Analysis of the potential development of beef cattle in East Sumba Regency, East Nusa Tenggara Province, Indonesia

B K Watuwaya¹, J A Syamsu², Budiman², and D Useng³

¹PhD Candidate in Animal Science, Faculty of Animal Science, Hasanuddin University, Makassar - Agricultural Vocational School Kupang, Ministry of Agriculture, Indonesia
²Faculty of Animal Science, Hasanuddin University, Makassar, Indonesia
³Faculty of Agriculture, Hasanuddin University, Makassar, Indonesia

E-mail: bogarthw@gmail.com

Abstract. This study aimed to examine the potential development of beef cattle in East Sumba Regency, East Nusa Tenggara Province, Indonesia. The study used a secondary data by analyzing the structure of livestock populations, livestock density, i.e., economic density, regional density and farming density. Location Quotient (LQ) was used to find out the comparative advantage of beef cattle in East Sumba Regency. The results of the analysis showed that the population of beef cattle in East Sumba Regency during the last five years (2014-2018) showed an increase in population of 2.03% per year, with population structure based on the age of livestock, i.e. 2.821 AU of calf, 5.342 AU of heifers and 29.843 AU of cattle. Livestock density in terms of economic density shows a dense category (> 300 AU/person) 55% in 12 districts, regional density showed a rare category (<10 AU/Km²) 81.82% in 18 districts and farming density showed a balanced category between moderate (0.25 - 1.0 AU/ha) and rare (<0.25 AU/ha), 45.45% in 20 districts. While districts with a LQ value > 1 (potential) was reached 40.91% are found in 8 districts namely Lewa, Nggaha Ori Angu, Karera, Kahaungu Eti, Pahunga Lodu, Rindi, Pandawai and Haharu. This showed that there were 8 districts that have a comparative advantage in beef cattle production.

1. Introduction
Development of beef cattle farming required appropriate planning to ensure a special spatial plan that could guarantee food security and certainty in doing business in certain region [1]. To respond this issue requires an analysis of the potential for beef cattle development which could be further used in decision making to improve the welfare of the farmers as a whole.

Increasing of the welfare of Indonesian people was directly proportional to the increase in consumption of protein from animal origin, especially beef. Therefore, the fulfilment of meat requirement still comes from imported beef, where in the past five years (2013-2017) there was a surge in beef imports by 62.19% [2,3]. Nationally, beef cattle population and meat production were still not able to serve consumer demand. The fact showed that Indonesia has the advantage of natural resources in the form of vast land and human resources that can be capital in developing a specific beef cattle business.
In order to accelerate the achievement of economic development, the government divides main economic activities in six corridors, according to the potential of natural resources they owned. The East Nusa Tenggara Province was included in fifth corridor, where the livestock sector was the main leading commodity besides tourism and fisheries [4]. Natural conditions and the availability of extensive grazing land in East Nusa Tenggara Province supports the prime development of livestock businesses, especially beef cattle. East Sumba Regency was one of the regencies in East Nusa Tenggara Province that meets the criteria for developing the livestock business. Beef cattle farming in East Sumba Regency are dominated by small scale farmer, this was in line with Siregar's [2] statement, which states that 90% of livestock farming in Indonesia was owned by small and medium scale businesses.

The challenges of economic acceleration require an appropriate analysis in determining which areas have the potential for beef cattle development in terms of population structure, livestock density and potential base areas. This study aimed to examine the potential for developing beef cattle in East Sumba Regency, East Nusa Tenggara Province.

2. Method
This research was a descriptive study required secondary data obtained from relevant agencies which were processed to get a broader and a comprehensive picture of what is obtained in the field. Secondary data were obtained from the Central Statistics Agency, the Ministry of Agriculture, National Planning and Development Agency (Bappenas) and other relevant agencies.

2.1. Analysis of population and structure of beef cattle
This study aimed to analyze patterns of the population growth over the past five years and to standardize beef cattle population units from head units to animal units (AU) based on the ages of cattle, heifers and calf in each district. This value of animal unit (AU) became the standard in subsequent calculations. The number of livestock population calculated based on population structure (head) multiplied by the standard value of animal units.

2.2. Analysis of animal density
Livestock density can be divided into three types i.e. economic density, regional density and farm density. Calculation of livestock density used the following formula [5]:

\[
\frac{\Sigma \text{Beef Cattle Population (AU)}}{\Sigma \text{Inhabitants}} \times 1000
\]

Economic density was measured by the population (AU) in 1000 inhabitants. The criteria used are very dense (> 300 AU / person), dense (100-300 AU / person), moderate (50-1 AU / person) and Rare (<50 AU / person).

\[
\frac{\Sigma \text{Beef Cattle Population (AU)}}{\text{Farming area (ha)}}
\]

Farming density is measured from the number of livestock population (AU) per hectare of farmland (wet land, dry land). The criteria used were for ruminant animals which were very dense (> 2 AU / ha), dense (1-2 AU / ha), moderate (0.25 - 1.0 AU / ha) and rare (<0.25 AU / ha)

\[
\frac{\Sigma \text{Beef Cattle Population (AU)}}{\text{tillage area (km2)}}
\]

Regional density was measured by the number of livestock population (AU) per km². The criteria used are very dense (> 50 AU / Km²), dense (> 20 - 50 AU / Km²), moderate 10-20 AU / Km²) and rare (<10 AU / Km²)
2.3. Analysis of the comparative advantages of beef cattle

Location Quotient (LQ) analysis was used to determine the relative comparison between the ability of beef cattle in a district with the ability of the same sector at the regency level. The LQ formula according to Syamsu [5] was:

$$LQ = \frac{\left( \frac{Xi \circ}{X \circ} \right)}{\left( \frac{Xi (N)}{X (N)} \right)}$$

where:
- \(Xi \circ\): i-beef cattle population in district \(R\)
- \(X \circ\): total population of ruminants in district \(R\)
- \(Xi (N)\): i-beef cattle population in the regency
- \(X (N)\): total population of ruminants in the regency

LQ > 1 explains that the region has a comparative advantage compared to other regions.

LQ < 1 explains that the region lacks of comparative advantage compared to other regions.

3. Results and discussion

3.1 Beef cattle population

Sumba Island has long been known as a breeding and a purification centre for Ongole beef cattle, so it is now known as Sumba Ongole (SO) cattle. In the early twentieth century, the Dutch East Indies colonial government breed four species of cattle, buffalo and horses. In its development of the four species of cattle that have been bred, only Ongole cattle have been able to adapt well in the region to date [6,7].

Based on statistical data [3] [8] the population of Sumba Ongole cattle in East Sumba Regency in the past five years (2014-2018) shows an increase of 2.03% per year as shown in the following figure 1. The increase of population per district showed the differences. The districts with the highest increased in population were in Waingapu City (30.99%), Karera District (25.46%), Pinu Pahar District (15.47%) respectively. While the district with population numbers decreased consecutively was in Umalulu District (-18.20%), Matawai La Pawu District (-17.12%) and Kahaungu Eti District (-13.47%).

The slow population increase in beef cattle population in East Sumba Regency as in other regions in Indonesia was influenced by several factors, i.e. land use change and limited grazing land, limited sources of breedings, the nature and characteristics of cattle development, policies that are not yet comprehensive, limited financing schemes, ineffective management and development patterns, unstable price and market certainty and the institutional coordination [7,9,10].

Availability of accurate data related to the carrying capacity of the area to use the continuous supply of feed was very important in efforts to increase livestock populations [7]. The increase in monoculture farming was one of the primary reasons for the land use change of grazing land which was unmanageable to be detained [10].
3.2 Density of beef cattle
Livestock density is categorized into three types of density, i.e. economic density, regional density and farm density. Table 1 showed the category of livestock density in East Sumba Regency by District.

Table 1. Livestock Density and Location Quotient (LQ) 2018

| Districts                  | Economic | Density | Regional | Farming | Location Quotient (LQ) |
|---------------------------|----------|---------|----------|---------|------------------------|
|                            |          |         |          |         |                        |
| Lewa                      | 121      | +++     | 7.47     | +       | 0.15                   | 1.28 **               |
| Nggaha Ori Angu           | 203      | +++     | 6.98     | +       | 0.65 ++                | 1.22 **               |
| Lewa Tidahu               | 102      | +++     | 2.21     | +       | 0.20 +                 | 0.43 *                |
| Katala Hamu Lingu         | 188      | +++     | 1.72     | +       | 0.39 ++                | 0.47 *                |
| Tabundung                 | 115      | +++     | 2.03     | +       | 0.12 +                 | 0.64 *                |
| Pinu Pahar                | 152      | +++     | 4.64     | +       | 0.20 +                 | 0.70 *                |
| Paperiwai                 | 143      | +++     | 4.41     | +       | 0.26 ++                | 0.54 *                |
| Karera                    | 376      | ++++    | 9.46     | +       | 0.84 ++                | 1.93 **               |
| Matawai La Pawu           | 80       | ++      | 1.30     | +       | 0.28 ++                | 0.32 *                |
| Kakaungu Eti              | 219      | +++     | 4.15     | +       | 1.58 +++               | 1.20 **               |
| Mahu                      | 92       | ++      | 2.12     | +       | 0.22 +                 | 0.25 *                |
| Ngadu Ngala               | 50       | +       | 1.26     | +       | 0.03 +                 | 0.16 *                |
| Pahunga Lodu              | 231      | +++     | 8.83     | +       | 0.50 ++                | 1.88 **               |
| Wula Waijelu              | 41       | +       | 1.44     | +       | 0.06 +                 | 0.19 *                |
| Rindi                     | 564      | ++++    | 15.62    | +       | 2.14 +++               | 3.49 **               |
| Umalulu                   | 55       | ++      | 3.26     | +       | 0.29 ++                | 0.61 *                |
| Pandawai                  | 410      | +++     | 16.34    | +       | 1.43 +                 | 4.11 **               |
| Kambata Mapambuhang       | 143      | +++     | 1.35     | +       | 0.12 +                 | 0.34 *                |
| Kota Waingapu             | 34       | +       | 18.20    | +       | 0.60 ++                | 0.82 *                |
| Kambera                   | 36       | +       | 23.53    | +++     | 0.51 ++                | 0.75 *                |
| Haharu                    | 274      | +       | 2.93     | +       | 0.15 +                 | 1.07 **               |
| Kanatang                  | 119      | +       | 4.45     | +       | 0.71 ++                | 0.76 *                |

Very dense = ++++, Dense = ++, Moderate = +, Less Potential = *
Economic density is a picture of the number of beef cattle ownership per person in one area. Based on Table 1, the category of economic density was dominated by dense category (> 100-300 AU / person) of 54.55%, followed by a rare category (<50 AU / person) of 18% in four districts namely Waingapu.
City (34 AU/person), Kambera District (36 AU/person), Wula Waijelu District (41 AU/person) and District Ngadu Ngala (50 AU/person). Areas with very dense categories indicated the possibility of livestock competition in the provision of food so that the cost of providing feed ingredients for livestock will be more expensive and vice versa (figure 2).

Regional density provided an overview of the population of beef cattle per square kilometre. The lower category of regional density showed that the population of beef cattle was still possible to be developed. Based on Table 1, the regional density of East Sumba Regency was dominated by rare category (<10 AU/km²) of 81.82% in 18 districts, 3 districts at moderate category (10-20 AU/km²) 13.64% and 1 district with dense category (> 20-50 AU/km²), i.e., Kambera District (23.53 AU/km²). Lower regional density also indicated that there was still an adequate open land for grazing, where livestock will be free to choose forages that were mostly like and of course reduce a cost and the role of farmers in providing feeds. Conversely, in areas with denser categories, beef cattle business was carried out more intensively (figure 2).

Farm Density is a comparison between the number of beef cattle population and the area of tillage land (total area of wet and dry lands). In Table 1 it can be seen that there are two districts with a dense category of farming density (> 2 AU/ha) 9.09%, while there are 10 districts of moderate category (>0.25-1.0 AU/ha) 45.45% and 10 districts with the rare category of density (<0.25 AU/ha) 45.45%. The category of livestock density is based on moderate and rare category shows that the area of farming land still can supports the development of beef cattle. The by-product of agricultural farming in the form of forages and agricultural waste is a source of feed that supports livestock productivity, but it can also be used as a grazing land (figure 2).

Figure 2. Livestock Density in East Sumba Regency 2018
3.3 Regional comparative advantage
Table 1 showed that beef cattle farming was a base sector or there was a concentration of cattle raising activities in eight districts in East Sumba Regency, namely Lewa District (1,28), Nggaha Ori Angu District (1,22), Karera District (1,93), Kahaungu Eti District (1,58), Pahunga Lodu District (1,88), Rindi District (3,49), Pandawai District (4,11) and Haharu District (1,07). Districts with LQ value > 1 indicate that this district area has the potential or has a comparative advantage to be developed as well as being a supplier area for beef cattle in the surrounding area.

![Location Quotient](image)

**Figure 3.** Regional comparative based on location quotient

The highest LQ value was in Pandawai District (4.11) followed by Rindi District (3.49). This can be explained based on data on livestock density, where livestock development was strongly influenced by the potential carrying capacity of the land and size of farming land and the amount of human resources available at a district area (figure 3).

4. Conclusion
Beef cattle population in East Sumba Regency in the past five years (2014-2018) has increased by 2.03% per year. Livestock economic density was dominated by dense category (> 100-300 AU / person) of 18%. Regional density was dominated by rare category (<10 AU / km2) of 81.82% in 18 districts. Meanwhile, moderate farm density (> 0.25-1.0 AU / km2) and rare density (<0.25 AU / km2) balanced at 45.45%. The highest LQ value was in Pandawai District (4.11) followed by Rindi District (3.49). This can be explained based on data on livestock density, where livestock development was strongly influenced by the potential carrying capacity of land and farming as well as the amount of human resources available in a district area.

References
[1] Syamsu J A, Jusuf M and Zulkharnaim 2019 Sustainability status of pasture for cattle development area in Pinrang Regency, South Sulawesi IOP Conf. Ser. Earth Envir. Sci. 247 012058
[2] Siregar A R 2019 Persaingan Usaha Peternakan di Era Revolusi Industri Seminar Nasional Perhimpunan Ilmuwan Sosial Ekonomi Peternakan (PERSEPSI) IV (Makassar)
[3] Direktorat Jenderal Peternakan dan Kesehatan Hewan 2018 Statistik Peternakan dan Kesehatan Hewan 2014 - 2018 (Jakarta: Kementerian Pertanian Republik Indonesia)
[4] (Bappenas) B P P N 2014 Arahan Kebijakan dan Strategi Percepatan Pengembangan Kawasan Timur Indonesia. (Jakarta: Kementerian Perencanaan Pembangunan Nasional)
[5] Syamsu J A 2006 Analisis Potensi Limbah Tanaman Pangan Sebagai Sumber Pakan Ternak Ruminansia di Sulawesi Selatan Disertasi (Bogor: Institut Pertanian Bogor)
[6] Kementerian Pertanian 2014 *Keputusan Menteri Pertanian Republik Indonesia Nomor 427/Kpts/Sr.120/3/2014, Penetapan Rumpun Sapi Sumba Ongole*

[7] Bamualim A M 2011 Pengembangan teknologi pakan sapi potong di daerah semi-arid Nusa Tenggara *Pengemb. Inov. Pertan.* 4 175–88

[8] Badan Pusat Statistik 2018 *Sumba Timur dalam Angka 2014 - 2018*

[9] Nuhung I A 2015 Kinerja, Kendala, dan Strategi Pencapaian Swasembada Daging Sapi *Forum Penelit. Agro Ekon.* 33 63

[10] Parmawati R, Mashudi, Budiarto A, Suyadi and Kurnianto A S 2018 Developing sustainable livestock production by feed adequacy map: A case study in Pasuruan, Indonesia *Trop. Anim. Sci. J.* 41 67–76