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Sustainability of beef cattle farming production system in South Konawe Regency, Southeast Sulawesi

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ABSTRACT

This research aimed to analyze the sustainability of beef cattle farming in smallholder farms with semi-intensive and intensive production systems in the South Konawe Regency. It was conducted in West Ranomeeto and Konda sub-districts through Participatory Rural Appraisal with 55 farmers in the semi-intensive system and 50 farmers in the intensive system. The secondary data were obtained from literature, reports, and publications. The sustainability analysis was determined based on selected indicators in each aspect. The indicators of economic aspect were livestock income, feces utilization, savings and insurance. The indicators of environmental aspect were concentration of E. coli, fecal coliform, total coliform, nitrate, and Fe. The sindicators of social aspect were land ownership, livestock health, mortality, area of pen, and dry matter consumption. The analysis results showed that the total value of the economic, environmental, and social aspect indicators in semi-intensive and intensive production systems was -0.45 and +0.17; -1.15 and -3.85; -0.10 and +0.27, respectively. Meanwhile, the total indicator value in both production systems was -0.57 and -1.14. It can be concluded that both beef cattle production systems in South Konawe Regency carried out by smallholder farmers have not sustainable.
Keywords: *Bali cattle, Environment, Production systems, Socioeconomic, Sustainability analysis.*

INTRODUCTION

South Konawe Regency in Southeast Sulawesi was one of the regions in Indonesia designated by central government as a national beef catte development area and as a source area for Bali Cattle breeds, based on the Decree of Minister of Agricultural No 43 of 2015, and No 803 of 2016, respectively (Minister of Agriculture 2015[a], 2016). The beef cattle population in this regency was the highest in the Southeast Sulawesi Province and is dominated by Bali Cattle. Furthermore, as at 2018 the population was 69,907 heads, with an average increase in the last 5 years of 3.60% (BPS South Konawe Regency, 2019). Generally, beef cattle farming in South Konawe Regency was carried out extensively or traditionally by grazing on land (Saediman *et al.*, 2019). However, the increase in population, the widespread use of land for agriculture sector and the increasing density of settlements has resulted in less land for grazing. This has caused farmers to change the production system of beef cattle farming from extensive to a semi-intensive and intensive system (Saili, 2020).

The changes of livestock production system will influence the production of calves and body weight gain. Therefore, it will have an impact on the farmers' economy (Udo *et al.,* 2011*)*. Furthermore, environmental conditions in this regency such as land use for agriculture, grazing, and grass cultivation are very low. The social aspects have an impact on livestock welfare, cattle pens being adjacent to residential areas will affect the quality of water consumed by humans. The economic, environmental, and social implications arising from this transformation are critical to the prospects for the sustainability of this new livestock system and the adoption of interventions (De Boer and Cornelissen, 2002). The beef cattle population in South Konawe Regency increased, However, sustainability analysis is not widely reported.

Sustainable agriculture is the management of agricultural resources to meet changing human needs while maintaining or improving environmental quality and preserving natural resouces (Ates *et al.,* 2020, Bisth *et al.,* 2020). Livestock production sustainability was understood as the combination of economic viability for farmers, environmental soundness and social acceptability by being respectful of animals and humans (Ten Napel *et al*., 2011, Lebacq *et al*., 2013, Martin *et al.,* 2020). Sustainability was very important to the livestock production system sector because it is a source of information on the challenges and problems to be prevented and repaired, therefore it has a positive impact economically, environmentally, and socially, both now and in the future (Labecq *et al.,* 2013). Sustainability of small-holder traditional farming has been a big challenge in all Indonesian agroecologies (Sembada *et al*., 2019). There has been large-scale ignorance at all levels farmers, researchers, and policy-makers making smallholder farms economically viable for sustainable development (Bisth *et al*., 2020). Sustainability analysis of the livestock production system with small-holder traditional farming in Indonesia have been conducted, namely, beef cattle production in Central Java (Widi *et al*., 2015) and dairy cow production in West Java (Sembada *et al*., 2019).

Sustainability has become an important agenda in the development of the livestock world recently, due to the failures experienced in achieving the goals and the environmental impacts of livestock production development (Labecq *et al.,* 2013). Meanwhile, the concept of sustainability is dynamic, or in other words, sustainable livestock systems in one area will be different from other areas, and a sustainable system at this time will not be sustainable in the future. All these are due to changes in environmental conditions and behavior (De Boer and Cornelissen, 2002). This research aimed to analyze the sustainability of the beef cattle production system, namely semi-intensive and intensive, which have been adopted by smallholder farmers in the South Konawe Regency. Meanwhile, the analysis was carried out as an effort to respond to the changes in the production system, therefore the results can be recommended as reference materials for the development of policies by the local government which aim to both develop and ensure the sustainability of beef cattle.

MATERIALS AND METHODS

Research area

This research was conducted from September 2018 to December 2019 in West Ranomento and Konda sub-districts, South Konawe Regency. West Ranomeeto Subdistrict has a population of 3,183 cattle with only a semi-intensive production system, while Konda sub-district has a population of 5,915 cattle with a semi-intensive and intensive production system (BPS South Konawe Regency, 2019). The number of respondents was 55 farmers in semi-intensive and 50 in intensive production system.

Selection of indicators for the sustainability analysis

Data for the sustainability analysis were obtained through literature studies, interviews, focus group discussion (FGD), and field surveys with respondents and experts. Meanwhile, determination of indicators from the economic, environmental, and social aspects was carried out in stages (De Boer and Cornelisson, 2002). The first stage involved determining the source of the problem based on the conditions in the field from the three aspects including economic, environmental, and social as indicators. The second stage was the FGD activity to select and determine the indicators used to test sustainability.

Furthermore, the target value of each indicator was determined based on literature studies and conditions in the field. The FGD activity was conducted informally and was attended by eight farmers and three employees of the Department of Animal Husbandry and Health. The selected indicators and their target value for each indicator in economic, environmental, and social aspects were presented in Table 1.

Data collection

Data were obtained using the Participatory Rural Appraisal method (Uddin *et al.,* 2013). A total of 105 respondent farmers were selected by purposive sampling, with the consideration of 1) having 3-7 cattle, 2) apply semi-intensive and intensive production system, 3) giving permission to be the subject of observation, and 4) being at easily accessible locations. Secondary data were obtained from literatures, reports, and publications related to this research.

The economic aspect. An economic condition analysis approach was used for the one year (September 2018-September 2019) on 284 Bali cattle in the semi-intensive and 301 in the intensive system. Apart from participatory rural appraisal, there are also observations and production sampling of the cattle (body weight, fecal production, data on cattle purchases and sales, and cattle mortality). Furthermore, the calculation of total production, value added, fecal utilization and the intangible benefit as savings, and insurance was conducted using the formula proposed by Budisatria *et al*. (2010):

Total production (kg) per year

Total production was obtained by calculating the total population of cattle that were obtained last, and subtracting it from the number of the initial population. Furthermore, weight assessment and data on sales and purchases for one year, deaths, expenses, and cattle slaughtered were obtained by directly asking the farmers. The total production was calculated using the following formula: Yk = FSk – ISk + Sk – Pk – OTk – ITk + Ck. Description: Yk = Total net production (kg) of beef cattle for 1 year; FSk = Body weight (kg) at the end of the observation; ISk = Body weight (kg) at the start of the observation; Sk = Body weight (kg) of all cattle sold; Pk = Body weight (kg) of all cattle purchased; OTk = Body weight (kg) of all cattle removed; ITk = Body weight (kg) of all cattle transferred; Ck = Body weight (kg) of cattle slaughtered.

The formula used was as follows: Economic value of total production = total net production x price/kg. The average price was IDR 40,000/kg (farmers information). Net economic value or value added (VA) = economic value of total production - costs of feed, medicine and artificial insemination

Fecal production and its economic value (VM)

Fecal production was calculated based on the annual sales of farmers. Meanwhile, these sales were made in the form of dry and unprocessed materials. The formula used was as follows: VM = fecal dry matter production x price/kg. The average price is IDR 225/kg (Fyka *et al*., 2019).

The economic value of savings (FK)

The benefit from financing was estimated as a proportion (financing factor) of the estimated price of animals sold, slaughtered and transferred out for social reasons. (Moll, 2005). This benefit was formulated as follows: FK = YK x F, Description: Fk = The value of economic returns on savings from the financing of bank interest; YK = Selling price when households need cash; F = Financial factors (bank interest) in the research area (5.45%) (Bank Sultra South Konawe Regency, 2019).

The economic value of insurance (IK)

The insurance benefit can be estimated based on the insurance premium in areas (Moll, 2005). This value was stated as an amount per year and was calculated with the following formula: IK = WK x S, Description: IK = Insurance benefits; WK = Number of cattle owned by a farmer multiplied by price/kg of live weight; S = Insurance premium. The insurance premium set was 8%. Furthermore, this insurance was obtained within a year, with an annual coverage cost of IDR 600,000 (IDR 600,000/IDR 7,500,000 = 8%) (IDR 7,500,000 was the selling price of cattle in normal conditions) (PT. Jasindo, Southeast Sulawesi Province, 2019).

Total benefits/income (Y).

The total value of benefits generated in one year was calculated with the following formula: Y = VA + VM + FK + IK, Description: Y = Total economic value; VA = Added value; VM = Economic value of feces production; FK = The economic value of savings; IK = The economic value of insurance

The environmental aspects. The collection of data on environmental indicator was based on the pollution of well water by livestock farming. The biological quality were E. coli, Total coliform, and Fecal coliform, while the chemical quality were nitrate and Fe content (budisatria *et al.,* 2007). The sampling of well water in the

Table 1. Indicators and target values from economic, environmental and social aspects in the beef cattle farming system in South Konawe Regency

Aspect	Parameters	Unit	Target	Description of the target value source
Economy	Feces	IDR/Year	656,790	The economic value of feces is based on the sale of 65% of its total production yearly, as a by-product from people's farms, with 3-6 head ownership at IDR 168,000/ton (Fyka *et al*., 2019)
	Savings	IDR/Year	785,474	The loan interest rate from Bank Sultra for livestock/head is 5.45%. (Bank Sultra, South Konawe Regency, 2019)
	Insurance	IDR/Year	1,152,990	Insurance per farmer was 8%, and it was obtained from PT Asuransi Jasindo AGRI for Cattle Business Insurance (PT Asuransi Jasindo AGRI, Southeast Sulawesi Province, 2019)
	Total income	IDR/Year	14,412,384	Family income poverty line (per household) in the rural areas of Southeast Sulawesi Province, which was IDR 316,729/person/month (per household of 4 people IDR 14,412,384) (BPS Southeast Sulawesi Province, 2019)
Environment	Faecal coliform	ppm/40ml	80	The standard limits for water chemistry in cattle farming (Center for Environmental Health Engineering, 2019)
	Total coliform	ppm/40ml	80	The standard limits for water chemistry in cattle farming (Center for Environmental Health Engineering, 2019)
	E. coli	ppm/100ml	10	The standard limit for water biology in cattle farming (Center for Environmental Health Engineering, 2019)
	Fe	ppm/100ml	0.3	The standard limit for water biology in cattle farming (Center for Environmental Health Engineering, 2019)
	Nitrate	ppm/100ml	10	The standard limit for water biology in cattle farming (Center for Environmental Health Engineering, 2019)
Social	Land ownership	Ha	1	Certified land ownership based on standards is estimated by the Government of Indonesia to achieve a good standard of living in rural areas (Hekmatyar & Nugroho, 2018)
	DM consumption	%/BW	2.5	The standard consumption needs of DM for adult beef cattle are based on the Technical Manual of Beef Cattle Breeding (Minister of Agriculture, 2015[b])
	Cattle pen area	M^2	2.5	The standard area of adult male/female beef cattle based on the Technical Manual of Beef Cattle Breeding (Minister of Agriculture, 2015[b])
	Mortality	%	5	Mortality standards based on the Technical Manual of Beef Cattle Breeding (Minister of Agriculture, 2015[b])
	Number of sick	%	10	Number of cattle sick standard based on the Technical Manual of Beef Cattle Breeding (Minister of Agriculture, 2015[b])

semi-intensive system was conducted on six farmers in West Ranomeeto sub-district. Moreover, the well was 10 m deep, and the distance between the pen and the well was 25 m. Well-water sampling in the intensive system were carried out on nine farmers in Konda Sub-district. Furthermore, the wells tested had depths of 10-15 m, while the distance between the cattle pen and the wells was between 15-20 m. All of the well water was used as drinking water by the farmer. The analysis of well water quality biologically and chemically were presented in Table 2.

The social aspects: This was carried out through interviews with farmers and direct observation of Bali cattle in the field. Data on social aspects consist of land ownership for the forage provision, pen area, number of sick cattle, mortality, and consumption of dry matter. Measurement of the land area owned by farmers was conducted through interviews. The pen area (m^2) was obtained by measuring the length and width using a measuring tape (*Butterfly®*) directly on each pen. The number (%) of sick cattle and mortality were calculated in one year. The data of sick and dead (mortality) cattle were obtained based on interviews with farmers and confirmed with recording cards. Measurement of feed consumption was carried out for 24 hours using a digital scale (*Wighang SF-400®*). Furthermore, this measurement for intensive system was carried out in the morning and afternoon, the remaining feed was weighed the following morning. Meanwhile, for semi-intensive, measurement was carried out only in the late afternoon, and consumption during grazing was estimated. This estimation was carried out with an approach to measuring forage production and the number of herds grazed. Measurement of forage production was conducted by taking random samples using a quadrant of (1x1m) at five different locations in each of the farmers' grazing areas. Forage in the frame was then cut as close to the ground as possible, and its botanical composition was observed. Furthermore, its samples were collected, weighed, and 5% of sample were analyzed to determine the dry matter content. Production calculations were carried out using the estimation method based on regional and weather conditions. It was assumed that the pasture experiences six harvests yearly, and its Proper Use Factor is 30%. To determine the dry matter consumption/head/day, the total production was divided by the number of animal units, only adult cattle which had a body-weight of 300 kg was used (Sulfiar *et al*., 2020).

Data analysis

The sustainability of the economic, environmental, and social aspects was analyzed using the sustainability analysis method. Meanwhile, to assess the contribution of indicators (SI) to sustainability, the formula of De Boer & Cornelissen (2002) was used.

Deviation of actual value against the target value:

Dij = ± (Ti-Aij)/Ti
= ± (1- Aij/Ti)

Total SI contribution to sustainability:

Table 2. Biological and Chemical Water Quality Test Methods

No	Test name	Method	Test location
1	E. coli	E. Coli was test with CFU/100 miles of water, using the APHA 2012 Section 9222 H method	Environmental Biology Laboratory,
2	fecal coliform	Faecal coliform testing was conducted with the amount of water CFU/100 miles using the APHA 2012 9221 E method	Yogyakarta Environmental Health Engineering Center
3	Total coliform	Total coliform testing with CFU/100 miles of water using the APHA 2012 Section 9222 H method	
4	Fe	Iron (Fe) testing with 100 miles of water using the SNI 6989.4-2009 method	Water Chemistry Physics Laboratory,
5	Nitrate	Nitrate (NO3-N) testing with 100 miles of water using the APHA 2012 method, section 4500-NO3B	Yogyakarta Environmental Health Engineering Center

$$C_j = \sum_{i=1}^{n} W_i D_{ij} / \sum_{i=1}^{n} W_i$$

Description:
Dij = deviation, Ti = target value, Aij = actual value, Cj = total contribution, and W = value for each aspect of sustainability (W = 1). The interpretation was based on the Dij value and the character of the indicator, namely, increase (Inc) and decrease (Dec). If the indicator increased, then the Dij value was greater and or equal to Ti. It was interpreted as sustainable, but when the Dij value was smaller than Ti, it was unsustainable. Meanwhile, the Dij value that was smaller or equal to Ti was interpreted as sustainable in the decreasing indicator. However, when the Dij value was greater than Ti, it was interpreted as unsustainable.

RESULTS AND DISCUSSION

South Konawe Regency was a very potential area in developing sources of beef cattle, especially Bali cattle with all its potential, in terms of farmers, production systems, land and government policies. Animal husbandry development policies need to be in line with the small farmers welfare. In addition, Nalefo (2020) explained that improving the welfare of small farmers was one of the long-term agricultural development goals in Indonesia. Therefore, the development direction should be implemented in the sustainability context. The concept of sustainability in livestock farming has been already proposed and discussed in various contexts. Sustainable livestock farming systems can be broadly defined as systems that were economically viable for farmers, environmentally friendly, and socially acceptable (Ten Napel *et al*., 2011, Lebacq *et al.,* 2013, Martin *et al.,* 2020). The results of the sustainability analysis, and the overall contribution of each indicator in the semi-intensive and intensive production systems were presented in Table 3.

The indicators in the economic aspect were increasing, meaning that the higher the actual value, the higher the contribution to sustainability. The results showed that in a semi-intensive system, all indicators give negative results and the total contribution value is negative (-0.45). Therefore, the economy indicator in semi-intensive systems has not been able to contribute to business sustainability. Conversely, farmers who raise cattle with an intensive system show that the indicators used were positive (+0.17), therefore contributing to business sustainability in the economic aspect. The difference in the sustainability analysis results from an economic aspect was probably due to differences in the number of animals being raised and the raising purpose. In the semi-intensive system, the number of livestock was less than in the intensive system Furthermore, the main objectives in the semi-intensive system was breeding while in the intensive, it was fattening. This will affect the physical production (kg/years) and the economic value of the livestock function as a producer of feces, savings and insurance.

Economic sustainability referred this research related to the calculation of the economic aspects use in smallholder livestock farms. It focused on physical production and economic benefit (Budisatria *et al*., 2010, Widi *et al.,* 2015), the added value of feces as fertilizer (Agus and Widi, 2018) and its functions as savings and insurance (Haq *et al* 2019). Indicators of livestock function as savings and insurance on the semi-intensive system give negative values, in contrast to the intensive system, which is positive. This value due to the number of cattle and production was lower than in the intensive system. Moll (2005) reported that the livestock value in function as savings and insurance affects the total benefits generated and can help farmers increase their business sustainability. The value of livestock as savings and insurance was lower than Jabres cattle with the semi-intensive and intensive production system, namely IDR/year 3,161,000 and 1,042,000 (Haq *et al*., 2019). The total economic benefit from raising livestock during one year was higher than the regional minimum wage (UMR) or the poverty line for family income per household. The total economic benefit in the intensive system was 49.88% higher than in the semi-intensive system. Udo *et al*. (2011) stated that although intensive farming costs are quite high per year, the resulting net production can provide good economic value even though the small-business scale.

Indicators in environmental aspects were decreasing, meaning that the lower of the actual value was better. The results showed that indicators in both production systems give negative results, meaning that they have not contributed to sustainability. Table 3 showed two indicators of the environmental aspects in a semi-intensive production system have not contributed positively to sustainability. The concentrations of faecal

Table 3. Sustainability analysis of economic, environmental, and social aspects in the beef cattle farming system in South Konawe Regency

Aspects	Unit	Target value (T)	Semi intensive system			Intensive system	
			Character	Ai	Dij	Ai	Dij
Economy							
Feces	IDR/Year	656,790	Inc	120,500	-0.82	1,055,340	+0.61
Savings	IDR/Year	785,474	Inc	520,050	-0.34	789,360	+0.00
Insurance	IDR/Year	1,152,990	Inc	763,367	-0.34	1,158,690	+0.00
Total income	IDR/Year	14,412,384	inc	10,034,100	-0.30	15,040,080	+0.04
C					***-0.45 Un-sustainable***		***+0.17 Sustainable***
Environment							
E. coli	Ppm/40ml	10.0	Dec	0.00	+1.00	200.00	-19
Fecal Coliform	Ppm/40ml	80.0	Dec	540.10	- 5.75	94.10	-0.18
Total Coliform	Ppm/40ml	80.0	Dec	250.00	-2.13	201.80	-1.52
Iron (Fe)	Ppm/100ml	0.3	Dec	0.08	+0.74	0.10	+0.67
Nitrate	Ppm/100ml	10.0	Dec	5.95	+0.41	2.08	+0.79
C					***-1.15 Un-sustainable***		***-3.85 Un-sustainable***
Social							
land ownership	Ha	1.0	Inc	0.98	-0.02	1.24	+0.24
Cattle pen area	m^2	2.5	Inc	4.04	+0.62	4.30	+0.72
Sick cattle	%	10.0	Dec	10.40	-0.04	7.22	+0.20
Mortality	%	5.0	Dec	7.80	-0.56	4.01	+0.20
DM consumption	%/BW	2.5	Inc	1.21	-0.52	2.30	-0.08
C					***-0.10 Un-sustainable***		***+0.27 Sustainable***
Total C					***-0.57 Un-sustainable***		***-1.14 Un-sustainable***

Note: Dij = Deviation of the sustainability indicator; T= The value of the sustainability target; Ai = The actual value of sustainability; Inc = Increase; Dec = decrease; C = Total contribution of indicators to sustainability coliform and total coliform higher compared to the quality standards. While for the intensive production system, three indicators which have not contributed to the sustainability of the environmental aspect were the concentration of E. coli, faecal coliform and total coliform. Furthermore, the total contribution value in the intensive production system was lower than the semi-intensive system (-3.85 vs -1.15).

In the environmental aspect, one of the factors causing the high concentration of E. coli, faecal coliform and total coliform in well water was the pen condition and fecal storage which is about 10-25 meters away. Furthermore, cattle were usually grazzed in their yards therefore cow dung can have a negative impact on the quality of conventional well water and cause a negative contribution value. Budisatria *et al*. (2007) found that livestock farming from an ecological aspect has not been contributing to sustainability, especially the existence of air and water pollution. The faecal coliform and total coliform values obtained in the small ruminant farmer's well-water were 920 and 202 cfu/100 ml. Meanwhile, the threshold set by the government is 80 cfu/100 ml. Research by Widodo *et al.* (2014) found a total coliform and E. coli contamination of 4.3-93 and 9.3-240 ppm/100 ml on beef cattle farm in Yogyakarta. According to Krapac *et al.* (2002) apart from the distance of a cattle pen from a water source, the depth of the water source can also have an impact on the contamination level. Furthermore, they found that bacterial contamination was significantly reduced at a well depth of 30 m. The well depth in this research was around 10 m caused the manifestation of E. coli and coliform bacteria was very high, especially in intensive systems.

The beef cattle farming, both with a semi-intensive and intensive production system were still below the quality standard threshold in conventional well-water pollution caused by cow fecal pollution. Ogino *et al.* (2015), Widi *et al.* (2015), and Leinonen (2019) stated that in livestock farming was difficult to positively contribute to sustainability, given that there was still high production of gas emissions resulting from its activities, especially ammonia and methane. The effort in reducing the environmental pollution impact was handling and processing faecal waste into compost. After all, compost will positively reduce environmental problems caused by livestock and make more efficient use of internal resources for crop farming.

The indicators of social aspect, namely sick cattle and mortality, have a decreasing character, meaning that the actual value will be better when it was lower. In contrast, the other three indicators have an increase character, meaning that the actual value will be better when it was higher. The results showed that all indicators give negative results in the semi-intensive system and have not contributed to sustainability (-0.10). Meanwhile, four indicators were positive in an intensive system, except for the dry matter consumption was still negative. In total, the social aspect of the intensive system positively contributed to sustainability (+0.27).

One negative indicator in both the semi-intensive and intensive production systems was dry matter consumption, and this indicated that raising management was still not being carried out properly, especially in the feeding aspect. The quantity and quality of feed consumed by beef cattle in Southeast Sulawesi was strongly influenced by the production system carried out by farmers. Sulfiar *et al.* (2020) reported that pasture production and carrying capacity in the semi-intensive system in South Konawe during the dry season were very low, namely 0.72 tonnes/year and 0.22 animal unit (AU). Whereas in intensive systems, feeding was only field grass and sometimes combined with *Gliricidia* or *Macroptilium* legumes (Saediman *et al*., 2019). All the condition due to the farmers do not have knowledge on feed management, such as types, nutrient content and requirement of feed (Saili, 2020).

Based on the sustainability analysis results of the three aspects, it can be mentioned that the beef cattle production system in South Konawe Regency carried out by farmers using a semi-intensive or intensive system has not contributed positively to sustainability. The total value is still negative, namely -0.57 in semi-intensive systems and -1.14 in intensive systems. The conditions of traditional livestock farming in developing countries, farmers have not thought about the sustainability aspect because the farming objectives were multipurpose and also involve radical changes in the mindsets of farmers regarding the production process, environmental conservation as well as quality and food safety (Widi *et a*l., 2015, Ates *et al.,* 2018, Bisht *et al.,* 2020). The difference of beef cattle production system in the South Konawe Regency does not necessarily ensure sustainability even though the intensive system was able to provide higher economic benefits, it also produced high levels of bacterial which contaminated drinking water sources. Baba *et al.* (2014) stated that the factor with a positive influence on the adoption of intensive production system was the relative profit obtained by farmers due to increased productivity. The policy implication based on the sustainability analysis was to plan beef cattle (Bali cattle) development using an intensive production system. It is necessary to improve maintenance management by scaling-up raising cattle, increasing the provision and quality of feed, and improving of waste processing and handling so that it will not pollute the environment (well water). In the future, government policies in developing beef cattle farming in South Konawe Regency were needed to support the sustainability of smallholders by balancing increased productivity with the resulting environmental impacts.

CONCLUSION

Based on the sustainability analysis, the economic, environmental and social aspects in the semi-intensive production system have contributed negatively. In the intensive, the economic and social aspects have contributed positively by +0.17 and +0.27. However, the negative contribution from environmental aspects was quite large by -3.85 due to the high content of E. coli and Fecal Coliform on well water quality of 200 ppm/40 ml. Overall, both the beef cattle production system in South Konawe Regency carried out by smallholder farmers have not sustainable to beef cattle farm.

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