



Factors Affecting Sustainable Animal Husbandry Development: Evidence from Kalimantan

MOH ZALI

University of Madura, Pamekasan, Indonesia.

Abstract | The article analyses the potential value of local livestock breeds with the aim of analysing useful elements to both conserve and attribute value to them. This study uses the integrated rural development approach. This study identifies that maintaining a continuous supply of beef cattle stock have already become serious attention and problem in both developed and developing countries. Such situations also cannot be separated from the current situation in Indonesia. This is because the availability of adequate livestock populations are under uncertainty. This study empirically finds that in Kalimantan, the livestock population can continue to increase if there are serious efforts for an increase in the number of births of livestock, controlled mortality of livestock, and reduced cutting of productive female cattle. This is true statement that the continuity of meat supply is generally related to the number and the production level of beef cattle. Therefore, it requires a form of sustainable animal husbandry development to increase the production and productivity of livestock. This study proposes factors associated with stimulating higher productivity for cattle ranching intensification. Those are developed from an empirical study in which Kalimantan are taken as case study. This study suggests that an increased beef consumption which is under the subsidy can be addressed if government of Indonesia carefully consider a complex interplay of cultural and socio-economic factors. This study also identifies that volumes of livestock slaughtered; animal husbandry farmers' terms of trade; livestock products consumption; meat production have considerable effects on cattle population such as, beef cattle; dairy cattle; buffalo; horse in Kalimantan Island. In general, we found that the long-term interests of socio-economic and environmental factors become a broad range of significant issues affecting farmers, local government and the community in Kalimantan Island.

Keywords | Local livestock breeds, Livestock populations, Cattle ranching intensification, Production and productivity of livestock

Received | March 13, 2019; **Accepted** | July 15, 2019; **Published** | September 25, 2019

***Correspondence** | Moh Zali, University of Madura, Pamekasan, Indonesia; **Email:** zali@unira.ac.id

Citation | Zali M (2019). Factors affecting sustainable animal husbandry development: evidence from kalimantan. *Adv. Anim. Vet. Sci.* 7(10): 866-875.

DOI | <http://dx.doi.org/10.17582/journal.aavs/2019/7.10.866.875>

ISSN (Online) | 2307-8316; **ISSN (Print)** | 2309-3331

Copyright © 2019 Zali. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

It must be confessed, the growing demand for high-value animal products that makes an increasing pressure on the livestock sector has become crucial issues faced by global and regional authorities. For example, the U.S. livestock sector is predicted to increase production over the next decade (United States Department of Agriculture, 2016). An increased demand for livestock products is predominantly caused by, but not limited to, the increase in the number of individuals in a population (Wang et al., 2010; Thornton, 2010) and income growth and urbanization (Gandini and Villa, 2003). According to OECD

(2018), the world' consumption of livestock products is on the rise. It shows that "annual meat production is projected to increase from 218 million tonnes in 1997-1999 to 376 million tonnes by 2030". Even though the trade projections and production for livestock commodities are on the dynamic trends (Thornton, 2010), the growing livestock population is complex enough as it stands.

Self-sufficiency in preserving certain breeds has become serious academic attention over the years. For instance, Thornton, (2010) studies the projections of total demand for livestock products, both current and future conditions in the livestock sector globally. He argues that in devel-

oped and developing countries, they have similar problems associated with rapidly increasing demand for livestock commodities. For this issue, he suggests that the domestication processes and the local development of specialised dairy and beef breeds must be a prioritise agenda. Then he accentuates and urges future studies must be focused on further development of local breed characteristics. Separately, Godfray et al. (2010) who explore the future of the global food system provide conceptual discussion about an increasing concern about food security. They document that the ability of the world to provide livestock commodities can be predicted unmanaged because the threats and opportunities for local cattle breeds to meet demand for direct human consumption are likely to conflict each other. As a result, they argue further studies to explore the major drivers (e.g. environmental concerns) affecting the productivity of local livestock breeds. Therefore, the current study attempts to fulfil the void as recommended by prior studies in response to global meat production that is projected to be 15% higher in 2027 (OECD, 2018).

Simianer (2005) in his study sees local farm animal breeds as potential alternative in addressing heavy pressures on local husbandry productivity or market needs that are globally competitive. However, as he explains that the challenges of production systems confronted with regional and local ranchers, in particular in developing countries can bring implication on, or can threaten the existence of breeds in developed countries. Such socio-economic factors are recognised as important components of the existence of world cattle populations. As mentions by Thys et al. (2005), the traditional (rural) producers of breeds faces a wide range of specific constraints, which is not only related to environmental issues. Thys et al. explore “Socio-economic determinants of urban household livestock keeping in semi-arid Western Africa”. They find, local breeders in Western Africa tend to be effected by governmental policy (e.g. market demand that provoke government to do export for cattle). Similarly, the most current literature study related to the cattle population shows government programs on farmer’s level bring positive and negative influences on domestic cattle population and beef meat production (Agus and Mastuti, 2018). In this point, Agus and Mastuti suggest, there is need for empirical study which focuses on how external or national factors affect farmers’ productivity in improving cattle performance.

Therefore, in addition to testing those some active areas of research, this study also explores the cattle population for Beef Cattle, Dairy Cattle, Buffalo, and Horse in Kalimantan. It is intended to provide preliminary consideration or concern for government Indonesia in expanding a significant quantity of cattle in other areas which have declined considerably over the last three decades. Importantly, this study also possess significant contribution to the poor

quality and quantity of the cattle populations, especially in terms of the cattle system of ancient Greece (McInerney, 2010, p. 3).

RESEARCH METHODOLOGY

The study area is Kalimantan Island which consists of four provinces such as East, South, West, North and Central Kalimantan. Exploratory factor analysis was performed on each of the proposed items. The data used in the study include secondary data. Secondary data used consisted of tabular data in the form of livestock population data, data on imports and exports of livestock commodities, data on livestock production, volumes of livestock slaughtered, animal husbandry farmers terms of trade, from various related agencies, for example both national and local Central Bureau of Statistics (2018). It is a non-departmental government institute of Indonesia that is responsible for conducting statistical surveys. Its main customer is the government, but statistical data is also available to the public. Annual surveys include national and provincial socio-economics, manufacturing establishments, population, and agricultural sectors.

In analysing the collected data, this study employs Statistical Package for the Social Sciences (SPSS) that can determine the causal factors of the phenomenon. Components of the proposed factors were analysed using standardized measures consistent previous studies. We combine data from different levels of analysis. Because the data are from different levels of analysis, the statistical model in this study recognise changes in each of the groups for the investigated issues. Based on the collected information, a scoring system is manually developed to determine the percentage of the explanatory constructs in this study.

BRIEF BACKGROUND OF STUDY AREA – KALIMANTAN ISLAND

Seeing the geographical condition of the island of Kalimantan in the territory of Indonesia is located between 4 ° 24 ‘LU - 4 ° 10’ LS and between 108 ° 30 ‘BT - 119 ° 00’ BT. The island of Kalimantan is located on the north of the island of Java, east of the Straits of Malacca, located west of the island of Sulawesi and to the south of the Philippines. Whereas for the area of Kalimantan Island is 743,330 Km². Kalimantan has a wealth of abundant forests. In 1968, Kalimantan was estimated to have 41,470,000 Ha of forest. This area covers 34% of the total forest area in Indonesia. By the year 1990, the area of land in Kalimantan which was still covered by forests was only 34,730,000 Ha. This figure shows forest loss of seven million hectares for twenty years.

This study focuses on the island of Kalimantan because the long-term agendas of Indonesia government for future

Table 1: Bivariate correlations between all variables.

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|-------|------|-------|------|------|------|-----|-----|------|-----|
| Cattle Population | | | | | | | | | | |
| Beef Cattle | .89 | | | | | | | | | |
| Dairy Cattle | .22* | .82 | | | | | | | | |
| Buffalo | .16 | .28* | .82 | | | | | | | |
| Horse | .16 | .04 | .21 | .80 | | | | | | |
| Independent Variables | | | | | | | | | | |
| Livestock Slaughtered | .27* | .24* | .28* | .22* | .79 | | | | | |
| Animal Husbandry Farmers Terms of Trade | .25* | .27* | .42* | .25* | .08 | .94 | | | | |
| Livestock Products Consumption | .43** | .25* | .31** | .55* | .10 | .11 | .95 | | | |
| Meat Production | .42** | .26* | .33** | .25* | .16 | .07 | .17 | .97 | | |
| Control Variables | | | | | | | | | | |
| Livestock Export | .28* | .28* | .11 | .15 | .24* | .27* | .13 | .12 | .83 | |
| Livestock Import | .24* | .22* | .10 | .23* | .01 | .11 | .12 | .06 | .23* | .90 |

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

The result of cronbach's alpha to show the internal consistency as displayed in table 1 appears in bold.

livestock development priorities tend to be prioritised in areas outside Java Island. The main consideration is the vast potential of land resources and the low population density. Kalimantan's potential aspects in an effort to meet animal food security from domestic resource-based livestock is considered to be quite large. Given the vast nature of pasture, superior grass planting and integration between plantations and livestock population in Kalimantan have considerable attention from Indonesia government. This study is hoped to provide empirical guidance in supporting the National Program for Self-Sufficiency of cattle population in Indonesia, which is one of the main programs of the Ministry of Agriculture related to livestock. Importantly, this study is to answer a call given by prior studies related to how socio-economic constructs influence local cattle populations.

RESULTS

BIVARIATE CORRELATIONS

Table 1 presents the bivariate correlations between all variables used in the study. Of note are the positive and moderate significant relationships between independents variables (Livestock Slaughtered; Animal Husbandry Farmers Terms of Trade; Livestock Products Consumption; Meat Production) and dependent variable (Cattle Population such as, Beef Cattle; Dairy Cattle; Buffalo; Horse). According data depicted in Table 1, it shows that multicollinearity does not appear to be an issue in this data. It means that designed experiments are considerable to be free from misleading results. As evidenced by there is no inter-correlations among independent variables.

Then, Table 1 also presents a measure of internal consistency for the data being analysed. As we can see, in general an estimate of the reliability (or consistency) of test scores suggests satisfied results (*Dependent variables*, such as Beef Cattle, 0.89; Dairy Cattle, 0.82; Buffalo, 0.82; Horse, 0.80; *Independent variable*, such as Livestock Slaughtered, 0.79; Animal Husbandry Farmers Terms of Trade, 0.94; Livestock Products Consumption, 0.95; Meat Production, 0.97; *Control Variables*, such as Livestock Export, 0.83; Livestock Import, 0.90). These results show that the items have relatively high internal consistency. According to Johnson & Wichern's (2007) explanation, a reliability coefficient of .70 or higher can be considered "acceptable" to measure elements in the evaluation of proposed concerns.

EFFECTS OF CONTROL VARIABLES ON CATTLE POPULATION

As can be seen in Table 2, conditions of livestock export are likely related to the commercial population of cattle across national borders. It is suggested that conditions of livestock export to the population of cattle have negative implications. The populations of Beef Cattle ($B = -.19 p < 0.01$), Dairy Cattle ($B = -.09 p < 0.01$), Buffalo ($B = -.21 p < 0.01$), Horse ($B = -.10 p < 0.01$) were significantly more likely to pose "potential for serious suffering when the conditions of livestock export are forced to lift or increase export quotes to partner countries. Meanwhile, the occurrences of livestock import have considerable *positive* effects on the populations of Dairy Cattle ($B = .06 p < 0.05$), and Horse ($B = .01 p < 0.05$), but have considerable *negative* effects on the populations of Beef Cattle ($B = -.01 p < 0.01$) and Buffalo ($B = -.02 p < 0.01$). These results suggest all domesticated animals tends to fluctuated when

Table 2: Tobit regressions predicting cattle populations: Control Variables

| Variable | Livestock Export | | Livestock Import | |
|-----------------------|------------------|------------|------------------|------------|
| | Coefficient | Std. Error | Coefficient | Std. Error |
| Beef Cattle | -.19** | .34 | -.01** | .41 |
| Dairy Cattle | -.09** | .25 | .06* | .20 |
| Buffalo | -.21** | .32 | -.02** | .21 |
| Horse | -.10** | .34 | .01* | .35 |
| Constant | 7.53 | 1.47 | 5.61 | 1.67 |
| Pseudo R ² | .038 | | .011 | |

***p* < .01, **p* < .05 (two-tailed)

Table 3: Tobit regressions predicting cattle populations: Livestock Slaughtered

| Variable | Livestock Slaughtered | | Livestock Export | | Livestock Import | |
|-----------------------|-----------------------|------------|------------------|------------|------------------|------------|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| Beef Cattle | .00** | .03 | -.56** | .07 | .05* | .10 |
| Dairy Cattle | .02* | .52 | .45 | .35 | .00** | .42 |
| Buffalo | .42 | .43 | .31 | .52 | -.12** | .46 |
| Horse | -.57 | .07 | -.16** | .03 | .04* | .03 |
| Constant | 5.93 | 2.27 | 6.01 | 2.65 | 6.14 | 2.81 |
| Pseudo R ² | .047 | | .028 | | .032 | |

***p* < .01, **p* < .05 (two-tailed)

Table 4: Tobit regressions predicting cattle populations: AHFToT

| Variable | AHFToT | | Livestock Export | | Livestock Import | |
|-----------------------|-------------|------------|------------------|------------|------------------|------------|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| Beef Cattle | .01** | .32 | .42 | .32 | .05* | .37 |
| Dairy Cattle | .05* | .41 | .23 | .34 | .00** | .41 |
| Buffalo | .03* | .23 | .41 | .25 | -.12** | .32 |
| Horse | -.71 | .07 | -.26** | .06 | .04* | .06 |
| Constant | 5.43 | 2.21 | 5.24 | 1.31 | 5.03 | 2.01 |
| Pseudo R ² | .052 | | .055 | | .034 | |

***p* < .01, **p* < .05 (two-tailed)

the occurrences of livestock export and import take place. In effect, the livelihood of many people in rural and regional Kalimantan are affected by practices of livestock in overseas markets.

EFFECTS OF LIVESTOCK SLAUGHTERED ON CATTLE POPULATIONS

As reported in the Table 3, livestock slaughtered is responsible for ensuring the sustainable cattle populations. As we can see, the populations of Beef Cattle (B = .00 *p* < 0.01), Dairy Cattle (B = .02 *p* < 0.05), are positively likely to affected by the slaughter of livestock. At this point also the slaughtering circle may cause serious quality problems in the few domesticated livestock animals, especially the population of horse. It is statistically evidenced by the negative coefficient (B = -.57, *p* < 0.01) in relation to livestock slaughtered. Then, the population of Buffalo (B = .42) are not influenced by the routine activities of livestock slaugh-

tered. Horse and Buffalo, in Kalimantan are usually trained on a periodical basis for indigenous cultural rituals not for livestock slaughtered. Thus this statistic results is congruent with real lives of Kalimantan people.

EFFECTS OF ANIMAL HUSBANDRY FARMERS TERMS OF TRADE (AHFToT) ON CATTLE POPULATIONS

The results of analysis for Animal Husbandry Farmers Terms of Trade (AHFToT) in effecting the population of cattle are shown by Table 4. According to statistical results, the populations of of Beef Cattle (B = .01 *p* < 0.01), Dairy Cattle (B = .05 *p* < 0.05), and Buffalo (B = .05 *p* < 0.05) are positively influenced by Animal Husbandry Farmers Terms of Trade. It means that the livelihoods of all who depend on these cattle categories affected by countries' own domestic policies and by domestic policies in trading partners and in individual or groups of countries with a large influence on world trade. These effects are particu-

Table 5: Tobit regressions predicting cattle populations: Livestock Products Consumption (LPC)

| Variable | LPC | | Livestock Export | | Livestock Import | |
|-----------------------|-------------|------------|------------------|------------|------------------|------------|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| Beef Cattle | .02* | .31 | .11 | .31 | .06 | .37 |
| Dairy Cattle | .05* | .22 | -.13 | .24 | .00** | .41 |
| Buffalo | .45 | .16 | .21 | .21 | -.22** | .32 |
| Horse | .36 | .17 | -.29 | .21 | .24* | .06 |
| Constant | 5.06 | 3.11 | 5.14 | 2.51 | 5.23 | 2.42 |
| Pseudo R ² | .041 | | .042 | | .031 | |

***p* < .01, **p* < .05 (two-tailed)

Table 6: Tobit regressions predicting cattle populations: Meat Production

| Variable | Meat Production | | Livestock Export | | Livestock Import | |
|-----------------------|-----------------|------------|------------------|------------|------------------|------------|
| | Coefficient | Std. Error | Coefficient | Std. Error | Coefficient | Std. Error |
| Beef Cattle | .00** | .20 | -.06 | .12 | -.02 | .18 |
| Dairy Cattle | .01** | .10 | -.14 | .29 | .05* | .21 |
| Buffalo | .35 | .24 | .51 | .36 | -.22** | .32 |
| Horse | .56 | .31 | -.34 | .12 | .34 | .14 |
| Constant | 6.21 | 2.32 | 4.34 | 3.21 | 4.15 | 4.77 |
| Pseudo R ² | .072 | | .033 | | .072 | |

***p* < .01, **p* < .05 (two-tailed)

larly driven by a range of factors such as the global supply and stocks of commodities. As a result, Kalimantan people agricultural income tends to be volatile and fluctuate from year to year. However, the population of horse (B = -.71) in Kalimantan does not have implications from Animal Husbandry Farmers Terms of Trade. This implies that livestock farming around the Kalimantan, especially Horse, does not face several challenges with many concerns from a public and consumer point of view.

EFFECTS OF LIVESTOCK PRODUCTS CONSUMPTION (LPC) ON CATTLE POPULATIONS

An increasing pressure on the livestock sector to meet the growing demand for high-value animal protein may effect on the populations of cattle itself. In the Table 5, the populations of cattle in Kalimantan for Beef Cattle (B = .02 *p* < 0.05), and Dairy Cattle (B = .05 *p* < 0.05) are much more likely positively influenced by the consumption of animal protein, with the consumption of meat and milk. This means higher consumption of meat, poultry, milk and other dairy products in Kalimantan or other areas in Indonesia cannot be isolated from Kalimantan cattle inventory. However, the pattern of consumption which is very unpredictable does not influence the Kalimantan cattle populations for Buffalo and Horse. The domestication of cattle for these two animals are only believed for culture and spirituality. In particular Horses are not used for consumptions but are commonly employed as draft animals to plow the fields or transport heavy objects. Therefore, it is logic if the populations of these two animals stand without

any particular reference to recent changes in agricultural and food systems.

EFFECTS OF MEAT PRODUCTION ON CATTLE POPULATIONS

Meat consumption appears to be another determinant of cattle population in Kalimantan and other regions in Indonesia, it can be seen in Table 6. Kalimantan cattle inventory for Beef Cattle (B = .00 *p* < 0.01), and Dairy Cattle (B = .01 *p* < 0.01) are much more likely positively related to food consumption changes. Rising domestic meat consumption is likely to have a productive impact on the populations of these two animals. The average amount of meat consumed per person here does not against farming structures and practices for Buffalo and Horse. And unlike many other cattle populations, Buffalo and Horse are not typically used for human consumption. The data show that livestock production which is growing rapidly have largely failed to increase the existing cattle populations. In line with the national aspects of livestock trade and globalisation provoke the opposite reactions on farming practices for Buffalo and Horse. It is suggested by statistic coefficient for the populations of Buffalo and Horse account B = .35 and B = .56.

ADDITIONAL ANALYSIS

Based on the data presented in Figure 1, it seems that, locally, total population of beef cattle in 2018 increased when compared to the population in 2014. Details as follow: beef cattle from 2014 to 2015 rose by 1, 1% to 160.018

Head. Then the population of beef cattle in 2016 (164.113 Head), 2017 (167.314 Head), and 2018 (173.566 Head) are slightly expected to arise or at least the growth population levels were maintained. The value of beef cattle population rose by 151.376 Head to 173.566 Head are entirely driven by volume of beef consumption per capita in 2017 was 0.469 kg, or increasing by 12.50 percent of beef consumption per capita in 2016 was 0.417 kg (Indonesian Statistics of Livestock and Animal Health, 2018).

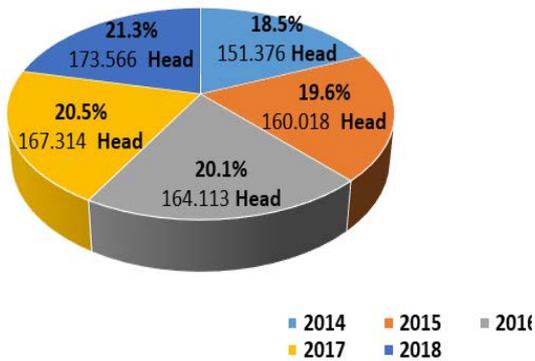


Figure 1: Beef Cattle Population 2014-2018 West Kalimantan

Then, Figure 2 tell us about the population of beef cattle in central Kalimantan. It suggest that, even though the volume of beef cattle in Mid-Kalimantan are not similar. But the growth patterns of the two regions are similar; that there is gradual increase over the years. It shows that it rose by 65.197 head to 84.661 head reflecting the increased populations for straw by the livestock industry. This population is a half of beef cattle population in West Kalimantan because farmers in Mid Kalimantan lack access to sufficient land and credit and insurance pushing them to increase their cattle volumes. Although considerable attention has been given to these concerns, local people still remain face challenges. Most of them are predominantly relying on lands that are accessed through land reform process and through subsequent inheritances from their previous family members.

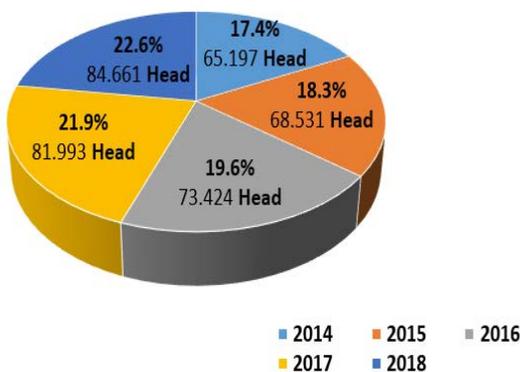


Figure 2: Beef Cattle Population 2014-2018 Central Kalimantan

Then the beef cattle population in South Kalimantan is currently increase since 2014 to 2018, as presented in the Figure 3. High volumes of manure and intensive manure management create and stimulate the growth rate of cattle populations in South Kalimantan. The Figure 3 shows that it was 141.446 Head for fiscal year of 2014, a rise of 166.825 head for fiscal year of 2018. This is because the motivations for these practices are compatible with strategies and livelihoods of the farmers. Figure 3 details the level of change to 2018 data since 2014. The highest progress of cattle population volumes occur between 2016 and 2017, which is a rise of 154.147 Head to 164.219 Head. It is a well-known reality that the development of livestock-raising in South Kalimantan flourishes most in those periods because operators of cattle fattening from private sectors provide the appropriate type of cattle feeding operation through intensive trainings, and the local government allows new or expanding livestock operations by providing land use. Then, in those periods also the development of meat production from 2015 to 2017 was fluctuating but generally experiencing enhancement. It was 4.056, 24 tons in 2015 to 7.210, 03 tons in 2017. Not surprisingly, cattle for the majority of South Kalimantan people are a means of saving money, an investment for hard times. They function at the same time as currency and a standard of value. One can use animals for payments and tell a person's status from their number.

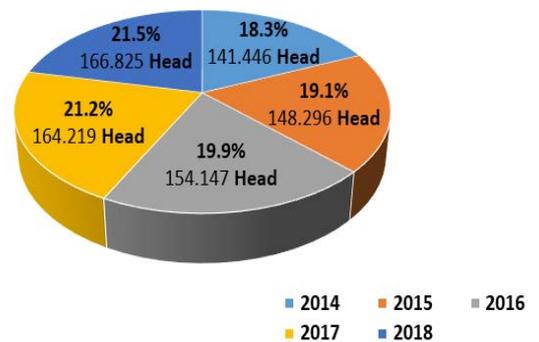


Figure 3: Beef Cattle Population 2014-2018 South Kalimantan

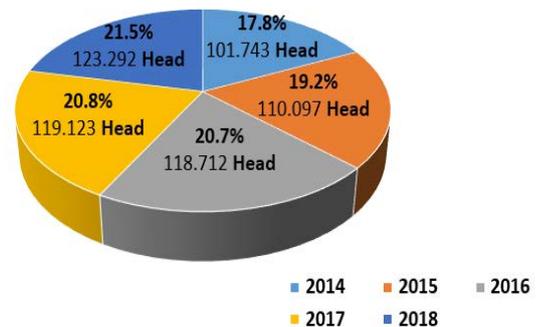


Figure 4: Beef Cattle Population 2014-2018 East Kalimantan

Figure 4 provides the cattle populations in East Kalimantan. The existence of livestock areas in East Kalimantan is a strategic step in the effort to develop and fulfil the needs of animal protein for the people in Indonesia in general and the people of East Kalimantan in particular. With the existence of farm areas, development programs farm from local governments, the beef cattle populations in East Kalimantan rose by 101.743 head to 123.292 head. Traditionally rearing of beef cattle in East Kalimantan has been cooperative with rice field activity. Changing patterns of land use and social and economic conditions are altering the way in which cattle are farmed. The Government of East Kalimantan Province through the Animal Husbandry and Animal Health Service provides land for the livestock sector, covering an area of 732.5 thousand hectares (The Government of East Kalimantan Province, 2018). This is primarily intended to perform activities that conform to their natural instincts (i.e. grazing on open pasture). In effect, The Government of East Kalimantan Province can meet the needs of beef consumptions. Data show, in 2014, beef consumed by East Kalimantan residents was around 10,400 tons, in 2015 around 10,600 tons, and in 2016 it was estimated that the consumption level was 10,852 tons, which is equivalent to 68,862 cows (Kaltim Post, 2016). Then it is reasonable for local government to ensure the availability of beef for their communities.

cut cattle, the most common were cattle and goats, which were 60,827 and 42,120. This shows the effect on meat production. The contribution of beef to meat production is the most compared to other livestock, namely 9,608.86 tons or 80.78 percent of the total livestock production, which amounts to 12,130.34 tons. Such situations make local government in North Kalimantan have to put great efforts to meet beef livestock consumptions.

DISCUSSION

This study identifies that volumes of livestock slaughtered; animal husbandry farmers' terms of trade; livestock products consumption; meat production have considerable effects on cattle population such as, beef cattle; dairy cattle; buffalo; horse in Kalimantan Island. One of the strong effects given by import and export activities. In other words, import and export activities have serious implication on the beef cattle population in Kalimantan. In particular import activities have negative effects on cattle population in north Kalimantan. Cattle breeders see the livestock climate in Kalimantan increasingly not conducive, especially throughout 2017. One main factor is the policy of the Ministry of Agriculture and the Ministry of Trade to widely open cheap beef import taps from India or Australia. The problems faced by the world of national livestock in Kalimantan farmers are not just a matter of skyrocketing beef prices, but also the fulfilment of domestic needs. The government cannot manage local farmers. In effect, this situation may cause the country's independence in meeting domestic meat stocks unmanageable. This finding is congruent with a condition of Japanese import demand for U.S. beef and pork products, as explored by Miljkovic et al. (2002); that uncontrolled import demand have effects on domestic livestock prices and recent economic volatility. As a result of the government's policy of importing meat, it resulted in an unstable conditions of local farmers.

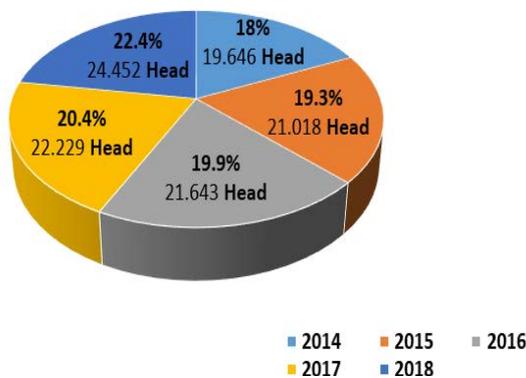


Figure 5: Beef Cattle Population 2014-2018 North Kalimantan

Uniquely, beef cattle populations in North Kalimantan are the least progress compared to the three provinces on the island of Kalimantan. As we can see in the Figure 5, in 2014 it is around 19.646 head and in 2018 around 24.452. As a result, central government suggests that North Kalimantan Government forms a group of farmers and stimulate them to increase their awareness towards risk guarantees or protection of his beef cattle. According to the Central Bureau of Statistics in North Kalimantan, in 2018 the animals cut in slaughterhouses were 40,825, consisting of 3 (three) types of livestock, namely cattle, buffaloes and goats. Whereas the cut outside the slaughterhouse numbered 89,886 from 6 (six) types of livestock. Of the total

According to data provided by Indonesian Statistics of Livestock and Animal Health, (2018) it shows that in term of volume, the livestock import in 2017 was 1.649 million tons, or increasing by 0.22 percent compared to the import volume in 2016 that was 1.645 million tons. Then in term of volume, the livestock export in 2017 was 0.23 million tons, or increasing by 8.54 percent from the export volume in 2016 that was 0.21 million tons. This suggests that there is significant gap in both volumes in which import activities outweigh export ones. The dependence on food imports is currently being concern and is still a serious problem faced by Indonesia. According to Sutaryono (2013 in Jiuhardi, 2016: 77) consumption is not comparable with domestic production, then it is the main reason for import policy made by Indonesia. As well as with other commodities such as rice, which stated that estimated consumption data always lower than production, but in reality Indonesia is

always import rice. Based this reasoning, rational production of high quality livestock feed (Babić and Perić, 2011), and the usage of genetically modified organism (GMO) technology (Philippidis, 2010) should be carefully considered by Indonesia, in order to meet the increasing needs for food in a continually increasing population.

Babić and Perić, (2011) argue that in analysing the increase in beef consumption cannot be isolated from a problematic domestic production, both in quality and quantity. For this reason, it is necessary to accelerate the beef self-sufficiency program. According to Sukardono (2009), in an effort to catch up with national beef needs, whose population growth is only 4.23%, the most important development is the acceleration of local cattle breeding and development, based on habitat and intensification efforts. Provision of sufficient quality food and quantity is a very important effort. It is because it plays a multi-faceted role in socio-economic development of rural households (Ali, 2007). In the case of the beef fattening system, Ogino et al. (2007) study beef cow-calf system by analysing environmental impacts in Japan. From their study, they document that environmental impacts on the entire beef consumption are linked to the Japanese beef-fattening systems. This suggests that, for investigating the beef cow-calf and beef-fattening systems, the contribution of each process of Japanese beef production system to the environmental impacts should be defined as one packaged-unit. Uniquely, the current study identifies, cattle ownership and trade cattle in the Kalimantan rural household and the village community are much relied on factors related to the conditions of cross-bred slaughter animals. Such conditions are not only influencing the feeding practices and selling prices of cattle, but also influences the cattle trade flows in Kalimantan.

Bearing in mind the multiple pressures on land use also contribute to the circles of cattle population in Kalimantan. It can be used as a basis for estimating the potential of cattle feeding, and calculating the capacity of livestock in the study area. The suitability of physical land for beef cattle is one of the factors that support the success of increasing livestock production and productivity. Livestock in areas with suitable physical conditions will show optimal body weight growth because environmental stress can be reduced (Morrison 1983). In this case not all regions in Kalimantan are suitable for the development of beef cattle, therefore it is necessary to conduct land suitability assessment using the agro-climate approach to assess the suitability of the physical environment for beef cattle and forage fodder. Then, it must be put in mind that the development of beef cattle breeding is closely related to the availability of forage fodder obtained by farmers so that the role of other agricultural sub-sectors is very important as a provider of agricultural waste and natural forage which is a weed for food crops, horticulture, and plantations. This

situation also contribute to the cattle population in Kalimantan.

Then, efforts to increase the cattle population should ideally be followed by increasing the welfare of farmers, which can be measured using the Farmer-Farm Exchange Rate approach. The Farmer-Farm Exchange Rate describes the purchasing power / exchange rate of farmers for products paid / purchased by farmers (Nurasa and Rachmat, 2013). The same thing was conveyed by National Development Planning Board, that the Farmer-Farm Exchange Rate is the purchasing power / farmer exchange capacity of goods, where this value shows the real ability of farmers and indicates the welfare of farmers. Thus, the higher the Farmer-Farm Exchange Rate the better the purchasing power of farmers so that it is relatively more prosperous. The ranching tradition for Kalimantan people living in the hill villages is long standing, enduring across many generations. This is often motivated by following reasons, such as financial security (saving), income, providing manure, raising the social status of their owner. The effects of changes in exchange rates on agricultural markets, in Kalimantan are affected by some factors, including contributions of livestock ownership to local families and communities and land use and ownership in the region. As a consequence, if they could not achieve their goals, they tend to do agricultural land conversion, commonly referred to deforestation because ranchers in Kalimantan are much more relying to a considerable degree on public land to graze their cattle.

Furthermore, due to the difficulties in accessing funding and marketing networks, this gives considerable effects on farmers' welfares because most of farmers who run cattle production place their business as main livelihood. Such concerns can be looked from the average livestock farmers exchange rate that goes very slow. According to data given by Indonesian Statistics of Livestock and Animal Health, (2018), the Average Livestock Farmers Exchange Rate in 2015 was 107.69. The average index of prices received by the livestock farmers in 2015 was 123.96. The average index of prices paid by the livestock farmers in 2015 was 115.10. The highest average in 2015 was in large livestock farmers' subgroup (125.83), while the lowest was in the production of livestock farmers' subgroup (119.23). These trends tell the difficulties of efforts to increase agricultural/cattle productivities in Kalimantan. The importance of continued funding here can make way for cattle-ranching stable; it also poses a significant effect to efforts to enhance farmer exchange rate and their productivity. In effect, Kalimantan cattle-ranching urge for funding to help halt cattle decline. To understand the problems and issues of cattle populations for buffalo and horse categories in Kalimantan, it might be better to understand cultural tradition and religious of most of Kalimantan people. These reasons that can make those cattle categories are not effected by external

factors. The majority Kalimantan people believe that the use of these two animals is not for consumptions. Rather they are commonly employed as draft animals to plow the fields or transport heavy objects. In particular, buffalo is designed for taking part in an elaborate traditional ritual, for example, performing the death rituals. In these beliefs, the local breeders have certain behavioural patterns which are suggesting objective beliefs for the importance of cultural values and community norms, rather than subjective self-interests. Focusing on respect for these concerns, breeds were chosen to respect and look after those animals in childhood. Therefore, local breeders for these kinds of cattle were not mainly connected to economic drivers. So this is clear that they are not too much affected by the trends of external factors, especially import and export activities.

The management system of problem of the old and unproductive animals in Kalimantan Island tends to have similarity to animal husbandry and dairy schemes as implemented in North America (Bowling et al., 2010). Kalimantan local breeders in optimising the physical and behavioural health and welfare of the cattle herd seriously pay attention on stock control through appropriate selection and weeding. But in some sense, the daily number of head slaughtered for human consumption in general, have strong pressure on the productivity of Kalimantan local breeders because unproductive livestock for slaughter seems to be rare found in Kalimantan. Of course, it severely disrupts the livestock supply chain at the heart of the rural economy.

This study agrees with the explanation given by Lesley et al. (2014) about dissemination of knowledge about effective model cattle farms for local breeders. This is because a complex interplay of cultural and socio-economic factors in national stages are difficult to be separated from the livestock populations in Kalimantan. This finding answers a call given by Gandini and Villa (2003) that what factors bring long-term effect on rural cattle ranchers. Even though those factors do not directly link to the practices and techniques for animal breeding and the intensification of production systems in rural areas, they could significantly affect livestock numbers. This study supports findings documented by Nkonki-Mandleni et al (2018); that livestock farming, especially dairy cattle production in province of south Africa are negatively affected by socio-economic and environmental factors.

CONCLUSION

The aim of this study is to explore and examine factors affecting the sustainable animal husbandry development in Kalimantan Island. Specifically, this study is to answer many calls for research focusing on sustainable animal in-

dustries (e.g. Odongo et al. 2010). This study provides important understanding of the sustainable growth of animal industries. We found that the long-term interests of cultural, socio-economic and environmental factors become a broad range of significant issues affecting farmers, local government and the community in Kalimantan Island. Therefore, the national government of Indonesia must carefully take into account those factors when considering the animal production sector and its development.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

Moh Zali, performed all the project which started from devising the project, the main conceptual ideas and proof outline, until revising the manuscript.

REFERENCES

- Agus A, Mastuti TS (2018). Current situation and future prospects for beef cattle production in Indonesia — A review. *Asian-Australasian J. Anim. Sci.* 31(7): 976-983. <https://doi.org/10.5713/ajas.18.0233>
- Ali J (2007). Livestock sector development and implications for rural poverty alleviation in India, *Livest. Res. Rural Develop.* 19 (2): 1-14.
- Babić Z, Perić T (2011). Optimization of livestock feed blend by use of goal programming, *Int. J. Prod. Econ.* 130(2): 218-223. <https://doi.org/10.1016/j.ijpe.2010.12.016>
- Bowling MB, Pendell DL, Morris DL, Yoon Y, Katoh K, Belk KE, Smith GC (2008). Identification and Traceability of Cattle in Selected Countries Outside of North America, *Professional Anim. Scientist.* 24 (4): 287-294. [https://doi.org/10.15232/S1080-7446\(15\)30858-5](https://doi.org/10.15232/S1080-7446(15)30858-5)
- Central Bureau of Statistics (2018). Road Map Pengembangan Kawasan Peternakan Provinsi Kalimantan Tengah Tahun 2016 – 2020.
- Gandini GC, Villa E (2003). Analysis of the cultural value of local livestock breeds: a methodology. *J. Anim. Breed. Genet.* 120 (1): 1–11. <https://doi.org/10.1046/j.1439-0388.2003.00365.x>
- Godfray HCJ, Crute IR, Haddad L, Lawrence D, Muir JF, Nisbett N, Pretty J, Robinson S, Toulmin C, Whiteley R (2010). The future of the global food system. *Philosoph. Transact. Royal Soci. B.* 365(1554): 2769-2777. <https://doi.org/10.1098/rstb.2010.0180>
- Indonesian Statistics of Livestock and Animal Health (2018). The fourth publication in the stages of the National Medium Term Development Plan 2015-2019. Published by Director General of Livestock and Animal Health Service.
- Jiuhardi (2016). Kajian tentang impor daging sapi di Indonesia. *Forum Ekon.* 17 (2): 75-91.
- Johnson RA, Wichern DW (2007). *Applied Multivariate Statistical Analysis.* 6th Edition, Pearson Prentice Hall, Upper Saddle River.

- Kaltim Post (2016). Konsumsi Daging Sapi di Kaltim Naik, (National reputable newspaper) <http://kaltim.prokal.com/read/news/276336-konsumsi-daging-sapi-di-kaltim-naik.html>
- Lesley S, Michael S, Peter HB (2014). Immigrants are attracted by local pre-breeders and recruits in a seabird colony. *J. Anim. Ecol.* 83: 1015–1024. <https://doi.org/10.1111/1365-2656.12206>
- McInerney J (2010). *The Cattle of the Sun: Cows and Culture in the World of the Ancient Greeks*, New Jersey: Princeton University Press. <https://doi.org/10.1515/9781400834877>
- Miljkovic D, Marsh J, Brester G (2002). Japanese Import Demand for U.S. Beef and Pork: Effects on U.S. Red Meat Exports and Livestock Prices. *J. Agric. Appl. Econ.* 34(3): 501-512. <https://doi.org/10.1017/S1074070800009275>
- Morrison SR (1983). Ruminant heat stress: effect on production and means of alleviation. *J. Anim. Sci.* 57 (6):1594–1600.
- Nkonki-Mandleni, B., Abiodun, O. O., Folasade O. (2018). Socioeconomic factors influencing livestock production among smallholder farmers in the free state province of south Africa. *Int. J. Entrepreneur.* 22 (4): 1-18 .
- Nurasa, T. dan Rachmat, M. (2013). Nilai tukar petani padi sentra produksi padi di Indonesia. *J. Agro Ekonomi.* 31(2): 161-179. <https://doi.org/10.21082/jae.v31n2.2013.161-179>
- Organisation for Economic Co-operation and Development (2018). *OECD-FAO Agricultural Outlook 2018-2027*.
- Odongo NE, Garcia M, Viljoen G (2010). Sustainable Improvement of Animal Production and Health, Food and Agriculture Organization of the United Nations in Rome.
- Ogino A, Orito H, Shimada K, Hirooka H (2007). Evaluating environmental impacts of the Japanese beef cow–calf system by the life cycle assessment method. *Anim. Sci. J.* 78(4): 42-432. <https://doi.org/10.1111/j.1740-0929.2007.00457.x>
- Philippidis G (2010). EU import restrictions on genetically modified feeds: impacts on Spanish, EU and global livestock sectors. *Spanish J. Agric. Res.* 8(1): 3-17. <https://doi.org/10.5424/sjar/2010081-1138>
- Simianer H (2005). Decision making in livestock conservation. *Ecolog. Econ.* 53(4): 559-572. <https://doi.org/10.1016/j.ecolecon.2004.11.016>
- Sukardono (2009). *Ekonomi Agribisnis Peternakan, Teori dan Aplikasinya*. Akademika Presindo. Jakarta.
- Thornton (2010). Livestock production: recent trends, future prospects. *Philosop. Transact. Royal Societ.* 365(1554): 2853-2867. <https://doi.org/10.1098/rstb.2010.0134>
- Thys E, Ouedraogo M, Speybroeck N, Geerts S (2005). Socio-economic determinants of urban household livestock keeping in semi-arid Western Africa. *J. Arid Environ.* 63(2): 475-496. <https://doi.org/10.1016/j.jaridenv.2005.03.019>
- United States Department of Agriculture (2016). *USDA Long-term Projections*, February 2016
- Wang Y, Beydoun MA, Caballero B, Gary TL, Lawrence R (2010). Trends and correlates in meat consumption patterns in the US adult population. *Pub. Health Nutri.* 13(9): 1333-1345. <https://doi.org/10.1017/S1368980010000224>