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Sustainability Status of Dairy Farms in Bogor District Area, Indonesia

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Abstract

The optimal management on dairy farms must consider the concept of sustainable development that fulfills the need of three pillars namely interest in ecological, economic, and social. This condition will increase income of agricultural or stock farmers, contributions to locally-generated revenue, farm institutional functioning, legal obedient, absorb labor, and more technology application to improve efficiency on reproductive and productivity. The aim of this research is to assess the sustainability status of dairy farms in Bogor District, represented by Cifa Farm, Erif Farm in Cisarua and Acep Farm in Kunak-Cibungbulang using the four dimensions analysis, namely ecology, economy, social and technology. Sustainability indices were analyzed by a modified method of Rapid Appraisal for Fisheries (RapFish) namely Rapid Appraisal for Farm (RapFarm) using Multidimensional Scaling approach.

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Results of study reveals that sustainability status on Acep farm in Kunak Cibungbulang and Cifa Farm were lower compared to Erif Farm (54.13, 70.87 vs 76.46). However, all of the farms are still sustainable, even Erif Farm shows very sustainable. Analysis result on four dimensions shows that Cifa Farm and Eri Farm are very sustainable while Acep Farm is fairly sustainable in **ecology dimension**, Erif Farm is very sustainable while Cifa Farm and Acep Farm are fairly sustainable in **economy**, Erif Farm is very Sustainable while Cifa Farm and Acep Farm are fairly sustainable in **social,** and Cifa Farm and Erif Farm are very sustainable but less sustainable for Acep Farm in **technology dimension**. There are 24 over 40 examined attributes need to be considered and improved to enhance the sustainability status of dairy farms in Bogor.

Keywords: sustainability status; dairy farms; Bogor District.

1. Introduction

The development of dairy farms in Indonesia has fluctuated within the last 5 years. Data from the Directorate General of Livestock and Animal Health, Ministry of Agriculture in 2015 (525.171) showed an increase in population of dairy farms in Indonesia from 2014 (502.516), that was 22,655 heads (4.51%). Meanwhile, the dairy cattle population in 2011 was about 597,213 and in 2012 reached 611,939 [1]. Although the increase is considered very low but it gives hope in addressing the needs of the domestic cow's milk production. Data in 2015, milk production reached 805,363 tons or up to 0.5% from 2014 (that was 800,751 tons per year). On the other hand, the need for fresh milk in the country reaches 3.3 million tons per year. It's therefor Indonesia is still imported 75.73% from various countries, such as; Australia, New Zealand, United States of America and the European Union [2].

Milk production of dairy cattle in Indonesia is low due to populations is low and also the average dairy cow milk production in Indonesia is low. This is due to the dairy farm in Indonesia is traditional farm with low-scale livestock holdings. Reference [3] Stated that milk production can be increased with the improvement of the quality of cattle feed. Further, it was noted that the analysis of the dairy cows concentrate feed in several locations reportedly has low quality and not according to the standards required. Meanwhile, there is already widely available biomass utilization technologies resulted from agricultural wastes that can increase the value of nutrients into fibrous feed source for dairy cows. However, the deployment, development and implementation of biomass utilization technologies is uneven so it needs socialization and assess the applicability in the field [4]. Feeding with low quality in long period will affect the development of the reproductive organs of cattle.

Bogor district is one of that contribute to the national milk production. The contribution of milk production in Bogor district farms amounted to 14.643 tons/year, (5.25%) [5], which is derived from dairy farm business the area (Kunak) Cibungbulang and community dairy farms in the area of Cisarua. The milk production from Bogor district is feared to decline due to various factors such as limitations of green cattle feed, a decrease number of farmers, the poor quality of the milk produced as a result of unhygienic post-processing of milking, livestock diseases, lack of utilization of appropriate technology, functional shift of land, limited agribusiness facilities and infrastructure, and not achieving targets of the establishment program of regional community farm [6, 7]. Many factors including the challenges, the bottlenecks and also the problems in increasing milk production of dairy

cows and dairy development in Bogor require depth and comprehensive assessment of the various variables. Multidimensional study becomes one of approaches that can be used to look at various constraints on the dimensions of the sustainability of the dairy farm, such as: ecological dimension (aspect of bio-ecology), the economic dimension (economic aspects of business), the social dimension (aspects of social characteristics of farmers) and the technological dimension (the application of appropriate technology). The continuity study of these four dimensions becomes very important to look at the viability and prospects of development of dairy farms. Therefore, the research is conducted to assess the prospects for the development of dairy farms in Bogor through an analysis approach of multi-dimensional scaling (MDS).

2. Materials and Method

2.1 Place and Time of Research

The research was conducted at Cifa Farm, Erif Farm in Cisarua and Acep Farm in Kunak Cibungbulang which are the center of a dairy farms in Bogor District. The research was conducted from February to December 2015.

2.2 Types, Sources and Methods of Data Collection

The data used in the study on sustainable development of dairy farms is in the form of primary data obtained directly in the field. Method of data collection is done by interview method conducted through direct face to face and question and answer. Type, source, variables and data collection methods are created in the tabulation (Table 1) to see aspects of sustainability.

Table 1: Type, source, variables and methods of data collection

Aspects of the study	Variable	Data Type	Data Sources	Output
The sustainability level	The sustainability dimensions and attributes	Primary Data	The results of the interview (questionnaire)	sustainability ordination of development dimension
Attribute on sustainability levers	The attributes of each dimension	Primary Data	The average value of the respondents, the data tabulation (measures of central tendency)	Lever sustainability attributes of each dimension
The sustainability trade off	The sustainability percentage	Primary Data	Output (ordinate) RapFarm	The balance of sustainability development

Respondent determination was conducted using cluster method because the population does not consist of individuals but rather consists of individual groups or clusters [8]. This research was conducted in three clusters, namely Cifa Farm, Erif Farm and Acep Farm Kunak. Further, samples are drawn at random methods (random sampling). Determination of the number of samples refers to Slovin formula [9], as follows: $n = \frac{N}{1 + Ne^2}$

Information:

n= sample size

N = Population size

e = Percent on inaccuracy deviation due to errors retrieval a sample uses the value of e = 10% (0.1)

2.3 Data Analysis Method

Data analysis was processed by using the Multidimensional Scaling (MDS) with software Rapfish [10] modified by using the data from dairy farm (RapFarm). Rapfish stands for Rapid Appraisal for Fisheries which was first introduced by Pitcher and Preikshot [11].

RapFarm operational stages referring to RapFish consists of determination of the topic of study, determination of the dimensions of the study (ecology, economy, social, and technology), determination of attributes of each dimensions of the study, scoring (bad-good) on each attributes, and inputting the value/score assessment of each attributes into RapFarm software. Analyzing the sustainability status is carried out by operating RapFarm that raises Rap Analysis (sustainability ordination). Analyzing the attributes of sustainability lever is done by operating the Leverage Analysis, and to see the errors is done by operating the Monte Carlo. Rate accuracy (goodness of fit) is seen from the Squared Correlation (R2). [12] States that the value of Squared Correlation (R2) that is more than 80% indicates the sustainability index prediction model is good and used adequate. The role of the attributes to sensitivity sustainability status can be seen from the Root Mean Square (RMS) of each dimension. The larger the RMS value, the greater the role of these attributes [13]. The result of the analysis of the sustainability dimensions is shown in the form of kite diagram that is useful as a trade-off of sustainability.

Table 2: List, definition and scores of attributes used, RapFarm analysis is divided into four areas of dimensions and shows the value of good and bad

Attributes	Score	Good	Bad	Remarks
Ecology Dimension				
Clean water carrying capacity	0; 1; 2	2	0	The availability of clean water sources used by farmers: [0] is not available; [1] available enough but influenced by seasons; [2] available and easily obtained
Carrying capacity of feed	0; 1; 2; 3	3	0	Carrying capacity/availability of natural forage/grass: [0] is not available (very critical); [1] deficiency (critical); [2] reasonably available (cartilage); [3] safe (available and

Attributes	Score	Good	Bad	Remarks
				redundant)
Carrying capacity of the environment temperature	0; 1	1	0	Environmental temperature comfort zone for dairy cows: [0] temperature <5 0C or> 250C; [1] 50C - 250C [14]
Carrying capacity of the temperature humidity index	0; 1; 2; 3	3	0	The comfort or effective Temperature and Humidity Index (THI) in a dairy farm environment: [0] value THI≤88≤ 97; [1] The value of THI≤75≤80; [2] The value THI≤72≤75; [3] value TH <72 [15, 16, 17].
Sanitation	0; 1; 2	2	0	Cowshed Sanitation and milking equipment: [0] poor; [1] sufficient; [2] good
Availability of dairy waste disposal installation	0; 1; 2	2	0	Availability of dairy cattle waste disposal installations used as biogas or organic fertilizer: [0] is not available; [1] is available, it is not in use; [2] available and used
Distance to the location of the farm to settlements area	0; 1; 2; 3	3	0	Distance to the farms with the settlements area; [0] at the location of settlements; [1] 50-100 meters within the farms with settlements; [2] 100-200 meters within the farm with settlements; [3] >200 meters [18]
Livestock population	0; 1; 2	2	0	Cage density: [0] >40 cattles/100m2; [1] 26-40 cattles/100m2; [2] Max 25 cattles/100m2
Cows began mated	0; 1; 2	2	0	Age of Mother Cow was first mated: [0] <15 months or >36 months; [1] 15-23 months or 31-36 months; [2] 24-30 months
average estrus	0; 1; 2;3	3	0	The average holding back estrus: [0] >42-59 days; [1] 21-42 days; [2] <21 days; [3] >60 days
Economy dimension				
The quantity of milk production	0; 1; 2;3	3	0	Average production of milk: [0] <5 liters/cow/day; [1] is quite enough for 5-10 liters/cow/day; [2] is quite good for 10-15 liters/cow/day; [3] as very good or optimal >15 liters/cow/day.
Culling cows	0; 1; 2; 3	3	0	Terms of culling cows 1. sick cows; 2. low milk production ≤ 3 liters / day; 3. Sick cow (can/difficult to treat), 4. is not productive: [0] if one condition is met; [1] if two conditions are met; [2] if three conditions are met; [3] if four conditions are met
marketing of milk	0; 1; 2;3	3	0	Marketing of milk: [0] marketed to consumers; [1] marketed to the cooperative; [2] to the company; [3] to the company and processed (added value) for sale to consumers
The market share of dairy products	0; 1; 2	2	0	The scale of market utilizing dairies farm product: [0] local market; [1] national market; [2] international market
Leading commodity dairy products	0; 1; 2	2	0	Types the leading commodity of dairy products: [0] only one type; [1] 1-2 type of processing; [2] >2 types of dairy
Number of artificial insemination (AI) services	0; 1; 2	2	0	The average number of AI services per head/year female dairy cow: [0]> 3; [1] 2-3; [2] <2
Conception Rate (CR) Value	0;1; 2	2	0	The average value of Conception Rate (CR) female dairy cattle: [0] ≤30%; [1] 40% -70%; [2]> 70%

Attributes	Score	Good	Bad	Remarks
Farm land ownership	0; 1	1	0	Ownership status of dairy farm: [0] lease [1] one's own
lactation	0; 1;2	2	0	Lactation cows: [0] <4 months; [1] 5-7 months; [2]> 7-10 months
breeding	0; 1; 2	2	0	Breeding opportunities of dairy farm is highly prospective, refers to the high demand for feeder for breeding productive dairy cattle: [0] calf females one week - 1 month of birth for selling; [1] calf females 2-4 months for selling; [2] females calf to be made a feeder of productive cows
Social Dimension				
Farmer productive age	0; 1; 2	2	0	Productive age of farmers: [0] <15 or >65 years; [1] 16-25 years; [2] in the productive age: 26-65 years
Farmers' Education background	0;1;2;3	3	0	Farmers' Education background: [0] graduated from primary school/MI; [1] graduated from Junior High School (SMP/MTs); [2] graduated from Senior High School (SMA/MA); [3] Diploma/Bachelor
Farmers' experience	0;1;2;3	3	0	Farmers' experience: [0] <5 years; [1] 5-10 years; [2] >10-20 years; [3] > 20 years
Reason to be farmer	0; 1; 2	2	0	The reason for choosing to be ranchers: [0] sideline; [1] alternative employment; [2] The main work
Medical personnel	0; 1; 2	2	0	The availability of medical personnel: [0] is not available; [1] is available but difficult to access; [2] available and accessible.
Farm Institutions	0; 1; 2	2	0	Availability of farm institutions in the neighborhood farms: [0] no institutional/group; [1] No institutional /group but not yet effective; [2] available institutional/group and has been effective.
Knowledge of farmers	0; 1; 2	2	0	Knowledge of farmers to the signs of estrus: [0] do not know; [1] know a little bit; [2] know and practiced.
Potential of conflicts	0; 1; 2	3	0	Potential of conflicts: [0] frequent conflicts; [1] never happened and will appear again; [2] have occurred and can be solved well and will not reappear; [3] no conflict/never happen
Community role	0; 1; 2	2	0	The community role on the business of farm management: [0] is very negative; [1] negative; [2] neutral; [3] positive; [1] very positive [19]
Counseling and Training Frequency	0;1;2;3; 4	4	0	Farm business counseling and training provided by the local animal husbandry department: [0] never; [1] once in 5 years; [2] once in a year; [3] twice in one year; [4] at least three times a year [19]
Technology Dimension				
Parent and calf maintenance techniques	0; 1	1	0	Parent and calf maintenance techniques: [0] merged with the parent; [1] separated by parent
Feeding mechanical	0; 1; 2	2	0	Feeding mechanical in dairy cows: [0] grazing; [1] combinations; [2] feeding in cage
mating technique	0; 1; 2	2	0	Cow mating technique is done by: [0] natural mating; [1] The natural mating and AI; [2] AI
Farmers'	0; 1; 2	2	0	Farmers' observations frequency of to the

Attributes	Score	Good	Bad	Remarks
observations frequency of to the signs of estrus				signs of estrus in cattle: [0] once a day; [1] 2 times a day; [2] >2 times a day
The presence of medical personnel when cattle confinement and post-parturition handlers	0; 1; 2; 3	3	0	The presence of medical personnel when cattle confinement and post-parturition handlers: [0] not supported by medical/natural and there is no handler medicine; [1] conducted themselves breeders and handlers of drugs; [2] The combination done alone or assisted by medics and always given with medical aid; [3] assisted by medics and always given with medical aid
reproduction setting	0; 1; 2	2	0	Holding back on mated time (reproduction setting): [0] after estrus to three visible mated; [1] after estrus mated to two visible; [2] after the first estrus looks mated
check pregnancy technique	0; 1; 2	2	0	Frequency check pregnancy done: [0] >every 2 months; [1] every 2 months; [2] every month
milking technology	0; 1; 2	2	0	Milking technology: [0] manual; [1] a combination of manual and using technology; [2] using technology/milking machine.
dairy handling	0; 1; 2	2	0	How to handle post-milking dairy: [0] filtered and marketed; [1] was cooled/heated at a temperature below boiling temperature (pasteurization) and marketed; [2] pasteurized, processed and marketed.
Forage feeding mechanical on productive cow	0; 1; 2	2	0	Forage feeding mechanical associated with milking time on productive cow: [0] is not necessarily green feed given (before/after milking); [1] given before milking; [2] granted after milking

Assessment score of each dimension is expressed with the worst scale (bad) 0% up to the best (good) 100%. Sustainability index category as follows:

Table 3: Sustainability index category

Index Value (%)	Category	Sustainability Level
0 – 25	Poor	Not Sustainable
26 – 50	In Sufficient	Less Sustainable
51 – 75	Sufficient	Fairly Sustainable
76 – 100	Excellent	Very Sustainable

Source: [11]

3. Results

A RapFarm analysis result is used to assess the sustainability of the farm system through the sustainability index. Meanwhile, leverage is used to assess the attributes that are sensitive to sustainability in every dimension.

Sustainability Status on Ecology Dimensions

The results of the analysis of the sustainability status on ecology dimensions of all three farms in Bogor regency presented in Figure 1.

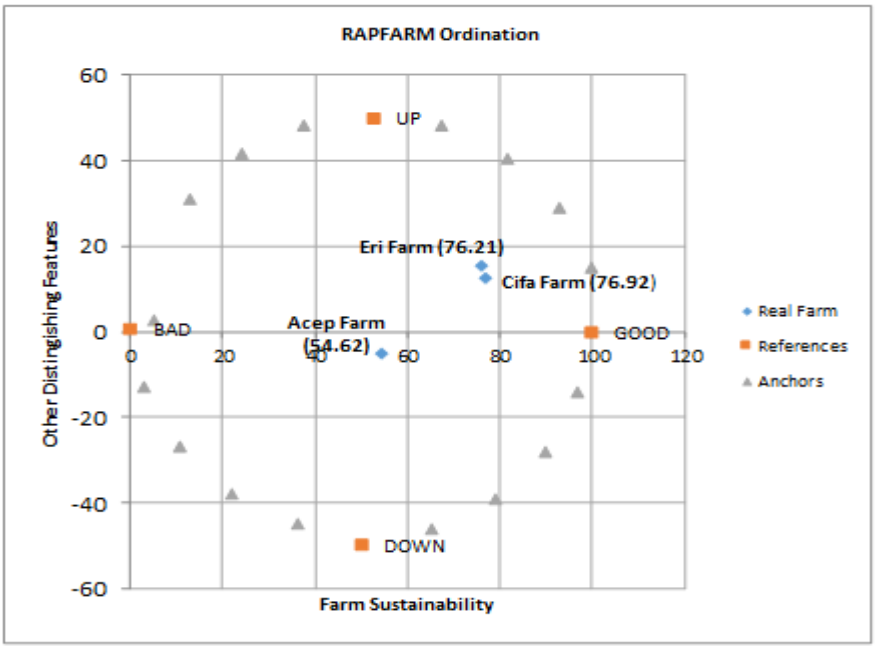

Figure 1: Index ordination of sustainability status on ecology dimension

Index ordination of sustainability status figure shows that the meaning of sustainability is shown by the horizontal line; further right shows higher level of sustainability, while vertical lines illustrate the variation of each attribute. RapFarm analysis results contained in Figure 1 shows the sustainability index on ecology dimension on Acep farm Farm in Kunak Cibungbulang (52.64) was lower compared to farm sustainability index in Erif Farm (76.21) and Cifa Farm Cisarua (76.92). The leverage analysis result of the sustainability status on ecology dimensions is shown in Figure 2.

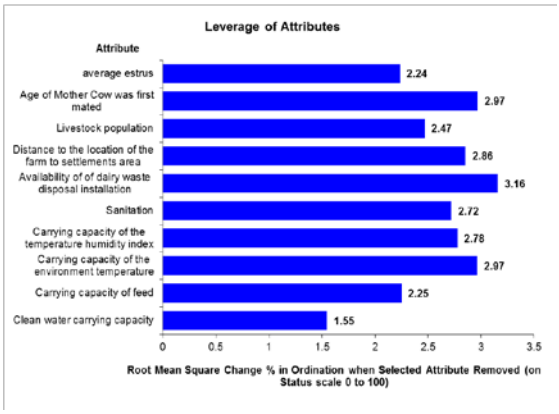

Figure 2: Leverage attributes of sustainability status on ecology dimension

Based on Figure 2, it shows that the lowest RMS value is 1.55 and 3.16 is the highest, the leap in value occurred at 2:47 so that the RMS value of 2.7 as a determinant limit of sensitivity level of leverage sustainability.

Leverage analysis results on ecology dimension shows six sustainability attributes that have a fairly prominent percentage value that is 1) Availability of of dairy waste disposal installation (3.16%); 2) the carrying capacity of the environment temperature (2.97%); 3) distance location from dairy farm with settlements (2.86%); 4) birth parent age (2.97%); 5) carrying capacity of the temperature-humidity index or the Temperature Humidity Index (2.78%); and 6) farms cage sanitary (2.72%).

Sustainability Status on Economy Dimension

The analysis result of the sustainability status on economy dimension is presented in Figure 3.

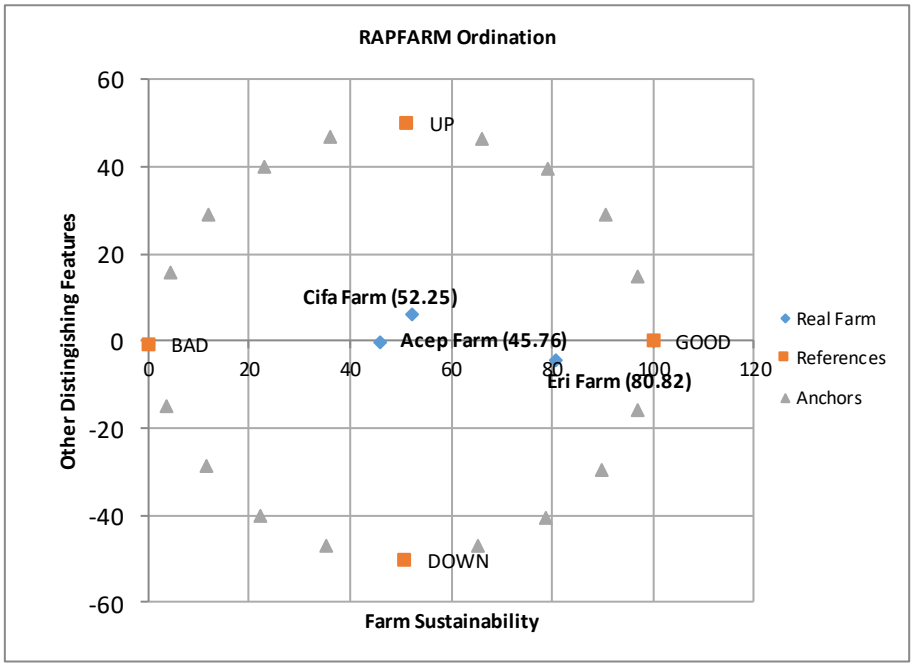

Figure 3: Index ordination of sustainability status on economy dimensions

The observations on economy dimension indicate that sustainability index on Erif Farm Cisarua is greater (80.82%) compared to Cifa Farm Cisarua (52.25%) and Acep Farm Kunak Cibungbulang (45.76%).

The leverage analysis result of of sustainability status on economy dimension has the lowest RMS value: 1.55 and the highest: 3.16 (Figure 4).

There are 6 economy dimension attributes that have the most responsible sustainability levers sensitivity, namely 1) the number of IB services (3.16%); 2) the marketing of milk (2.97%); 3) lactation (2.97%); 4) Conception Rate value/CR (2.86%); 5) the market share of dairy products (2.78%); and 6) the leading commodity of dairy products (2.72%).

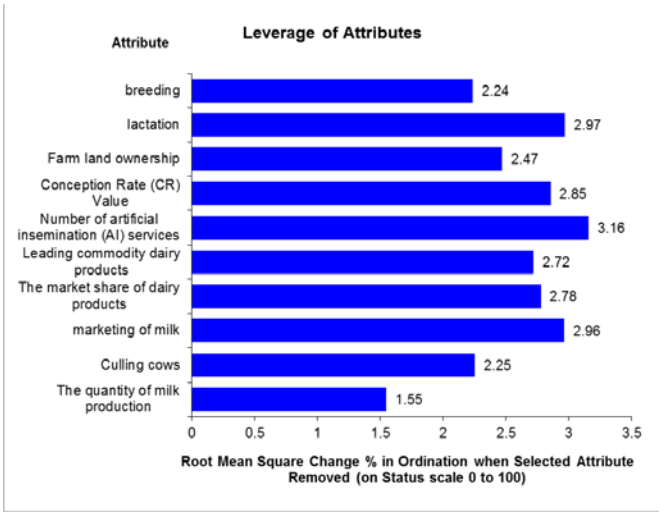

Figure 4: Leverage attributes of economy dimensions sustainability status

Sustainability Status of Social Dimension

The research result on sustainability status of the social dimension in the development of dairy farms is presented in Figure 5.

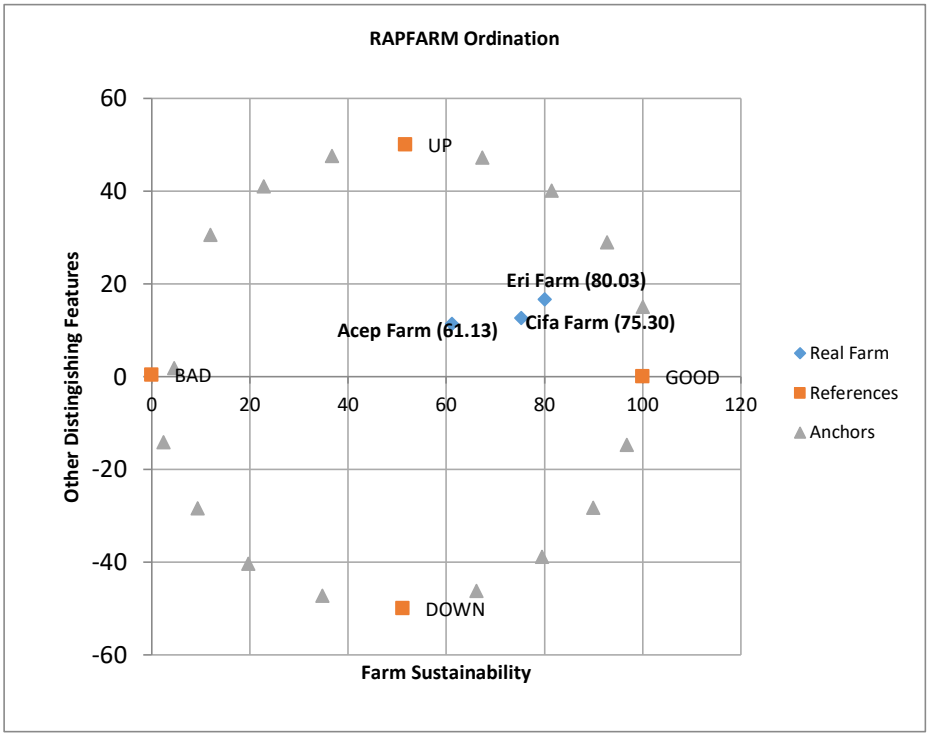

Figure 5: Social ordination of dimensions sustainability status

The results shows the social dimension sustainability index on Erif Farm Cisarua is greater (80.03%) compared with the sustainability index on Cifa Farm Cisarua (75.30%) and Acep Farm Kunak Cibungbulang (61.13%).

The leverage analysis results of the social dimension sustainability status shown in Figure 6.

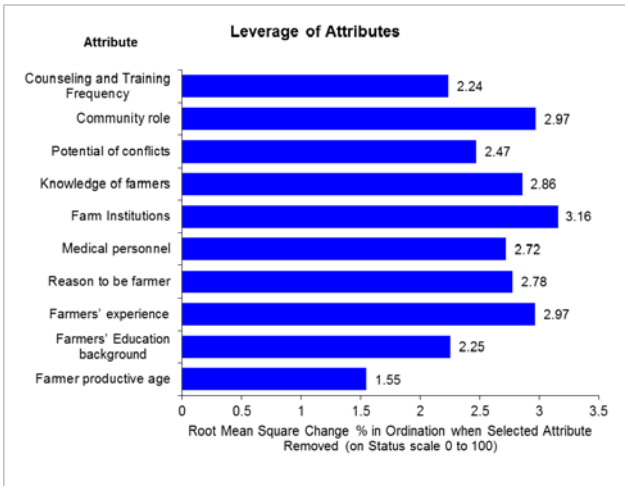

Figure 6: Leverage attributes of social dimensions sustainability status

The leverage analysis results of the social dimension obtain seven attributes of sustainability which has a fairly prominent percentage value that is 1) breeders institutional (3.16%); 2) the role of the community towards the management of the dairy farm (2.97%); 3) time or a long experience of farmers towards dairy farm (2.97%); 4) farmers knowledge to the signs of estrus of dairy cows (2.86%); 5) the breeding reasons (2.78%); and 6) the availability of medical personnel (2.72%).

Sustainability Status on Technology Dimensions

Ordination on Sustainability status of technology dimension in the development of dairy farm is presented in Figure 7.

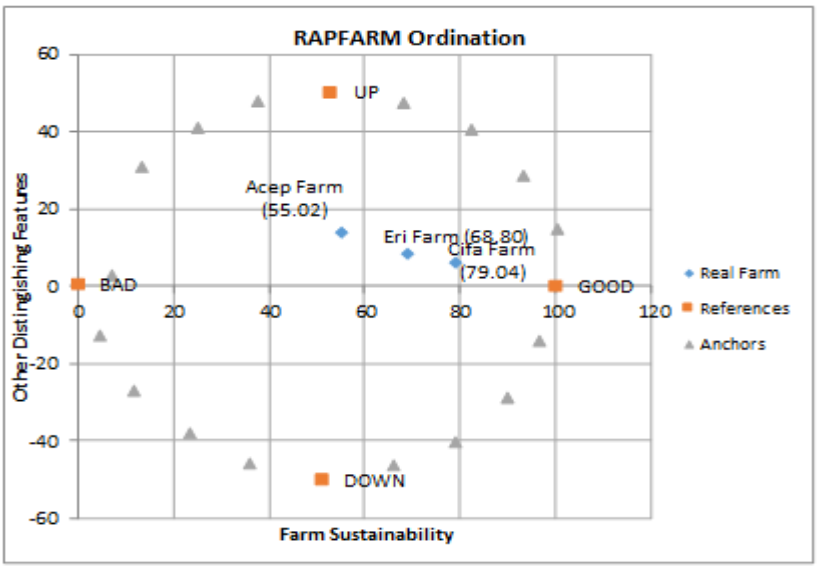

Figure 7: Sustainability ordination of the technology dimension

The RapFarm analysis results show the value of technology dimension sustainability index with the greatest value is shown by Cifa Farm Cisarua at 79.04 and followed by Erif Farm Cisarua sustainability index value of 68.80 and Acep Farm Kunak Cibungbulang only 55.02.

The leverage analysis results of the sustainability status presented in Figure 8 show six attributes of sustainability which has a fairly prominent percentage value, they are 1) setting reproduction (3:15%); 2) milk handling techniques (2.97%); 3) mating techniques (2.96%); 4) techniques of PKB (2.86%); 5) technical observation of the signs of estrus (2.77%) and 6) medical help when parturition (2.72%).

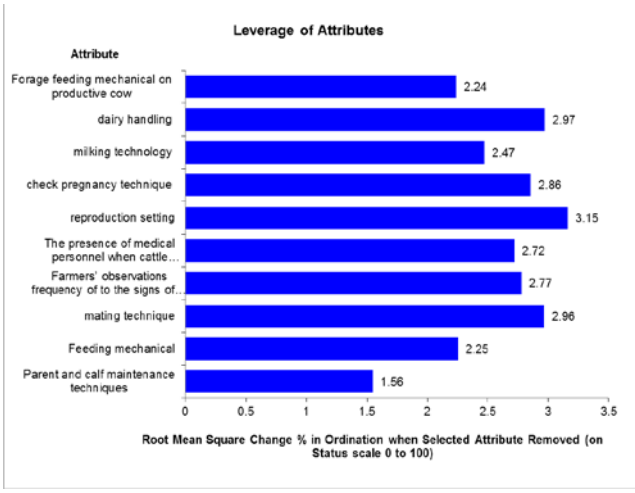

Figure 8: Leverage attributes of technology dimension sustainability status

Multidimensional Sustainability Status

RapFarm analysis results shows dairy farm in Bogor that Acep Farm Kunak and Cifa Farm have a mean value of sustainability index respectively by 54.13 and 70.87, so that the status of sustainability to the two farms is fairly Sustainable. As for Erif Farm Cisarua with the average value of sustainability index is greater than Acep Farm and Cifa Farm that is 76.46, so that the status of sustainability category is very sustainable (Table 4). The sustainability index value of to three dairy farms in Bogor Regency is generated based on an assessment of the 40 attributes that are included in the four dimensions of sustainability, from 10 ecology dimensions attributes, 10 economy dimension attributes, 10 social dimension attributes, and 10 technology dimension attributes.

Table 6: Mean index and sustainability status of a dairy farms in Cifa Farm, Erif Farm and Acep Farm, Bogor

Dimension	Farms, Sustainability Index			Mean Index	Status
	Cifa Farm	Erif Farm	Acep Farm		
Ecology	76.92	76.21	54.62	69.25	Fairly Sustainable
Economy	52.21	80.82	45.76	59.60	Fairly Sustainable
Social	75.29	80.03	61.13	72.15	Fairly Sustainable
Technology	79.04	68.80	55.02	67.62	Fairly Sustainable
Mean Index	70.86	76.46	54.13	67.15	Fairly Sustainable

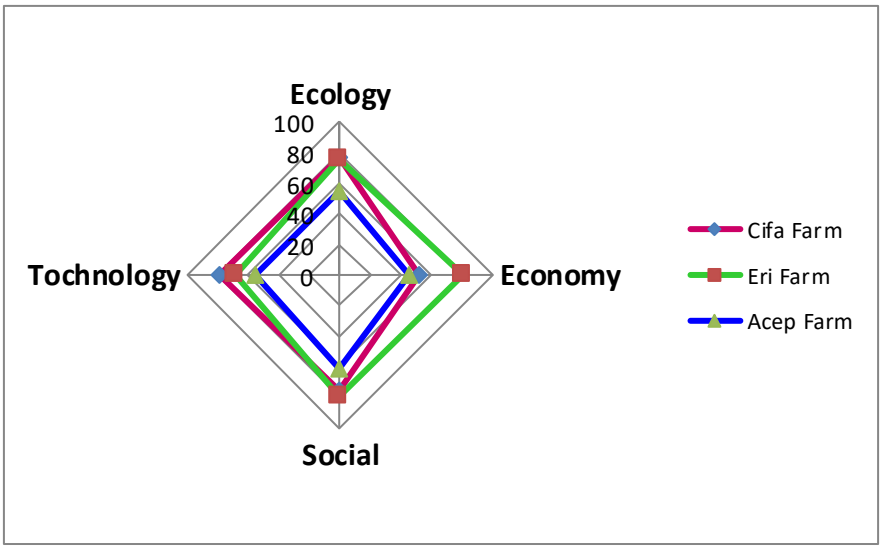

Figure 10: Index and sustainability status of a dairy farms in Cifa Farm, Erif Farm and Acep Farm Kunak, Bogor District

4. Discussion

Sustainability on dairy farms is strongly influenced by the role of various dimensions and attributes as indicators in sustainability analysis. **On ecology dimension**, leverage analysis results shows 6 sensitive attributes affect the sustainability index status dairy farm in Bogor, namely the availability of dairy cows waste disposal installations to be used as biogas or organic fertilizer that has not been used optimally. Cita Farm and Erif Farm Cifa already own waste treatment facilities to be used as biogas but still often untapped used, while Acep Farm does not yet have them. The current treatment facilities of handling animal waste is done by discharging directly into drains (gutters) at the farms are to be channeled into pools of waste, so that when heavy rainy season comes, waste ponds will overflow which can pollute the environment around the settlements that locate close to the farm. This can lead to degradation of the environment that will reduce the productivity of the farm. This livestock waste management needs to be done to avoid dairy cows of germs, avoid the onset of unpleasant odors, to keep the cage clean, to avoid moist so that the cage remains dry and clean [20].

The effective and comfortable environment temperature carrying capacity attributes for dairy cows affect the reproduction performance and productivity of dairy affect sensitively to the status of the farm sustainability. It is shown that the average temperature in Acep Farm (26.46 ^{0}C) is higher than the Cifa Farm (22.26 ^{0}C) and Erif Farm (22.22 ^{0}C). According to [14], comfort zone for dairy cows is at a temperature range between -50C to 25 ^{0}C. It was further reported, in the area that has a tropical climate, summer temperatures is often above 25 ^{0}C [14] which can impair physiological systems of the body and reproductive performance of dairy cows [21].

Female cow first mated has the sensitivity to sustainability attributes. It is shown that the average age of the female cow first mated in Cifa Farm, Farm and Acep Farm Erif average at the age of 2 years or 24 months. Reference [22] Reported that cows start mating for the first time between the ages of 24 months to 30 months (2-2.5 years) with an average age of 27 months, because at the age of cattle has reached adult body.

Meanwhile, the distance of dairy farm locations to population centers contribute to the sustainability sensitivity. Distance of Cifa Farm and Erif Farm to residential occupation ranges from 100 to 200 meters closer than the distance of Acep Farm population centers with an average of> 250 meters. [1] suggested that terms and conditions of the dairy farm is not located in the city center and residential areas with a distance of at least 250 meters from residential areas.

The carrying capacity of the temperature and humidity interaction (THI) that is effective and convenient contribute greatly to the level of heat stress to dairy cows [23, 24, 21, 25, 26]. THI value at the farm Erif Farm and Cifa Farm is lower than the value of THI at Acep Farm. This is because the height of the location at Erif Farm and Cifa Farm which has an average temperature is lower and higher humidity resulting a value of THI lower at 71 compared with Acep Farm which has an average value, the average value of THI is 77 [27]. Based on the THI average value, it was indicated that Cifa Farm and Erif Farm have a better comfort value compared with Acep Farm so that productivity in Cifa Farm and Erif Farm have a better sustainability score. As reported by [14] that the dairy cows will be comfortable on THI value under 72, dairy cows will experience mild stress if the value of THI $72 \leq THI \leq 75$, at the value of THI $75 \leq THI \leq 80$ dairy cows will experience the stress of being, and at value THI $THI \leq 88 \leq 97$ dairy cows will experience severe stress. Thus dairy cows at Acep Farm are suspected of having moderate stress levels.

Therefore those attributes should receive serious attention, especially at Acep Farm in order to provide a greater contribution to the sustainability of ecological dimension. Meanwhile Erif Farm and ranch Cifa Farm require a touch towards better sustainability status.

The economy dimension becomes greatly contributive to the sustainability of the dairy farms in Bogor, because the survival of farm businesses will depend largely on the financial aspects. Sustainability status of the economic dimension at Erif Farm is very sustainable, Cifa Farm has fairly sustainable and the lowest sustainable or less sustainable is Acep Farm. The economy dimension sustainability in the development of the studied dairy farms is illustrated through the economic aspects of the farm. The sustainability index status is strongly influenced by the role of the various attributes that become indicators of more prominent in the analysis, such as the average number of services IB, the average value of Conception Rate (CR), lactation cows, milk marketing, the market share of dairy products and the type of competitive commodities and dairy products.

The implementation of Artificial Insemination (AI) in cattle is one effort to the application of appropriate technology that aims to increase the population, the genetic quality of cattle, good quality of cattle dissemination can be done cheaply, easily and quickly so as to increase the income of farmers. The average number of IB services per head/year in Cifa Farm, Erif Farm and Acep Farm rate normal with an average below 2. Many factors must be considered for successful IB include the inseminator, the time of ovulation, the quality of frozen semen is used, season, the detection accuracy of the estrous cycle and environmental factors [28].

Conception Rate (CR) Value becomes indicator of female fertility of dairy cows. The CR average value of at Acep Farm is higher at 75.76% compared to Cifa Farm at 66.13 and Erif Farm with CR value is only 42.00%. Conception Rate (CR) which is ideal for dairy cows is 60-75%, the higher the CR the more fertile female dairy

cattle and vice versa [29]. CR value of dairy cattle is influenced by nutrition, health, farmers knowledge in the detection of estrus, treatment of farmers in determining the mating right time or right mating management, genetic, environmental [30, 31], experience and expertise inseminator and the quality of inseminated frozen semen [32]. Based on observations in the management of reproductive at Cifa Farm is more targeted and scheduled in the case of estrus detection and mating as well as at Acep Farm.

Lactation time of mother cows start production after childbirth and lactation length have an important role for farmers to increase income of farmers. The average lactation cows at the farm Cifa Farm, Erif Farm and Acep Farm include in normal range that is between 7-10 months or approximately 305 days.

Marketing of milk at Cifa Farm and Erif Farm has built a network of direct market to milk processing market such as Cimory and large scale milk processing industry (IPS) such as PT Friesen Flag and Indomilk. Meanwhile, the marketing of Acep Farm is still through cooperatives channels marketing. The big difference in the milk marketing makes the difference selling price that affect to the farmers' income. For the milk market share in all three farms still meet the demands of local and national markets. Besides marketing fresh milk, Erif Farm made dairy products such as yoguhrt and milky tofu thereby increasing economic revenues.

Economy dimension attributes to enhance the sustainability requires special attention towards better sustainability status, especially at Cifa Farm and Acep Farm.

Sustainability of the **social dimension** in the development of dairy farms in Bogor is classified as very sustainable for Erif Farm and fairly sustainable to Cifa Farm and Acep Farm. The value describes the condition of dairy farming recently from social aspect that is quite good. Social factors having sensitivity power on sustainability status that stands out is the availability of institutional capacities in the dairy farm environment, or a long time experience in the livestock breeders, business community's role in farm management, knowledge of the breeders toward their cattle, the reason for choosing to be farmers, and the availability of medical personnel.

Institutional role of farmers is very important and strategic in order to realize the relationship between farmers in the cooperative network with stakeholders to build and strengthen institutions, in order to encourage the growth of agribusiness farms more efficient, effective and sustainable.

Institutional around the dairy farm in Bogor, is namely Koperasi Produk Susu (KPS) Bogor (Bogor Dairy Product Cooperative) and KUD Giri Tani are considered sufficiently developed based on the function and increasing role of the year to year. KPS Bogor and KUD Giri Tani are the umbrella organization for Cifa Farm, Erif Farm and Acep Farm in dairy production activity for resale to companies or marketing, sustainability of livestock enterprises through venture capital loans livestock, and the application of technology through counseling. According to [18] the presence of institutional groups of will make farmers to get some ease in farm management. Such convenience are in terms of the formation of cooperatives that support the activities of groups of farmers and breeding technologies, feed, cultivation, and post-production that can be used by all members.

Knowledge and experience of farmers in farming hold important role in determining the success of farmers in

breeding livestock and business development efforts to increase the income of farmers. Farmer's knowledge observed in this study is the ability of farmers in the detection of estrus. The ability is generally obtained by experience through the duration of the breed. The lenght experience of breeding will enhance their knowledge and skills in the management of livestock breeding. The average length of experience in raising dairy cattle at Cifa Farm, Erif Farm and Acep Farm are more than 15 years. Long experience is the basic for the formation of individual perception in giving feedback or appreciation [33]. According [34] the longer experience of raising will ease farmers in overcoming the difficulties they experience and it will affect the success of the business.

The success cannot be separated from the seriousness in conducting business which can be seen from the main job or sideline. Breeders in Cifa Farm, Erif Farm and Acep Farm are as skilled workers in the dairy cattle business.

The role of the community is very supportive in trying to manage the farm. According to [35] that the role of society in an attempt to manage the farm can be through the development of human resources, mastery of technology, institutional strengthening, improvement of economic infrastructure and social and health care of livestock with the availability of medical personnel. The community role in Cifa Farm, Erif Farm and Acep Farm are quite conducive. This is indicated by the existence of good to supply of raw materials, marketers and buyers. Positive public response can ease the worker recruitment. Social dimension attributes to enhance the sustainability require special attention towards better sustainability status, especially in the farm Acep Farm. Cifa Farm requires a touch towards better sustainability status.

Technology dimension status at farms in Bogor occupies the second lowest position after the economic dimension. The use of technology in all three these farms are still not optimal and need to be improved. Technological dimension attribute that has the stands out sustainability sensitivity values is reproduction setting that is cow mating time after birth. The reproduction setting is very important to improve reproductive efficiency and productivity of dairy farms. Dairy cows return mating takes 60-80 days after birth because it takes at least 50-60 days to achieve a perfect uterine involution [36]. The reproduction setting at Acep Farm and Erif Farm is conducted over 80 days that is after the third estrus cycle, in comparison Cifa Farm mated postpartum in the first estrous cycle. Acep Farm and Erif Farm intentionally did not mate or a deliberate delay the cows so that milk production can be maintained. According to [37], cows that have high milk production will affect the performance of reproduction, that is a delayed estrus because of the energy required to produce the hormone estrogen after birth is still lacking due to the overhaul of the energy reserves to generate the milk.

Mechanical handling of fresh milk after milking is needed to slow the decline in the quality of milk or extending the shelf life of milk and increase the income side of dairy products. Mechanical handling of milk after milking at the farm Eri Farm and Cifa Farm is good enough that after being filtered, the milk is immediately cooled and then processed into yogurt, tofu and subsequently marketed. While at Acep Farm, the milk will normally be filtered and sent directly to the Dairy Processing Cooperative (KPS), Bogor. [1] Suggests milk processing directly after milking so the milk is not easily damaged and also to shorten the distance and travel time for no more 2 hours from the milking process.

Mating mechanical of dairy cows at Cifa Farm, Erif Farm and Acep Farm has been using the technology of mating that is Artificial Insemination (AI). According to [38] Artificial mating engineering advantage is saving on maintenance costs of male cow, prevent the transmission or spread of venereal disease, and can increase the number of births to quickly and regularly, or can set the distance of cattle with good birth.

Pregnancy examinations at three farms in Bogor are generally carried out over 90 days after mating or artificial insemination. Detection of gestation or pregnancy check is a very important thing to do after cattle mated aimed to evaluate the success of artificial insemination (AI), determine the gestation and birth. According [22] pregnancy examinations performed regularly at intervals of 30-40 days from the last insemination or about less than 60-90 days after mating is done by rectal palpation to determine the presence of a fetus.

Observations sign of estrus cow for farmers is key to the success of a mating that is the accuracy and speed while mating. Estrus detection is done at least be administered twice a day i.e. morning and afternoon or evening. The result of research observation techniques signs of estrus in Cifa Farm, Erif Farm and Acep Farm conducted twice a day. [38] Suggested that the occurrence of estrus in cattle in the late afternoon until early morning reaches 60% and in the morning until late in the evening to reach 40%.

The birth of the calf is the greatest hope for farmers with breeding patterns. A normal birth would allow the parent immediately undergo reproductive activities for the next pregnancy. Birth that is not delivered normal will cause reproductive disorders. The presence of medical personnel at the time of parturition cows aims to control and take decisions in birth assistance and the provision of medicines in the postpartum cow. The availability of medical personnel at the ranch Cifa Farm and Erif Farm easily accessible. At the farm Acep Farm, cow handling access when parturition and postnatal administration of drugs often have constraints in terms of access to information breeder with medical personnel, access to the location and the number of medical personnel.

Technology dimension sustainability attributes require more intensive attention toward better sustainability in the dairy farm Acep Farm. Meanwhile, Erif Farm requires only a slight touch to increase the sustainability of a better status.

But overall, the three farms still need improvement and refinement of various dimensions towards better sustainability status. Based on analysis of the sustainability index, sequentially rank from the highest of livestock are Erif Farm (76.46), Cifa Farm (70.87) and Acep Farm (54.13).

5. Conclusion and Recommendation

The results of the study at three dairy farms in Bogor has a of sustainability index value 67.15 with fairly sustainability status, this means to have prospects for further development. Sequentially index value and sustainability status of each dimension are the social dimension (72.15), ecology (69.25), technology (67.62) and the economic dimension (59.60). Therefore, all these four dimensions still require attention and improvement towards better sustainability status.

Conflict of Interest

This experiment and the article do not contain any conflict of interest.

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