Maintenance Model and Bali Cattle Density in the Development Center of South Konawe Regency, Southeast Sulawesi

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ABSTRACT

The maintenance model and cattle density of Bali cattle in a central development region can influence the region's capacity to accommodate the developed Bali cattle. Therefore, regions capable of managing good maintenance models and cattle density management are crucial to enhancing the competitiveness of Bali cattle. The purpose of this research is to analyze the cattle-raising model and the density of Bali cattle in the development center of South Konawe Regency, Southeast Sulawesi. The research was conducted from June to August 2024. The research location was determined using purposive sampling in South Konawe Regency, focusing on four priority districts for Bali cattle development: Baito, Palangga, Buke, and Tinanggea, with 240 respondents being Bali cattle farmers. The research results indicate that based on the economic density parameter, the value is 107.60 ST (high), farming density is 0.19 ST (moderate), and regional density is 8.19 ST (low). According to the combinations of livestock density, the farming-region combination has a value of 4, while the economy-farming combination and economy-region combination both have a value of 3. In terms of the rearing model, 71% of Bali cattle are raised using a semi-intensive system, while 29% are raised intensively. Additionally, the combined rearing pattern of breeding and fattening accounts for 64%, with fattening alone at 36%. Thus, the livestock density in South Konawe Regency indicates that the economic density still has potential for developing Bali cattle. The farming density is still very capable of accommodating more Bali cattle than currently present, and the regional density offers significant opportunities for Bali cattle development. The areas of distribution and development exist within the farming-region combination, while development areas are found within the economy-farming and economy-region combinations. The predominant rearing model is semi-intensive, while the breeding model is combined with fattening.

Keywords: Bali cattle, density, development, maintenance

ABSTRAK

Model pemeliharaan dan kepadatan ternak sapi Bali di suatu wilayah sentra pengembangan dapat mempengaruhi kemampuan wilayah tersebut dalam menampung ternak sapi Bali yang dikembangkan. Oleh karena itu, wilayah yang mampu mengelola model pemeliharaan yang baik dan manajemen kepadatan ternak sangat penting untuk meningkatkan daya saing sapi Bali. Tujuan penelitian ini untuk menganalisis model pemeliharaan dan kepadatan ternak sapi Bali di sentra pengembangan Kabupaten Konawe Selatan, Sulawesi Tenggara. Penelitian telah dilakukan sejak bulan Juni hingga Agustus tahun 2024. Lokasi penelitian ditentukan dengan cara *purposive sampling* yaitu Kabupaten Konawe Selatan pada empat kecamatan prioritas pengembangan sapi Bali yaitu Kecamatan Baito, Palangga, Buke dan Tinanggea dengan responden dalam penelitian ini yaitu peternak sapi Bali sebanyak 240 peternak. Hasil penelitian menunjukkan bahwa berdasarkan parameter kepadatan ekonomi 107.60 ST (padat), kepadatan usahatani 0.19 ST (sedang), dan kepadatan wilayah 8.19 ST (jarang). Berdasarkan kombinasi kepadatan ternak, kombinasi usaha tani-wilayah bernilai 4, ekonomi-usaha tani bernilai 3 dan ekonomi-wilayah bernilai 3. Sedangkan berdasarkan model pemeliharaan, model sistem pemeliharaan sapi Bali secara semi intensif 71% dan intensif 29% sedangkan model pola pemeliharaan secara pembibitan+penggemukan 64% dan penggemukan 36%. Oleh karena itu Kepadatan ternak di Kabupaten Konawe Selatan menunjukkan kepadatan ekonomi masih terdapat potensi pengembangan sapi Bali, kepadatan usahatani masih sangat memungkinkan untuk menampung ternak sapi Bali melebihi yang sudah ada, kepadatan wilayah masih sangat berpeluang menjadi wilayah pengembangan sapi Bali, wilayah penyebaran dan pengembangan terdapat pada kombinasi usaha tani-wilayah, wilayah pengembangan terdapat pada kombinasi ekonomi-usaha tani dan ekonomi-wilayah. Untuk model pemeliharaan didomonasi oleh model sistem pemeliharaan secara semi intensif sedangkan model pola pemeliharaan pembibitan digabungkan penggemukan.

Kata kunci: kepadatan, pemeliharaan, pengembangan, sapi Bali

INTRODUCTION

Livestock farming is a vital agriculture subsector that plays a crucial role in supporting human life. This is evident from the high demand for livestock products. According to Ding (2021), these products include meat, fiber, milk, eggs, and other livestock goods. Beef cattle farming serves as the primary source of animal protein and supports sustainable food systems (Rindayati *et al.* 2007; Moore *et al.* 2021). The development of beef cattle also contributes to achieving the Sustainable Development Goals (SDGs), such as poverty alleviation, zero hunger, good health and well-being, responsible production and consumption, climate action, and life on land conservation (UN 2024).

Livestock productivity is closely related to the farmers' success in producing high-quality, protein-rich meat (Kurnianto *et al.* 2022). For example, the productivity of Bali cattle is greatly influenced by the naintenance models employed. Bali cattle are known for their ability to adapt to less-than-ideal environments (Warmadewi *et al.* 2017). However, their productivity in terms of growth, reproduction, and meat quality largely depends on the maintenance approach used. In general, cattle maintenance models are divided into two categories: system models and pattern models. The system model refers to the maintenance system implemented, while the pattern model refers to the maintenance pattern applied by farmers. In Indonesia, the pattern model for Bali cattle maintenance is mostly carried out using fattening and breeding patterns (Daroini 2013).

The choice of the appropriate maintenance model is influenced by the types of inputs and outputs used, costs, and potential risks. A suitable maintenance model also affects the level of cattle density (Aisah and Haris 2020). Bali cattle density refers to the number of cattle per unit area of land, whether at the village, district, or broader regional level, taking into account factors such as region, farming, and economic conditions. The government has designated Bali cattle development centers as local beef cattle production areas to achieve the Sustainable Development Goals (SDGs) (UN 2024). One such development center is Southeast Sulawesi Province, particularly in South Konawe Regency (Ministry of Agriculture 2016).

South Konawe has extensive land potential, consisting of plantations and agricultural land, which can be utilized for cattle grazing (Abadi *et al.* 2019). This land is highly suitable for Bali cattle farming, which, if managed with good business practices, can provide significant benefits to farmers (Syaiful *et al.* 2018). South Konawe Regency also has great potential for the development of Bali cattle breeding, which is expected to support the success of the livestock sector in the region (Abadi *et al.* 2023).

According to Abadi *et al.* (2023), this potential is based on factors such as the productive age of farmers and their extensive experience, a semi-intensive rearing system, normal Bali cattle reproductive activities, the availability of various feed types and sources, the presence of livestock officers, and adequate infrastructure. According to BPS (2024), the population of Bali cattle in South Konawe Regency, as a Bali cattle development center, is recorded at 69,157 head. Therefore, this study aims to analyze the maintenance model of Bali cattle in the development center of South Konawe Regency and to assess the density of Bali cattle. This will help the government implement appropriate policies to ensure the sustainability of the region as a Bali cattle development center in Southeast Sulawesi Province, Indonesia.

MATERIALS AND METHODS

The research was conducted from June to August 2024 in South Konawe Regency, with the location selected through purposive sampling. South Konawe Regency was selected as it serves as a central area for Bali cattle development, housing the majority of the Bali cattle population, with a significant annual increase. The study focused on four priority districts for Bali cattle development: Baito, Palangga, Buke, and Tinanggea, and involved 120 respondents, all of whom were Bali cattle farmers.

Livestock density analysis is a method used to measure the ratio of livestock to available resources in a region, considering factors such as population, agricultural land area, and the administrative area where the livestock is developed. The purpose is to determine whether a development area can be classified as a distribution area, development area, consolidation area, or consumer area. To determine the parameters of livestock density, an analysis of economic, farming, and regional density was conducted as shown in Table 1 (Ashari *et al.* 1995). Criteria for livestock development areas are presented in Table 2 (Rohaeni 2014).

RESULTS AND DISCUSSION

Respondent Characteristics

Based on the total number of respondents in the study, 78% are male in South Konawe Regency. Regarding education level, 56% of farmers in South Konawe have a moderate education (junior high to senior high school). In terms of farming experience, 35% of farmers have been raising livestock for over 10 to 20 years. The results are presented in figures 1(a), 1(b), and 1(c).

Gender plays a significant role in determining productivity in farming. Generally, male farmers tend to have higher productivity levels compared to their female counterparts, as men often engage in more physically demanding tasks, while women are typically responsible for household duties. According to Idris *et al.* (2023), livestock farming is more often carried out by men due to their greater physical strength compared to women, particularly in tasks such as gathering feed.

The education level of Bali cattle farmers is predominantly at the junior high to senior high school level, which is considered moderate. This moderate education can influence the mindset of farmers, as they may find it difficult to think forward regarding the development of their businesses and tend to follow what they see around them. In contrast, individuals with higher education levels are more likely to understand new concepts, such as technological advancements that could benefit their businesses. Education

Table 1. Livestock Density Analysis Formulas

Description	Economic Density (1)	Farming Density (2)	Regional Density (3)
Formula	$\dfrac{\sum Number\ of\ livestock\ (LSU)}{\sum Populastion\ (People)}$ $\times 1000$	$\dfrac{\sum Number\ of\ livestock\ (LSU)}{Farming\ area\ (ha)}$	$\dfrac{\sum Number\ of\ livestock\ (LSU)}{Administrative\ area\ (Km^2)}$
Criteria	· Very Dense: > 300 · Dense: 100 – 300 · Moderate: 50 – 100 · Sparse: < 50	· Very Dense: > 2 · Dense: 1 - 2 · Moderate: 0.25 - 1 · Sparse: < 0.25	· Very Dense: > 50 · Dense: 20 – 50 · Moderate: 10 – 20 · Sparse: < 10

Note: LSU = Livestock Units

Table 2. Criteria for Livestock Development Areas

Combination	Sparse	Moderate	Dense	Very Dense
Sparse	DDA = 4	DDA = 4	DA = 3	CSA = 2
Moderate	DDA = 4	DA = 3	CSA = 2	CSA = 2
Dense	DDA = 3	DA = 3	CA = 1	CA = 1
Very Dense	DA = 3	CSA = 2	CA = 1	CA = 1

Notes: DDA (Development and Distribution Area); DA (Development Area); CSA (Consolidation Area); and CA (Consumer Area)
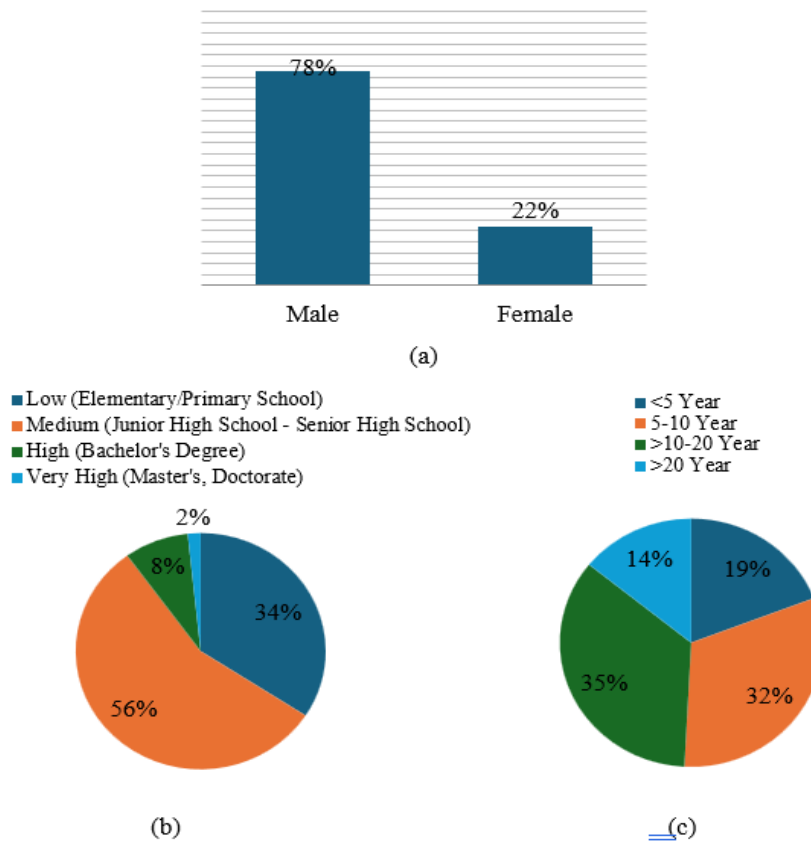

Figure 1. (a) Distribution of Gender Among Bali Cattle Farmers;
(b) Distribution of Education Levels Among Bali Cattle Farmers;
(c) Distribution of Farming Experience Among Bali Cattle Farmers.
Source: Primary Data (processed 2024)

affects their ability to think critically and accept new ideas (Prabawa 2020).

Farmers in South Konawe Regency have substantial experience in livestock farming, with the majority having over 10 to 20 years of experience. This experience allows farmers to gain a deeper understanding of their livestock operations. The duration and extent of their experience enable them to make informed decisions about the best practices for developing Bali cattle. More experienced farmers can create better plans because they have acquired comprehensive knowledge about farming. According to Ibrahim *et al.* (2020), the success of a farmer is influenced by the amount of time they have spent farming; the more experience they possess, the more knowledge they gain about the intricacies of livestock farming.

Bali Cattle Maintenance Model

Based on the total number of respondents in the study, it was found that 71% of farmers in South Konawe Regency raise Bali cattle using a semi-intensive maintenance system. Regarding the maintenance pattern model, 64% of Bali cattle farmers in South Konawe focus on breeding and fattening. The results are presented in Figure 2.

The model of Bali cattle rearing system applied by farmers in South Konawe Regency is generally semi-intensive, according to Abadi *et al.* (2024) semi-intensive maintenance was 51% in Palangga sub-district, 90% in Baito sub-district (Abadi *et al.* 2023), in Buke sub-district the semi-intensive maintenance system was also dominant (Sani *et al.* 2021). Nafiu (2018) states that South Konawe is a development area for Bali cattle in Indonesia, where around 95% are raised by smallholder farmers in rural areas using small-scale operations and traditional maintenance patterns, specifically extensive and semi-intensive systems. In the semi-intensive model, part of the Bali cattle's life is spent grazing in the open, while the other part is kept in pens or enclosures. The high proportion of farmers applying the semi-intensive system supports the development of Bali cattle farming in the region. However, field survey results indicate that those implementing intensive systems typically own more than 3-4 head of cattle. According to Sawo (2020), the maintenance system practiced by Bali cattle farmers in the Bali cattle development centers, including South Konawe, is predominantly semi-intensive.

The livestock raising model for Bali cattle implemented by farmers in South Konawe Regency generally combines breeding and fattening patterns (see Figure 2). This is due to the management practices of the farmers, where some Bali cattle are allowed to live freely in nature or are grazed, while others are kept in pens. According to Nafiu (2018), the raising pattern developed in South Konawe Regency tends to integrate breeding with fattening. This pattern is more commonly applied by respondents compared to the fattening-only model, which is closely related to the semi-intensive management system widely adopted by farmers.

Density of Bali Cattle

The results of the analysis of Bali cattle density in this study are presented in terms of density values and criteria, as well as combinations of livestock density to identify priority areas for development. These findings can be seen in Figure 3 and Table 3.

Based on the calculations of cattle density in the Bali cattle development area of South Konawe Regency, the analysis of economic density shown in Figure 3 indicates that the economic density of Bali cattle falls into the "dense" category, with a value of 107.60 LSU/1000 people. This suggests that there is still potential for further development of the economic density. For areas classified as dense, the development of Bali cattle should be carried out intensively through effective management practices. The analysis of farming density, also shown in Figure 3, indicates that the farming density has a "moderate" criterion with a value of 0.19 LSU/ha. This implies that there is still ample capacity to accommodate the development of Bali cattle. The moderate farming density indicates that the livestock population can still be increased based on the agricultural land utilized by the community, which has significant potential for further livestock development. The analysis of
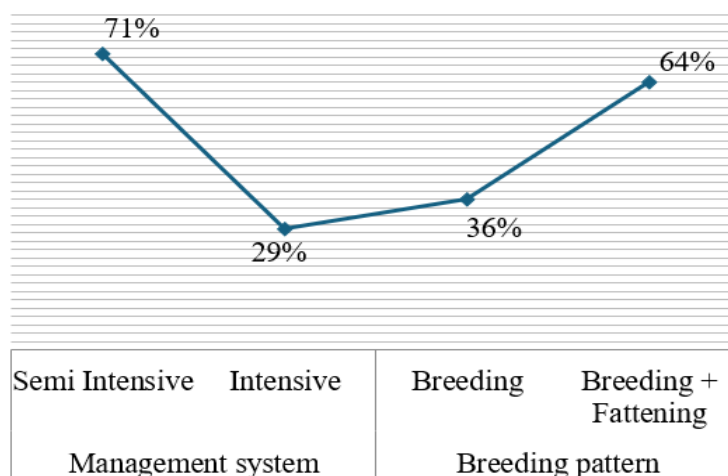

Figure 2. Distribution of Bali Cattle Maintenance Models
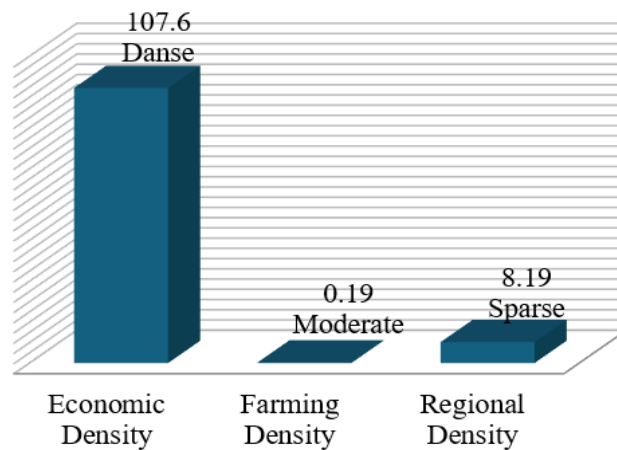Source: Primary Data (processed 2024)

Figure 3. Results of the Bali Cattle Density Analysis
Source: Primary Data (processed 2024)

Table 3. Results of the Bali Cattle Density Combinations in South Konawe Regency

Density Combination			Density Value	Priority Value
EF	ER	FR	(4)	(5)
(1)	(2)	(3)		
DA = 3	DA = 3	DDA = 4	10	2

Source: Primary Data (processed 2024)

Note: LSU = Livestock Units; EF = Economic Density vs. Farming Density; ER = Economic Density vs. Regional Density; and FR = Farming Density vs. Regional Density

regional density in Figure 3 reveals that the regional density falls into the "sparse" category with a value of 8.19 LSU/km². This indicates that there are substantial opportunities for the development of Bali cattle. Regions with sparse livestock density indicate that the ownership of Bali cattle among residents is still low, suggesting that there is room for increasing the scale of Bali cattle ownership.

The results of the density combination calculations for the development of Bali cattle can be seen in Table 3. Based on these findings, the Bali cattle development center in South Konawe Regency, across the four priority sub-districts, ranks in the second priority tier. Areas with the same priority level require different recommendations due to their unique characteristics (Abadi *et al.* 2023). The Bali cattle development center in South Konawe Regency is well-suited for the spread and development of Bali cattle. The area is still in the development stage, with a density value of ten for raising Bali cattle.

CONCLUSION

Economic density is categorised as dense, meaning there is still potential for Bali cattle development. Farming density is medium, meaning it is still possible to accommodate more Bali cattle than already exist. Regional density is categorised as sparse, meaning there is still a great opportunity to develop Bali cattle. Based on the combination of livestock density, the distribution and development areas are in the combination of farming-region and development areas are in the combination of economy-farming and economy-region. The rearing model Bali cattle is dominated by the semi-intensive rearing system model while the nursery rearing pattern model is combined with fattening.

REFERENCES

Abadi, M., L.O. Nafiu, & J. Karim. 2019. Mapping the potential of green feed resources for Bali Cattle in Tinanggea District, South Konawe Regency. J. Trop. Anim. Sci. Tech. 6(1): Art. 1. https://doi.org/10.33772/jitro.v6i1.8203.

Abadi, M., L.O. Nafiu, R. Libriani, Rahman, & Gerhana. 2023. Analysis of regional carrying capacity for the development of bali cattle in Baito District, South Konawe Regency. J. Appl. Anim. Sci. 5(2):55-60. https://jurnal.polinela.ac.id/index.php/PETERPAN/index.

Abadi, M., L.O. Nafiu, T. Saili, M.A. Pagala, L.O.A. Sani, L. Yunus, R.M. Iswandi, L. Rianda, & L.O. Alwi. 2024. Potential development of balinese cattle breeding

in the seedling source area of Palangga sub-district, South Konawe district. Technological Innovations in Tropical Livestock Development for Environmental Sustainability and Food Security. 269-275. J. CRC. Press. http://dx.doi.org/10.1201/9781003468943-42

Abadi, M., R. Libriani, L.O. Nafiu, H.A. Hadini, A. Rizal, Gerhana, & Surahmanto. 2023. Development potential of bali cattle in Baito Sub-district, South Konawe Regency. J. Chalaza Anim. Husb. 8(1):1-10. https://dx.doi.org/10.31327/chalaza.v8i1.1904.

Aisah, & M.I. Haris. 2020. The impact of management practices on the income of smallholder beef cattle farmers in West Kutai. J. Trop. Environ. Livest. 3(2):58-63. http://dx.doi.org/10.30872/jpltrop.v3i2.7630.

Ashari, F., E. Juarini, W. Sumanto, B. Wibowo, & Suratman. 1995. Guidelines for Analyzing the Potential for Livestock Dissemination and Development Areas. Livestock Research Center and Directorate of Livestock Dissemination and Development. Jakarta.

Daroini, A. 2013. Marketing patterns of beef cattle among small-scale farmers in Kediri Regency. Agribusiness Management Journal. 13(1): 55-62.

Ding, M. 2021. Importance of animal husbandry. J. Int. J. Agric. Econ. Extens. 9(2):001. https://www.internationalscholarsjournals.com/articles/importance-of-animal-husbandry.pdf.

Habsari, I.K. & N. Irwani. 2021. Analysis of regional potential for ruminant development in Central Lampung Regency. J. Appl. Anim. Sci. 3(1):20-27. https://doi.org/10.25181/peterpan.v3i1.2211.

Ibrahim, I., S. Supamri, & Z. Zainal. 2020. Analysis of factors affecting the income of smallholder beef cattle farmers in Lampasio District, Tolitoli Regency, Central Sulawesi Province. J. Agric. Socioecon. 13(3):307-315. https://doi.org/10.19184/jsep.v13i3.18446.

Idris, A. Nugraha, & M. Irwan. 2023. Factors affecting egg production in laying hens in Kaluppang Village, Maiwa District, Enrekang Regency. J. Sci. Technol. Anim. Husb. Ind. 3(2):34-40. https://doi.org/10.55678/jstip.v3i2.1133

KEMENTAN. 2016. Establishment of South Konawe Regency as a Source Area for Bali Cattle Seed, Jakarta.

Kurnianto, A., O.R.P.A. Nussa, & I.P. Hermawan. 2022. Improving beef cattle productivity through health management, reproduction, and veterinary services in Bulu Village, Purwoasri District, Kediri Regency. J. Community. Serv. 5(10):3521-3526.

Moore, D., K. Harden, & F. Sampaio. 2021. The Importance of Livestock Production and Animal Protein: The Western Hemisphere Perspective. Inter-American Institute for Cooperation on Agriculture, Global Dairy Platform, and US Dairy Export Council, New York.

Nafiu, L.O. 2018. Bali cattle breeding in Southeast Sulawesi: Issues and Development Strategies. Proceedings of the National Seminar on Technological Innovation in Animal Husbandry Supporting National Food Security. Faculty of Animal Science, Halu Oleo University, Kendari.

Prabawa, B.A.T. 2020. The relationship between agricultural extension communication strategies and ginger farmers' behavior. J. Nilacakra.

Rindayati, W., M.P. Hutagaol, & H. Siregar. 2007. The impact of fiscal decentralization on regional fiscal performance and food security in West Java Province. J. Manag. Agribus. 4(2):103-117. https://doi.org/10.17358/jma.4.2.103-117.

Rohaeni, E.S. 2014. Analysis of regional potential for developing beef cattle business in Tanah Laut Regency, South Kalimantan. Proceedings of the National Seminar on Agricultural Innovation Technology Specific to Location.

Saleh, I.M., T.G. Rasyid, A.R. Siregar, A. Amrullah, M. Hatta, P. Astaman, & Z. Basri. 2021. Farmers' perceptions of the bali cattle purification program. J. Agri. Sci. 6(2):91-93. http://dx.doi.org/10.35329/agrovital.v6i2.2689.

Sani, L.O.A., M. Abadi, L.M. Munadi, L.O. Nafiu, & R. Sawal. 2021. Family labour time integration of balinese cattle and paddy rice in Buke Sub-district, South Konawe District. J. Anim. Sci. 9(1):1-6. https://doi.org/10.21067/jsp.v9i1.5200

Sawo, K. 2020. Classification of population structure of pigs in Nabarua Village, Nabire District. J. Para-Para. 1(2): 78-83. https://uswim.e-journal.id/parapara/article/view/206.

Syaiful, F.L., F. Agustin, R. Ningrat, U.G.S. Dinata, & E. Efrizal. 2018. Development of beef cattle through the implementation of early pregnancy detection technology and environmentally friendly feed innovations in Farmers' Groups in Langgam Preparatory Village, West Pasaman. J. Technol. Innov. 1(4.A): Art. 4.A.

UN. 2024. Department of Economic and Social Affairs Sustainable Development. https://sdgs.un.org/goals.

Warmadewi, D.A., I.G.L. Oka, & I.N. Ardika. 2017. Effectiveness of body dimension selection of bali cattle breeders. J. Sci. Mag. Anim. Husb. 20(1):16-19. https://doi.org/10.24843/MIP.2017.v20.i01.p04.