http://ejournal.seaninstitute.or.id/index.php/Ekonomi
Jurnal Ekonomi, Volume 12, No 03, 2023
ISSN: 2301-6280 (print) ISSN: 2721-9879 (online)

REDESIGN SHEEP CAGE LAYOUT USING THE ACTIVITY RELATIONSHIP CHART METHOD & SHEEP HUSBANDRY SYSTEM USING MACRO ERGONOMIC APPROACH

[1]Ricky Yoseptry, [2]Sukendar, [3]Jejen Ahmad Jaelani
[1,2,3] Universitas Islam Nusantara

ARTICLE INFO

Keywords:
Livestock, Sheep,
Activity Relationship Chart,
Macro Ergonomics

ABSTRACT

Most of the population in Indonesia, both in urban areas, but especially in rural areas, many people invest in the livestock sector by taking advantage of the fertility of the soil they have for farming and some use it for raising livestock because the available feed is quite abundant in the types of grasses and leaves that are available. usually used for animal feed. One of them is raising sheep, this is because the sale value of sheep is quite high, and the consumption of lamb meat, especially for the regency, is quite high. As done by Young Farmer Farm, this farm which is located in the village of Cibiru Kindul, Bandung City, focuses on raising sheep, fattening sheep for beef, and making organic fertilizer from sheep manure on the farm. Most of the conditions of Indonesian livestock are only based on experience, meaning that they do not pay attention to the provisions in animal husbandry. This is the cause of the lack of good quality livestock systems in Indonesia. Therefore it is very important to improve the livestock system in order to obtain better quality and quantity of productivity. Activity analysis used to analyze input and output process flow of the livestock system uses the Activity relationship chart method which is a qualitative approach developed by Mucher. Is a way to analyze the flow of work, namely the relationship relationship with benchmarks degree of closeness of the relationship between one activity to another, in this study the data were obtained through observation and approved by the management of the farm. Macro ergonomics is a concept by defining a top-down sociotechnical system to produce a work system. The use of macro ergonomics is used to analyze the problems found in young farmer farm sheep so that in the end a number of suggestions for improvements related to the problems are obtained. The results of this research show that the problems that are considered to have a major impact on the sustainability of livestock are the conditions of the sheep pens, the process of feeding and drinking the sheep, caring for the sheep and the process of disposal and waste management. Improving the condition of the cage is done by relaying the condition of the cage, namely repositioning according to the provisions. Improving the process of feeding and drinking is carried out based on the provisions of feeding according to the rules. Treatment improvements were carried out by providing a quarantine process and sheep bathing. Improving the process of disposal and waste management is carried out by maximizing the use of manure as organic fertilizer.

E-mail:
rickyyoseptry01@gmail.com[1],
hendarhendar743@gmail.com[2],
jejenahmad78@gmail.com[3]

1. INTRODUCTION

An agrarian country is a designation for a country that has abundant natural resources. And one of them is Indonesia, which is an agricultural country located in Southeast Asia, as well as Indonesia has enormous potential in the field of agriculture and agriculture. The country of Indonesia benefits because it is blessed with supportive natural conditions, namely a wide expanse of land, abundant biodiversity which is one of the driving factors for the economic sector. One of these types of biological natural resources is the livestock sector, by utilizing one type of biotic natural resource, namely animals.

Because of this, most of the population in Indonesia, especially in rural and urban areas, invest in the livestock sector by taking advantage of the fertility of the soil they have for cultivation and some use it better because the feed available is quite a lot of types of grass and leaves which are usually used. for animal feed.

Like what is being done by Young Farmer Farms, the farm which is located in the village of Cibiru Kindul focuses on breeding sheep, fattening for beef cattle, and making organic fertilizer from sheep manure on the farm.

According to recapitulation data from the Central Bureau of Statistics for the Census of Sheep Farming in West Java in 2020 it was revealed that the sheep population was 11 958,048 heads, and for 2021 there were 10,035,352 heads. Meanwhile, for lamb meat production in West Java, recapitulation data from the Central Statistics Agency for 2020 stated 33,328.38 tons, while for the following year, namely 31,866.24 tons. From these data the sheep population has decreased by 19% while the production of lamb meat has decreased by 14%. This could be one of the benchmarks that the sheep farming system, especially in West Java, needs to be improved to increase the productivity of sheep farming.

In addition, according to the Swampland Agricultural Research Institute (2013) revealed that farmers (breeders) in Australia have applied high cultivation technologies, including breeding technology, livestock nutrition, cultivation of feed crops (grass), and others. There are also other supporting factors, such as counseling, infrastructure, investment support, and others which are very conducive so that investors and farmers are excited about carrying out their business. In contrast to Indonesia, most of the protection systems in Indonesia are still better in the traditional way, they are better only based on experience that has been handed down from generation to generation, making it difficult to develop.

Basically sheep breeders have to pay attention to several aspects, if these aspects can be met, then the sheep breeders will be able to develop. DISNAKKESWAN (2020) To be able to become a sheep breeding business manager, there is some knowledge about the goat farming system that every manager of the sheep breeding business needs to understand, including the system for selecting seeds, the reproductive system, feeding, housing systems, disease prevention and control.

An important factor that must be properly considered by every nursery business manager. The selection of sheep breeds needs to be done which will affect the growth and development of the offspring of the sheep produced.

As for the reproductive system for raising goats, it is obtained from natural marriages. For the success of mating goats, the manager of the goat breeding business must know about the knowledge of the lust cycle and the signs of lust in goats. The lust cycle of sheep will occur once every 17-21 days, the average lust cycle for sheep occurs once every 19 days. The length of time of heat in sheep is 24-36 hours.

Feed is one of the important factors that must be a concern of the manager besides the sheep breeding cattle. Another important factor, feeding will also determine the successful development of the sheep. Feeding the sheep must be able to meet the nutritional requirements of the feed for livestock growth needs. The feed provider must consist of forage feed, concentrate feed or additional feed which will complement the existing nutritional feed in forage feed. Additional feeding is recommended to be given 2 weeks before the cattle are mated, 2 weeks after the cattle become pregnant and 4 weeks before and after the cattle give birth.

Cages that are used as shelters for livestock must also be able to function to facilitate control, as a place for livestock to carry out resting activities, mating, eating and drinking and giving birth. The recommended cage model for sheep is a double or single stage type cage with the requirement that at the base of the floor of the cage there is a 1.5–2 cm wide gap so that the goats' urine and feces can fall to the bottom, the cage is equipped with a feed and drink area, on the under the cage can function to accommodate the feces and urine of goats and sheep which can be processed into manure.

Based on the results of research conducted on young farms for each aspect and system, it is known that the results of the aspect and system that have the lowest value are the cage layout and maintenance system aspects which include too far between feed storage stations and cages, there is no special spawning area. for sheep that are ready to mate, there is no quarantine place for sheep that have just arrived or are sick, there is no separate device for urine and sheep manure which results in a slow production process for making organic fertilizer which must wait for the urine water content in the manure to decrease, and there is no feeding system yet. which is structured so that the process of feeding using a taste system. This means that the cage management system and maintenance system are felt to be the least good in terms of knowledge and in the actual conditions of the cage.

With this in mind, this is the cause of the lack of good quality of the system implemented by the farm. Therefore it is felt that the improvement of the livestock system is very necessary in order to obtain better quality and productivity for the progress of sheep farming.

2. LITERATURE REVIEW

A. Operations Management

According to R. Reid, Nanda R. and Sanders translated by Nisa Lisnawati (2017) said that operations management is a business function that plans, organizes, implements and controls the resources required to produce a good company from its services and systems.

B. Layout

According to Wignjosoebroto (2009), the selection and placement of layout alternatives is a critical step in the workplace facility planning process, because the chosen layout will determine the physical relationship of the ongoing production activities. Determination of the types of specifications, the number and area of production facilities required is the first step before planning the arrangement of the layout of the facility. One of the reasons people tend to focus first on layout and then the delivery system of materials lies in the emphasis on the ongoing manufacturing process.

According to Handoko (1984), the layout of factory facilities must be designed to allow for the economical separation of people and materials in various processes and operations of the company. Transport distances to the site are as short as possible and the picking and dropping of products and equipment is minimized. This should result in minimal handling and transportation costs, as well as reduced uptime and idle machine.

C. Activity Relationship Chart

The values that indicate the degree of relationship are recorded together with the underlying reasons in an Activity Relationship Chart that has been developed by Richard Muther in Wignjosoebroto. S (2016: 199).

Activity Relationship Chart or map of activity linkages is a way to plan the linkages between each group of activities that are interrelated. Maps are similar to from-to maps, but only one device location is shown. This map is similar to a distance table - a road map where the distances are covered with a cipher color, the numbers indicating the reason for the cipher letter. Correlation Password shows the relationship between an activity and another and how important each relationship is. To help determine which activities should be placed in a certain place, a grouping of closeness levels has been set, followed by a sign for each of these closeness. Everything has been determined by Muther, that is:

A = Absolutely necessary, the activities are close to one another
E = Very important, the activities are proximity
I = It is important that the activities are adjacent
O = Ordinary (proximity), there will be no problem anywhere
U = There is no need for any geographic linkage
X = Do not want these activities to be close together.

D. System

According to Wayne C. Turner (2000) defines the system is a group of components or sub-systems that are interconnected, interact and have a common goal. Based on the examples of systems and components above, there are several types of systems where one another has different components depending on the system being the subject of discussion. One example of such a system is the animal husbandry system. Just as the system in a company consists of machines, materials, people, methods, products, and others, the stables system also consists of several components, namely sheep, breeders, pens, production managers, and marketing.

E. Ergonomic

Ergonomics comes from the Greek words ergos (work) and nomos (natural law). Ergonomics is defined as the science that studies the study of the relationship between people and the work environment. Ergonomics studies the interaction between humans and the objects they use and the environment where humans work. (Purnomo, 2004:61). In disciplines, ergonomics is divided into two namely micro ergonomics and macro ergonomics.

Macro ergonomics will lead to the process of designing machines that not only have more sophisticated production capabilities, but also pay attention to the related aspects and limitations of the humans who operate these machines. The main goal is to create an integrated human-machine system design so that work effectiveness and efficiency can be optimally achieved, (Wignjosoebroto, 2006:110).

Conceptually, macro-ergonomics can be defined as a sociotechnical top-down system from top to bottom to obtain a work system design, and maintain a work system design to design the relationship

between humans and work, humans and machines, humans and software (Henrick, 1997; Henrik & Kleiner, 2001).

3. METHODS

This field research was carried out at Cibiru Wetan NO.09, Cileunyi District, Bandung City, West Java. In Young Farmer Farm SMEs which are engaged in sheep farming. The research was carried out from February 12 2023 to March 18 2023.

1. Observations of the research object
   Observations made aim to dig up important information relating to the floor plan of the place at the farm location. This information includes, stables, offices and other buildings in the sheep farm at Young Farmer Farm.
2. Identify types of production systems
   This stage provides an overview of the production system carried out by the Young Farmer Farm sheep farm which is the same as the ordinary industry, namely input, process and output.
3. Identifying the process techniques of the farm
   Observations were made in order to know the techniques in the process of managing livestock on Young Farmer Farm farms. The techniques intended to find out start from the input needed by the livestock to the output issued in the livestock processing process.
4. Identifying from the variance data
   This observation was carried out to find out what problems arise from each process in the processing of the shelter.
5. Analysis of the matrix of variance
   This observation aims to determine the key variance. This observation was carried out by distributing questionnaires and analyzing them using an activity relationship chart, which is to look for relationships between existing variants.
6. Variance of Control
   Control variance is the variance that will be the key to the problems obtained from previous observations, which are then processed from the variance data to find out more about the variance obtained.
7. Perform function and time allocations
   This stage is for technical changes that may need to be made to prevent or control key variances.
8. Re-design of the layout of the pen and livestock system
   This design is carried out to make various improvements to the problems that arise in the management of security locks that have been analyzed in the previous stages.
9. Analysis of the data and conclusions
   A series of presentations from research and results from evaluations that have been completed so that conclusions can be drawn from the goals that have been achieved.

4. RESULTS AND DISCUSSION

1. Observations of the research object

Observations made aim to dig up important information relating to the floor plan of the place at the farm location. This information includes, stables, offices and other buildings in the sheep farm at Young Farmer Farm.

a) Farm Plan

http://ejournal.seaninstitute.or.id/index.php/Ekonomi
Jurnal Ekonomi, Volume 12, No 03, 2023
ISSN: 2301-6280 (print) ISSN: 2721-9879 (online)

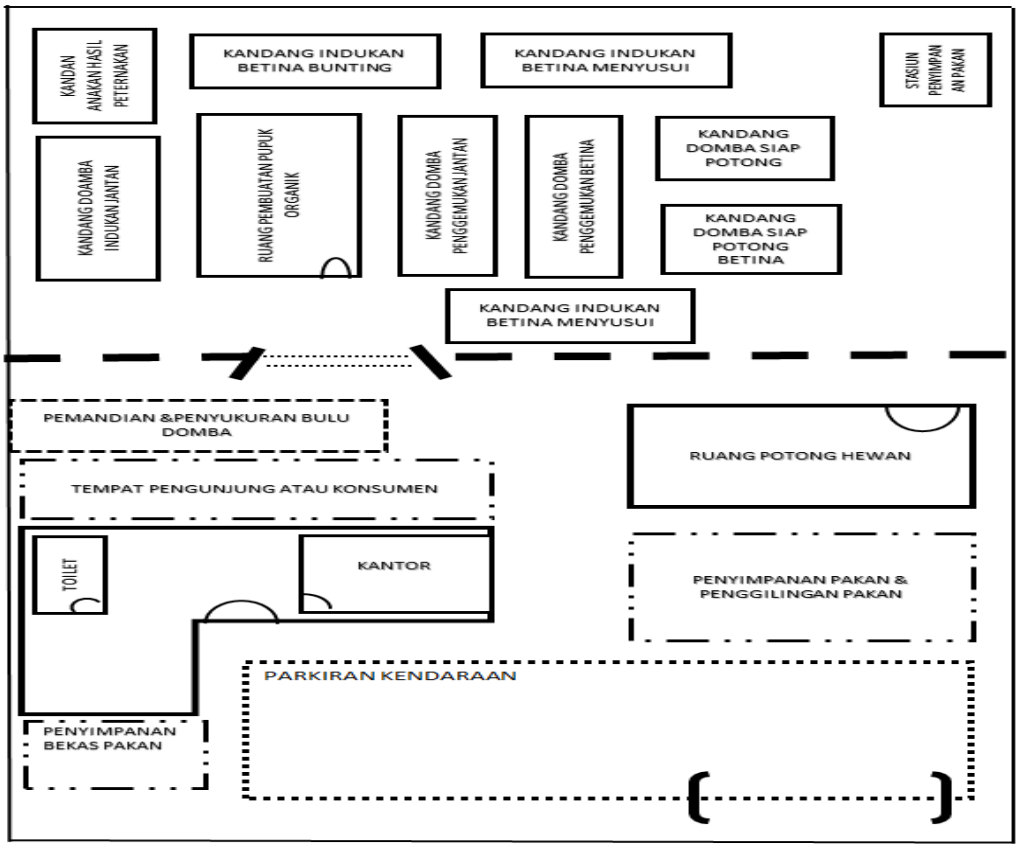

Figure 1. Farm Plan

a) Layout of the Cage

Figure 2. Layout of the Cage

2. Identify types of production systems

Based on the analysis results of the Young Farmer Farm sheep farming production system, which is a Make To Stock production type, the following will explain why the livestock production system is called that:

a) a) The product produced, in this case is sheep, which will be raised and will be sold to prepare for Eid al-Adha and Eid al-Fitr, so that the sheep that are kept are deliberately prepared for these activities.
b) In addition to being used for stock for Eid al-Adha and Eid al-Fitr, the barn also sells its sheep before the holidays if there are consumers who want to buy lamb for akikah or other celebrations at the right price. This is in accordance with the MTS (Make To Stock) system which will send its products if the order has been received.

3. Identifying the process techniques of the farm

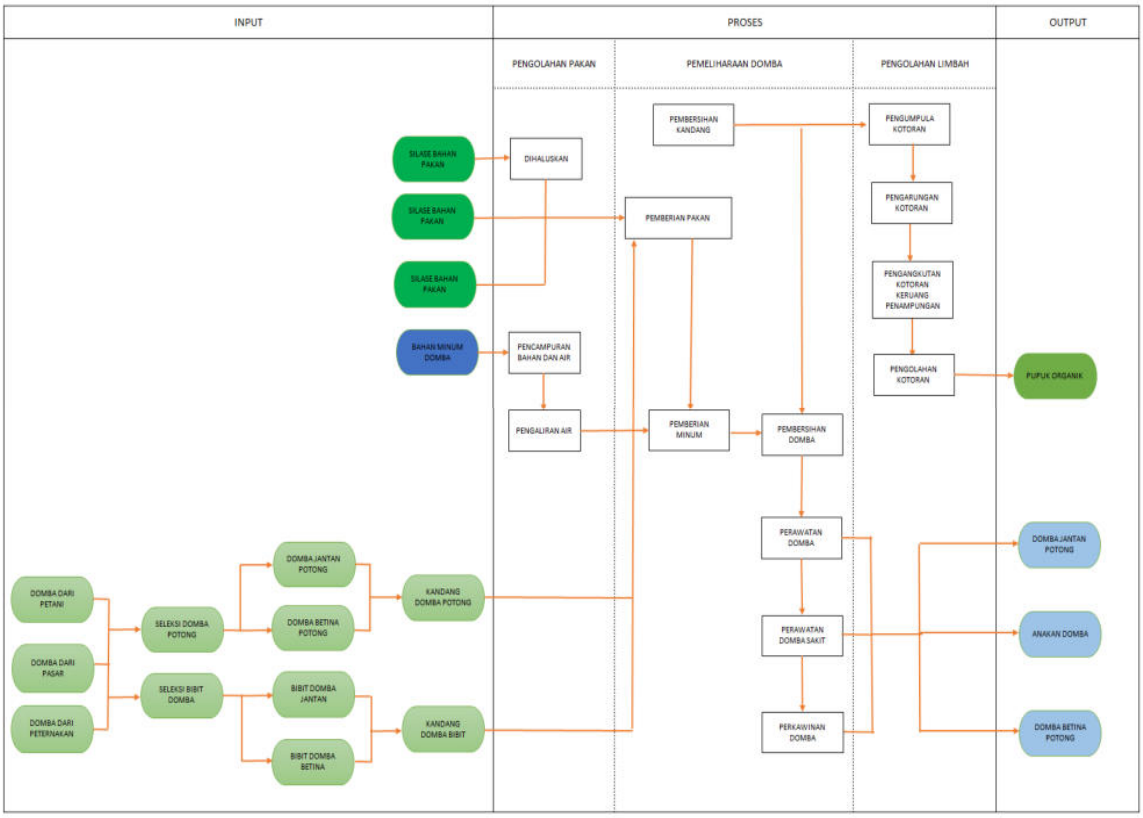

Figure 3. Identifying the process techniques of the farm

Observations were made in order to know the techniques in the process of managing livestock on Young Farmer Farm farms. The techniques intended to find out start from the input needed by the livestock to the output issued in the livestock processing process.

4. Identifying from the variance data

The collection of variance is based on the variance of the data obtained from the identification of the manufacturing process flow technique. And the results show that the stages of the process that cause variance are the absence of incoming quarantine of the sheep, the feed storage is too far away, the provision of feed and drink that does not have a dosing schedule, the cleaning of the sheep feed area that is not scheduled, the cleaning of the sheep that is not scheduled, the separator between the doma droppings and sheep urine.

5. Analysis of the matrix of variance

The variance matrix mapping is carried out using two stages, namely the first stage is to look for interrelationships between variances using the Activity Relationship Chart and the second stage is to distribute questionnaires to all workers who work in the stables of the Young Farmer Families. The results showed that the biggest variance was that there was no sheep feces and urine separator on the floor of the barn, there was no quarantine cage for new and sick sheep, and the feed storage station was too far away from the barn.

http://ejournal.seaninstitute.or.id/index.php/Ekonomi
Jurnal Ekonomi, Volume 12, No 03, 2023
ISSN: 2301-6280 (print) ISSN: 2721-9879 (online)

6. Variance of Control

Variance control is a step taken to find out how the key variant is controlled. And the following is a control variance analysis that has been carried out:

Table 1. Control Variance Analysis

No	Key Variance	Stage Variance Happens	Responsible	Information Needed	Attempts made
1	the floor of the cage does not have a separator for feces and urine of the sheep	The duration of withdrawal of water content in sheep manure	Worker in the stable	How many cages do not have a manure and urine separator?	Dirt is put in sacks so that water in feces can be wasted
2	no quarantine pen for new and sick sheep	It's easy to spread disease	Worker in the stable	How many quarantine cages are required	Sheep that look sick are immediately given treatment
3	the feed storage station is too far from the pen	The time for taking feed is quite long and draining workers	Worker in the stable	Distance of feed storage to the cage is too far	Feeding with the trolley

7. Perform function and time allocations

In this function and design allocation phase, efforts are made to allocate functions and tasks to either humans or machines/technology to prevent or control key variations. And according to the results of observations, the allocation of functions and designs that need to be carried out on Young Animal Husbandry Animal Husbandry improve the condition of the cage, improve the process of providing feed and drink, and improve sheep care.

8. Re-design of the layout of the pen and livestock system

a. Improvement of cage layout

The following is an overview of the layout of the Young Farmer Farm sheep pen layout:

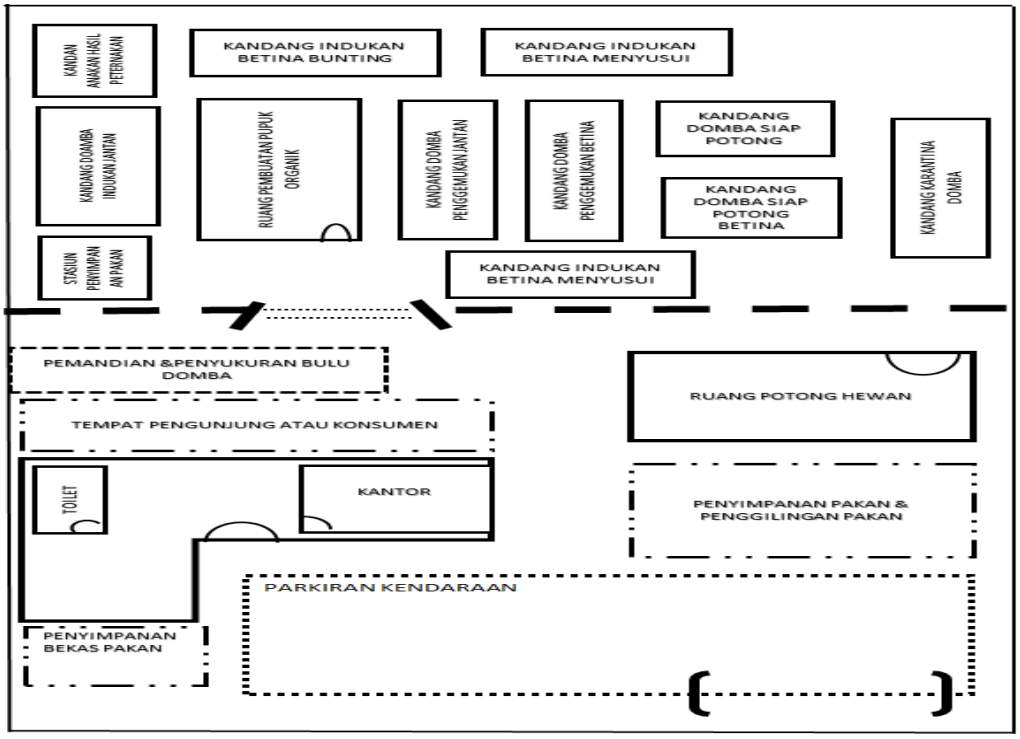

Figure 3. Young Farmer Farm sheep pen layout

http://ejournal.seaninstitute.or.id/index.php/Ekonomi
Jurnal Ekonomi, Volume 12, No 03, 2023
ISSN: 2301-6280 (print) ISSN: 2721-9879 (online)

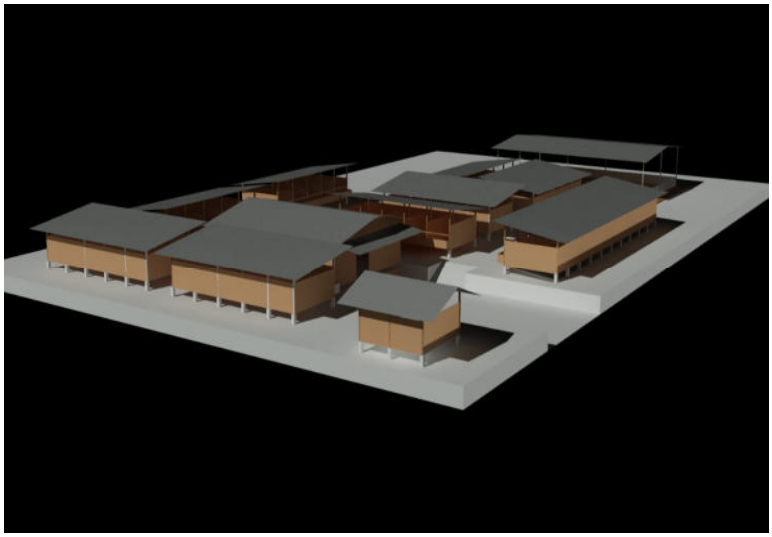

Figure 4. layout of the Young Farmer Farm

b. Restorasi the condition of the cage floor

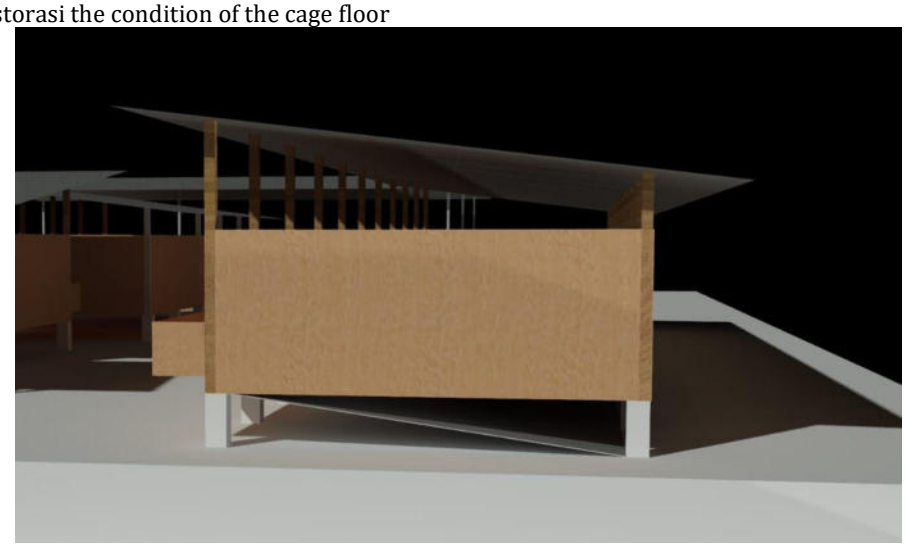

Figure 5. Restorasi the condition of the cage floor

In the proposed design of the enclosure that has been designed, it can be seen that as a whole there are differences in the position or placement of some parts of the cage including the location of the feed storage station, plus the existence of quarantine cages for sheep that have just arrived and sheep that are sick, and the addition of a separator partition between the manure and urine of the sheep.

b. Repair of examples of feeding and drinking processes

The following is an example of a feed formula for each of the sheep's needs in accordance with the established provisions.

1) Example of Sheep Feed Formula for the Pregnancy Phase

Table 2. Feed Material

No.	Feed Material	Feed requirements per head / day (kg)	
		Alternative 1	Alternative 2
A	Pregnant Sheep 1-4 months		
1.	Hollow Tofu	-	1,5

2.	Legium forage (fresh)	1,5	1
3.	Non legionary feed (legion)	27,5	21
4.	Concentrate	0,15	0,15
Jumlah		29,35	23,65
B	Sheep 5 months pregnant / Breastfeeding		
1.	Sweet Cassava (fresh)	-	4
2.	Legium forage (fresh)	27,2	15,5
3.	Forage non legion (legion)	11,6	15,1
4.	Concentrate	0,15	0,15
Jumlah		38,95	34,75

2) Example of sheep feed formula for rearing

Table 3. Material

No.	Material	Quantity (kg/day)
1.	Empty Tofu	3 - 5
2.	Cassava Skin	3
3.	Silage	5 - 6
4.	Concentrate	2 - 3

3) Example of sheep feed formula for the fattening phase

Table 4. Types of Sheep

No.	Types of Sheep	Targets PBB (kg/day)	Concentrate (kg/day)	Forage (kg/day)	Cassava (kg/day)
1.	Ewes	>0,6	2,5 - 4	25 - 40	6 - 9
2.	TUP	>1	6 - 8	15 - 20	3,5 - 4

c. Repair the process of taking feed and cleaning the sheep feed

The process of taking feed is carried out according to the required feed requirements throughout the day which is taken from the feed mill and then stored at the feed storage station to wait for the feeding schedule and for weighing the required feed according to the example of the feeding formula above.

The process of cleaning the feed bins is carried out twice a day, namely in the morning and evening, while the remains of used feed are transported using a trolley and collected using a sack in the used feed storage area.

d. Repair care and maintenance of sheep on a regular basis

Repair the care and maintenance of sheep on a regular basis, namely by checking the health of sheep for sheep that have just entered the pen in order to anticipate disease outbreaks. and ensuring that the sheep are kept in good health by using routine checks, then shearing the sheep is done for a period of 30-40 days, and after that it is recommended to do it in a bath so that the sheep are not attacked by skin diseases and lice.

e. Repair of sheep manure collection and sheep manure processing

In short, the process of removing sheep manure is carried out every 14 days by collecting separated manure from sheep urine, then moving it to a manure collection facility using a transporter such as a trolley, then putting it in a sack to mix it with EM4 liquid, then cooking it for 30 days after the manure The lamb dries and then grinds it using a smoothing machine. After smooth packaging using plastic bags, with this in mind, the sheep manure is ready to be used as fertilizer and is ready to be marketed.

5. CONCLUSION

Variants or problems that are considered to have a major impact on the sustainability of the stables are the layout of the enclosure which includes the condition of the enclosure, and the enclosure system which includes the process of feeding, routine care of the sheep, as well as the process of waste disposal and the management of waste produced by the enclosure. The results of the cage suggestion were carried out by moving the feed station to make the workforce more efficient and shorten the time for taking and feeding the sheep. Furthermore, quarantine cages are made for sheep that have just arrived and sheep that

have symptoms of illness. Improvements to the feeding process that must be carried out are by providing socialization related to the provisions of the composition of feeding sheep. Provisions for the composition of the feed include the pregnant phase, enlargement phase, and fattening phase. With the aim of streamlining the feed given so that waste does not occur and so that the lambs produced have healthy bodies and good meat.

Recovery of care that must be carried out in the process of routinely caring for and caring for sheep is by providing knowledge about the importance of caring for sheep to every employee on duty at the stable. namely by carrying out a health check on the sheep that enter the pen to anticipate disease outbreaks, and ensuring that the sheep are kept in good health by carrying out routine checks, shearing the sheep's wool is done for a period of 30-40 days, and after that it is advisable to ponds are carried out so that the sheep are not attacked by skin diseases and lice. Process Improvements to collecting sheep manure and processing sheep manure in this activity involve guard officers at the stables who need to be trained on the process of collecting sheep manure and processing sheep manure. With an overview of the activities, namely the disposal of sheep manure is carried out every 14 days by collecting the manure that has been separated from the sheep urine and then being transferred to the manure collection site using a transporter such as a trolley and then put it in a sack to mix it. using EM4 liquid then fermented for 30 days after the sheep manure is dried then ground using a smoothing machine. After finely packed using plastic bags, with this sheep manure is ready to be used as fertilizer and ready to be marketed.

REFERENCES

[1] Adam, F.Y. 2014. *Persentase Karkas, Daging dan Kulit Domba Ekor Tipis Jantan pada Umur dan Bobot Potong yang Berbeda*. Skripsi. Fakultas Peternakan UGM. Yogyakarta. 35 hal. (Tidak dipublikasikan).
[2] Direktorat Jenderal Peternakan dan Kesehatan Hewan. (2012). *Statistik Peternakan Tahun 2012*. Jakarta: Departemen Pertanian.
[3] Hasnudi., Ginting, N., Patriani, P., Hasanah, U. (2018). *Pengelolaan Ternak Kambing Dan Domba.* Medan: Yayasan Al Hayat.
[4] Heizer, J., Render, B. (2010). *Manajemen Oprasi*. Jakarta: Selemba Empat
[5] Manahan P. Tampubolon. (2018). *Manajemen Operasi dan Rantai Pemasok*. Jakarta: Mitra Wacana Media.
[6] Maulana, T. F., Pujangkoro, S. A., & Kes, A. M. (2013). Usulan Perbaikan Fasilitas Kerja pada Stasiun Pemotongan untuk Mengurangi Keluhan Musculoskeletal di CV. Xyz. *Jurnal Teknik Industri USU*, *2*(2).
[7] Mukti, K. P. (2018). *Analisis Sistem Kerja untuk Mengurangi Kelelahan Perawat dengan Pendekatan Ergonomi Makro di Rumah Sakit* (Doctoral dissertation, Universitas Sumatera Utara).
[8] Rusdiana. (2014). *Manajemen Operasi.* Bandung: CV. Pustaka Setia
[9] Safitri, N. D., Ilmi, Z., & Kadafi, M. A. (2017). Analisis perancangan tataletak fasilitas produksi menggunakan metode activity relationship chart (ARC). *Jurnal Manajemen, 9*(1), 38-47.
[10] Setiawan, H. S. (2017). Pengaruh Ergonomi dan Antropometri bagi User Gudang Bahan PT. MI guna Meningkatkan Produktivitas Serta Kualitas Kerja. *STRING (Satuan Tulisan Riset dan Inovasi Teknologi)*, *2*(2), 161-168.
[11] Simbolon, B. R. (2018). *Usulan Perbaikan Sistem Kerja dengan Pendekatan Ergonomi Makro di PT. XYZ* (Doctoral dissertation, Universitas Sumatera Utara).
[12] Subagyo YBP. (2009). *Manajemen Ternak Potong dan Kerja*. Jurusan Peternakan Fakultas Pertanian Universitas Sebelas Maret Surakarta.
[13] Suminar, L. A., Wahyudin, W., & Nugraha, B. (2020). Analisis Perancangan Tata Letak Pabrik PT. Xyz Dengan Metode Activity Relationship Chart (ARC). *J. Sains dan Teknol. J. Keilmuan dan Apl. Teknol. Ind, 20*(2), 181.
[14] Purnomo, H., & Ferdianto, K. (2011, July). Desain sistem kerja pada pengrajin mendong dengan pendekatan ergonomi makro. In *Prosiding Seminar Sains Nasional dan Teknologi* (Vol. 1, No. 1).
[15] Wignjosoebroto, Sritomo. (2006). *Pengantar Teknik dan Manajemen Industri*. Surabaya: Guna Widya