Ruminant Livestock Pen Design in the Al-Amin Industrial Park, Glugur Rimbun

Vina Arta Viola Ritonga, Fahri Pradinata, Reza Aulia, Purwo Siswoyo

Abstract

The increasing demand for animal food is driving the development of the livestock sector in a more structured and sustainable manner. This study aims to design a ruminant (sheep) pen in the Al-Amin Industrial Park area, Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency, based on the Good Animal Husbandry Practices (GAHP) concept. The method used was descriptive qualitative, with an area design approach through field surveys and literature review. The design resulted in a 5 x 10 m² raised pen with a capacity of 22 sheep. The pen was designed with an east-west orientation, a 30-degree roof slope, lattice ventilation, and a 2–3 cm gap in the floor to facilitate waste drainage. An integrated waste management system was designed, including processing manure into compost and directing liquid waste to a simple biogas unit. The application of GAHP principles to this design is expected to increase livestock productivity, maintain animal health, and support an environmentally friendly and sustainable livestock system in the Al-Amin Industrial Park area.

Keywords: Sheep Pen, Good Animal Husbandry Practices (GAHP), Ruminants, Al-Amin Industrial Park, Sustainable Livestock

Vina Arta Viola Ritonga[1]
[1]Animal Science, Universitas Pembangunan Panca Budi, Indonesia
e-mail: violavinaarta@gmail.com[1]

Fahri Pradinata[2], Reza Aulia[3], Purwo Siswoyo[4]
[2,3,4]Animal Science, Universitas Pembangunan Panca Budi, Indonesia
e-mail: fahripradinata022@gmail.com[2], ejaa9090@gmail.com[3], purwoyo@dosen.pancabudi.ac.id[4]

Introduction

The increasing demand for food, particularly from livestock products, continues to grow in line with the growing population and community activities. One livestock commodity with significant potential for development is sheep farming. In addition to producing meat as a source of animal protein, sheep also have economic value from their wool, hides, and livestock waste, which can be used as organic fertilizer.

Sampe Cita Village, located in Kutalimbaru District, Deli Serdang Regency, is an area with significant potential for livestock development. Its location on the border between Medan City and Deli Serdang Regency makes this village strategically located for the development of the agribusiness and livestock sectors. Furthermore, the environmental conditions and land availability in the area support sheep farming as a productive community enterprise (Lubis et al., 2024).

The development of the Al-Amin Living Lab and Industrial Park also serves as an effort to support livestock activities integrated with education, research, and community development. This area is planned as a field laboratory and eco-educational tourism center, combining aspects of technology, education, agriculture, and livestock farming in one integrated area. One focus of development is a sheep farming area based on the Good Animal Husbandry Practices (GAHP) concept.

The implementation of the GAHP concept is crucial because it not only focuses on increasing livestock production but also considers product quality, animal health, environmental cleanliness, worker safety, and the sustainability of the livestock system (Siswoyo, 2023). Based on these conditions, the planning of a sheep farming area in Sampe Cita Village is crucial for further study to create a productive, healthy, and sustainable livestock area.

Literature Review

Sheep farming is a subsector of livestock farming that holds significant potential for meeting the community's animal protein needs. Sheep are small ruminants that are easy to raise, highly adaptable to tropical environments, and capable of rapid reproduction. In addition to producing meat, sheep farming also provides economic benefits through the utilization of hides, wool, and livestock waste, which can be used as organic fertilizer (Ranggas Berrly Hutu & Hartati Candra Dewi, 2025).

Sheep farming development in Indonesia continues to increase in line with the growing demand for animal-based foods and increasing public awareness of protein consumption. A good livestock farming system focuses not only on increasing production but also on animal health, environmental quality, and efficient land management.

The concept of Good Animal Husbandry Practices (GAHP) is a livestock husbandry system that aims to produce safe, healthy, and high-quality livestock products while maintaining animal welfare and environmental sustainability. The implementation of this concept includes animal health management, pen cleanliness, provision of clean feed and water, and proper livestock waste management.

According to the Food and Agriculture Organization (FAO), a sustainable livestock farming system must achieve a balance between economic, social, and environmental aspects. In sheep farming, the GAHP concept can be implemented through proper ventilation, routine sanitation, waste control, and regular livestock health monitoring. In livestock farming, pens play a crucial role as a place to raise livestock and to support their comfort and health. Pen planning must consider natural lighting, air circulation, sanitation, and a good drainage system to maintain a healthy environment (Aliya et al., 2025). Pens with good ventilation can reduce humidity, thus minimizing the risk of disease in livestock.

Good pen design can improve farm operational efficiency and support the comfort of livestock and workers. The use of environmentally friendly local materials is also one way to create a more sustainable livestock system (Wisdianti et al., 2023).

Research Methodology

The research method used was descriptive qualitative, using a livestock area design approach based on Good Animal Husbandry Practices (GAHP). This method was used to identify site conditions, area potential, space requirements, and the implementation of a livestock system appropriate to the environmental conditions and livestock activities in Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency.

The research approach involved collecting primary and secondary data. Primary data was obtained through direct field surveys to determine the existing area conditions, accessibility, site orientation, vegetation conditions, topography, circulation, and environmental conditions surrounding the design area. Secondary data was obtained through literature review from journals, books, and previous research related to sheep farming, ruminant livestock pen design, and the application of GAHP.

To clarify the research stages, a research flowchart is shown in the following fig

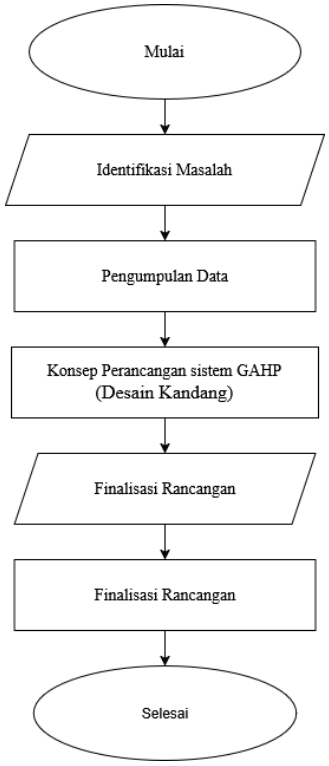


Figure 1. Flowchart Research The

next stage of data collection:

Table 1. Data collection

No	Parameter	Unit	Nilai / Keterangan
	Jenis ternak	-	Domba
	Kapasitas ternak	Ekor	22 ekor
	Kebutuhan luas/ekor	m²/ekor	2,27 m²/ekor
	Total luas kandang	m²	5x10m²
	Kebutuhan pakan	kg/ekor/hari	44 kg

1	Kebutuhan air	liter/hari	22 liter
2			
3			
4			
5			
6			
7			
8			
	Sistem pembuangan limbah	-	Drainase + pengolahan kompos
	Frekuensi pembersihan	kali/hari	1 kali/hari

Results

Based on field survey results, the Al-Amin Industrial Park area is located in Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency. This area has significant potential for sheep farming development, considering several aspects, including adequate road accessibility, relatively large land area, relatively flat topography, and existing vegetation that can provide natural shade for livestock.

The design of the ruminant livestock pens in the Al-Amin Industrial Park area adheres to the GAHP principles, taking into account air circulation, natural lighting, sanitation, and waste management. The pens are designed on stilts approximately 60 cm above ground level to facilitate cleaning and ensure livestock comfort, while also preventing direct contact with the soil, which can potentially harbor disease.

The pens are oriented east-west to maximize exposure to morning sunlight, which is beneficial for livestock health, while also preventing direct sunlight from entering the pens during the day, which can cause heat stress. The roof slope is designed at 30 degrees to facilitate upward circulation of hot air (the stack effect) and prevent rainwater splashback.

Table 2. Enclosure Design Specifications

Komponen	Spesifikasi	Keterangan
Tipe Kandang	Panggung (Elevated)	Tinggi ±60 cm dari tanah
Luas Total	50 m² (5 x 10 m)	Kapasitas 22 ekor domba

Material Lantai	Kayu broti / papan celah	Celah 2–3 cm untuk drainase
Drainase Lantai		Mengarah ke saluran terpusat
Kepadatan Ternak	1,2 m²/ekor	Standar GAHP domba dewasa
Sistem Pakan	Bak pakan individu	Tinggi 20 cm dari lantai
Air Minum	Nipple drinker / bak komunal	Kapasitas 22 liter/ekor/hari

The following is a simulation of a sheep pen design based on Good Animal Husbandry Practices (GAHP) with a capacity of 22 sheep and an area of 5 × 10 m², which is designed using a stage pen system to maintain the cleanliness and comfort of the livestock.

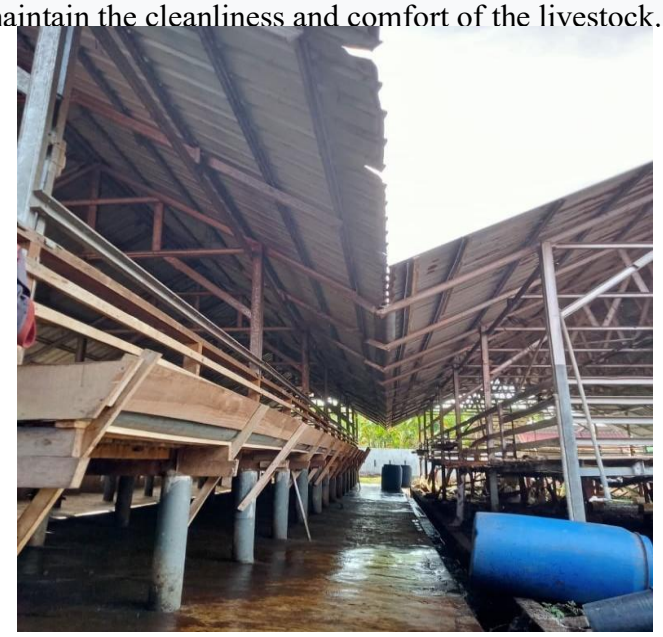


Figure2. *Outdoor appearance enclosure*

Kemiringan 2–3%



Figure 3. Indoor appearance cage

The image shows a sheep pen design based on Good Animal Husbandry Practices (GAHP) with a capacity of 22 sheep and a total area of 5 x 10 m². The pen design uses a raised pen system to improve hygiene and livestock comfort, as well as facilitate waste management.

The pen's structure primarily uses wood, bamboo, and concrete, with a lightweight metal roof. The walls of the pen are designed to be open and latticed to reduce humidity and maintain optimal air flow.

The barn layout shows an organized spatial division, including a livestock area, feeding area, feed storage, watering area, and livestock handling and care areas. This layout is designed to facilitate livestock husbandry activities and increase farmer efficiency. A cross-section of the barn shows that the floor is constructed on stilts at a height of approximately 60 cm above ground level, with gaps between the floors to facilitate manure drainage. Livestock waste is then channeled through drainage channels to a holding area and processed into compost for organic fertilizer.

This design also applies the GAHP principle, which encompasses livestock comfort through natural ventilation and lighting, livestock health through barn cleanliness, feed and water security, and environmentally friendly waste management. By implementing this concept, the barn is expected to produce healthy livestock, increase productivity, and support a sustainable livestock system.

The livestock waste management system is designed in an integrated manner to minimize negative impacts on the surrounding environment. Solid waste, in the form of livestock manure, is processed into organic compost through a composting unit separate from the main barn but within the same integrated area. Liquid waste is channeled through a central drainage channel to a settling tank before being fed to a simple biogas unit.

Processing waste into compost and biogas provides added economic value for the area's managers and serves as a concrete demonstration of the circular economy in the livestock sector. The resulting organic fertilizer can be used to fertilize agricultural areas within the AlAmin Industrial Park or sold to surrounding farmers.

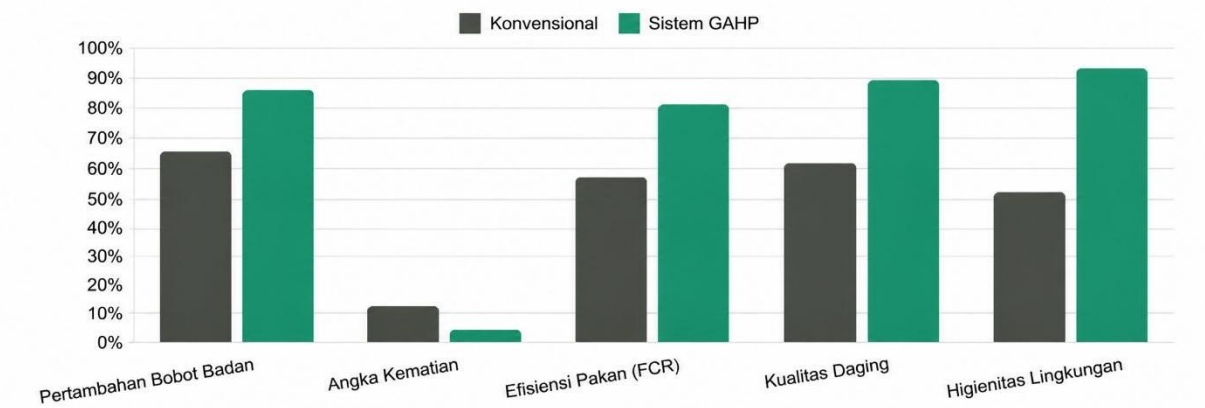


Figure 4. Comparison Chart

The graph above compares the performance of conventional livestock systems with the Good Animal Husbandry Practices (GAHP) system on several key sheep farming indicators. The graph shows that the GAHP system yields superior results compared to the conventional system across almost all observed parameters.

For body weight gain, the GAHP system achieved approximately 85%, higher than the conventional system, which averaged around 65%. This indicates that GAHP implementation can improve livestock growth through improved feed management, sanitation, and housing environment.

For mortality, the GAHP system showed lower values than the conventional system. This indicates that proper housing sanitation, ventilation, and livestock health monitoring can reduce the risk of disease and mortality.

The Feed Conversion Ratio (FCR) in the GAHP system was also higher, at approximately 80%, compared to only 55% in the conventional system. This indicates that feed use in the GAHP system is more effective in increasing livestock productivity.

Furthermore, meat quality in the GAHP system reached approximately 90%, higher than the 60% achieved in the conventional system. Improved meat quality is influenced by healthier and less stressful livestock rearing conditions. In terms of environmental hygiene, the GAHP system achieved the highest score, at around 93%, while the

The average waste management and barn hygiene of conventional systems is only around 50%. This demonstrates that the waste management and barn hygiene systems in GAHP systems are capable of creating a healthier and more sustainable livestock environment.

Overall, the graph shows that the implementation of the GAHP system has a positive impact on livestock productivity, husbandry efficiency, livestock product quality, and environmental cleanliness compared to conventional livestock systems.

Conclusion

The design of a ruminant livestock pen in the Al-Amin Industrial Park area, Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency, resulted in a pen design that adheres to the principles of Good Animal Husbandry Practices (GAHP). The pen is built on stilts approximately 60 cm above ground level, with a total area of 50 m² (5 x 10 m), and can accommodate 22 sheep at a stocking density of 1.2 m² per head, in accordance with GAHP standards. The pen faces east-west to maximize natural morning light, with a 30-degree sloped roof to facilitate hot air circulation and prevent rain splash. The pen walls are open and feature a lattice system to maintain optimal humidity and airflow. The primary materials used include wood, bamboo, and concrete, with a lightweight metal roof that is environmentally friendly and readily available locally.

The waste management system is designed in an integrated manner, with solid waste processed into compost and liquid waste directed to a simple biogas unit. This approach supports the circular economy concept in livestock areas while providing added economic value for managers. Overall, this pen design is expected to serve as a model for productive, healthy, and sustainable sheep farming, supporting the development of the Al-Amin Industrial Park as a center for field laboratories and agribusiness-based eco-tourism.

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