each factor was determined. The result of factors relationship power determination was presented in the form of matrix correlation as presented in Table 3 and 4. The result of the matrix on Tabel 3 and 4 was presented as an activity ratio and degree of interrelation table to determine each factors position in the quadrant (Table 5).

The coordinate determination on each factor becomes important to observe how each factor affects the system. Table 5 was transformed in the form of a diagram to see each factors' position in each respective quadrant. The result on factors transformation can be seen in Figure 2 and 3.

Figure 2 describes each factors position which affects the beef calves rearing decision in the quadrant. Furthermore, it can be seen that not all of the quadrants were filled by those five

affecting factors. The explanation of each factor was as follows: 1) Secondary income source as symptom element, in which this factor was highly affected by other factors and did not have any power to alter the system. This factor is highly depended on the farmers themselves, in which calves rearing was considered as a secondary income source for them, 2) Easy rearing practice, located between buffer and motor category. This factor was categorized as a buffer when it did not affect nor get affected by other factors, and categorized as a motor when it was predicted to be able to affect other factors, 3) High sale value was categorized in the buffer which means that it did not affect nor get affected by other factors. This explains why selling price was not a critical factor in cattle calves rearing, 4) Land and forage limitation was categorized in critical elements, noting that it accelerates and catalyze the system. Moreover, this factor should be understood in detail as it can be changed over time and yield side effect to the system. Land and forage limitation were the critical elements in beef calves rearing and were the determinant factors whether farmers reared their calves or not.

Land and forage were the critical elements in calves rearing as both factors highly affect the system and could inhibit farmers' calve rearing decision. This was the real condition on field practice because most of the beef farmers still struggled on land and forage limitation. Hernowo *et al.* (2012) stated that became the deciding factors for calves rearing in Wonogiri District were

Table 3. The relationship between factors affecting beef calves rearing

Elements	1	2	3	4	5	Active sum	Degree of interrelation
						(AS)	(PS*AS)
Secondary income source		0,5	0,5	0,1	2,0	3,1	13,0
Land limitation	2,0		2,0	0,1	0,1	4,2	11,3
Forage limitation	2,0	2,0		0,1	0,1	4,2	11,3
High sale value	0,1	0,1	0,1		0,1	0,4	5,3
Easy rearing practice	0,1	0,1	0,1	2,0		2,3	5,3
Passive sum (PS)	4,2	2,7	2,7	2,3	2,3		
Activity ratio (AS/PS)	0,7	1,6	1,6	0,2	1,0		

Table 4. The relationship between factors affecting dairy calves rearing

Elements	1	2	3	4	Active sum	Degree of interrelation
					(AS)	(PS*AS)
High production cost		2,0	1,0	1,0	4,0	24,0
Long rearing time	2,0		0,1	1,0	3,1	15,5
Secondary income source	2,0	2,0		2,0	6,0	18,6
Calves' quality	2,0	1,0	2,0		5,0	20,0
Passive sum (PS)	6,0	5,0	3,1	4,0		
Activity ratio (AS/PS)	0,7	0,6	1,9	1,3		

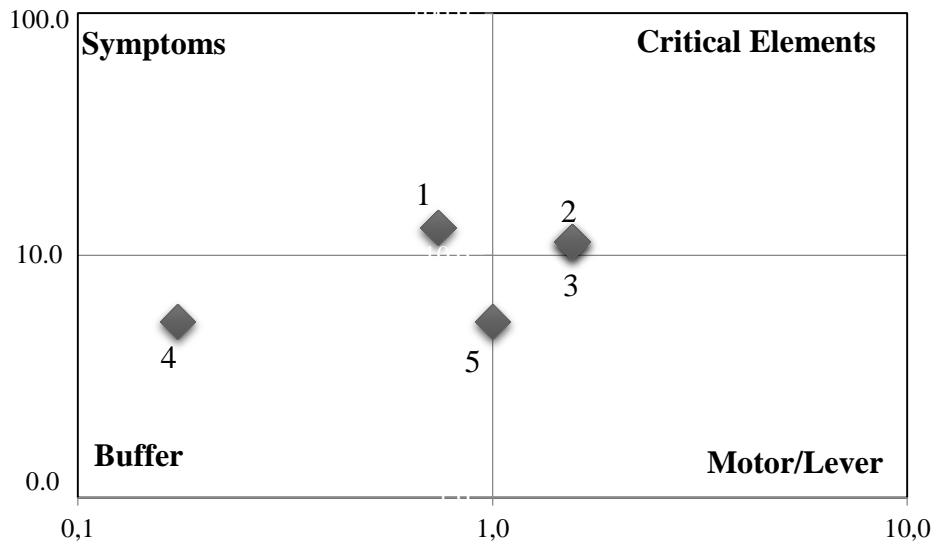


Figure 2. The position of the factors affecting beef calves rearing in the quadrant.

(1) human resource, especially their experiences and age to be able to apply semi-intensive and commercial technologies; (2) calves' breed, where breeds which more resistant to disease were more favorable. The breed could be obtained from inside or outside their farming area which based on the cattle price prediction; and (3) production facilities, in which its waste and by-products should be utilized maximally.

Factors which affect dairy calves rearing decision can be seen in Figure 3. The explanations were as follows: 1) High production cost and long rearing time were categorized as symptom element, in which these factors were highly affected by other factors and did not have any power to alter the system. The cost required for calves rearing until reached productive age was relatively high. Moreover, the rearing time was also long, as it required 15-24 months of rearing until it can bear its first calves. A research done by Latifah *et al.* (2015) in Pangalengan Sub-district, Bandung District, and Tanjungsari Sub-district, Sumedang District, showed that calves rearing until it reached 15-months old and ready to be inseminated costed Rp10,617,336/calf while rearing until 3-months pregnant calf costed Rp13,351,509/calf. Furthermore, the price for

ready to be inseminated calves and 3-months pregnant cows was Rp9,500,000/calf and Rp12,600,000/calf respectively. Thus, farmers will rear their dairy calves when the production cost was not high, 2) Secondary income source and calves' quality were categorized as critical elements. These factors were categorized as critical elements as both factors accelerate and catalyze the system. Moreover, these factors should be understood in detail as they could be changed over time and yield a side effect which alters the system. Secondary income source from selling the calves and calves' quality were the critical elements in calves rearing decision. Calves will be sold if farmers had an urgent need, and reared if the calves had good quality.

The development of a dairy farm should consider the farming status as a secondary income source and the calves' quality. A good calves' price could trigger calves selling, however, when dairy calves with good quality were produced, farmers will consider rearing the calves. The good quality calves, according to the farmers, were based on its posterior characteristics, not from its pedigree or parental history (Talib *et al.*, 1999). Another opinion stated that deciding factors in dairy calves rearing practice were (a)

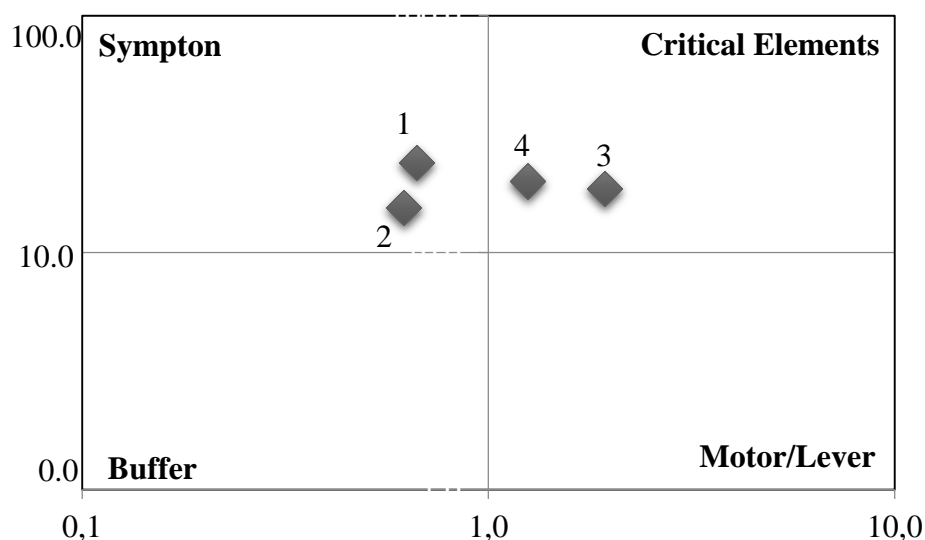


Figure 3. The position of the factors affecting dairy calves rearing in the quadrant.

Table 5. Coordinate activity ration and degree of interrelation on factors affecting dairy and beef calves rearing

Beef Calves			Dairy Calves		
Factors	Activity Ratio	Degree of interrelation	Factors	Activity Ratio	Degree of interrelation
Secondary income source	0,7	13,0	High production cost	0,7	24,0
Land limitation	1,6	11,3	Long rearing time	0,6	15,5
Forage limitation	1,6	11,3	Secondary income source	1,9	18,6
High sale value	0,2	5,3	Calves' quality	1,3	20,0
Easy rearing practice	1,0	5,3			

governmental policy; (b) the existence of farming instructors; and (c) human resources and technology (Rahayu *et al.*, 2015).

Conclusions

It can be concluded that there were 5 factors which affect beef calves rearing decision, which were its status as a secondary income, land limitation, forage limitation, high sale value, and easy rearing practice). Furthermore, there were 4 factors which affect dairy calves rearing decision, which were high rearing cost, long rearing time, its status as a secondary income source, and calves' quality. The critical factors in beef calves rearing decision were land and forage limitation, while in dairy calves rearing decision was its status as a secondary income source and calves' quality. The land and forage limitation factors affect the number of beef calves rearing, and can be anticipated by the communal housing system. The beef cattle communal housing system should become the government program to increase the beef cattle population. Moreover, alternative sources of income could help farmers to pay the production cost so that they do not have to sell their calves, especially when good quality calves were produced, which can be known when farmers recording the calves' data on the farm.

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