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Coexistence mode of production based dairy cow supporting farming in producing biogas as renewable energy resources

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Abstract. The development of dairy cows outside Java is an alternative effort to increase the population and national milk production. Production produced by dairy cows in the form of milk production, livestock production, and livestock waste production into biogas and fertilizer. The presence of a dairy farming starting from the input, process, and output has formed a different mode of production. This study aims to analyze the coexistence mode of production based dairy cow supporting farming in producing biogas as renewable energy resources. The research location was conducted in Enrekang Regency from April 2018 to June 2019. Data collection was done through observation, in-depth interviews, documentation, and triangulation and then the data were analyzed descriptively qualitatively. The results showed that dairy farming could coexist with the production of Dangka and its derivative products, the business of selling calves and cows and the processing of livestock waste in the form of biogas which is controlled by modes of production subsistence and commercial without mutually killing. This shows that the capitalists who grow in dairy farming in Java are different in Enrekang Regency.

1. Introduction

The development of the agricultural sector including livestock is one of the strategic choices to support the national and regional economy amidst the challenges of food crop agriculture such as climate change, mining expansion and socio-technical changes in food crop agriculture itself [1-3]. Based on the outlook for agricultural commodities in the 2016 dairy farming sub-sector by the Ministry of Agriculture, one important element in the development of national milk is the development of dairy cows in terms of both quantity and quality. Production results in the dairy cow business are a combination of various production factors used to produce milk production [4-5]. At present, some dairy farms have been managed in the form of commercial dairy farming and some are still in the form of traditional community farms [6]. The demand for fresh milk and its derivatives is expected to continue to increase in line with the growth of the human population, economic development, increased education, nutritional awareness, and lifestyle changes.

The prevailing livestock in Indonesia is carried out by traditional subsistence farmers who try to produce modestly but with the development of the times, the shift in the conditions of dairy farming production occurs. Enrekang Regency has long been known as a center for producing dairy cows in the province of South Sulawesi with the type of dairy cows which were originally the Sahiwal Cows and Santa Gertrudis in 2002, the dairy cow that developed on this time is the Friesian Holstein.



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Previous research in the national scope has discussed modes of fisheries production and coastal communities, market areas and the poor [7-9]. Whereas in other countries, previous studies have discussed manufacturing production planning modes, sustainable industrial mode of production, optimizing distribution with various modes of production and prices, strategic coordination of supply chain production, carbon emissions, knowledge acquisition and glucose fermentation. However, no research explores in the global context the coexistence mode of production based dairy cow supporting farming in producing biogas as renewable energy resources. The purpose of this study is to analyze the force of production and relations of production in the coexistence of dairy farming modes of production from time to time.

2. Methods

This research was conducted in April 2018 to June 2019 using a qualitative approach with a case study method in Cendana District, Enrekang. Data collected through interviews can be recorded through field notes and transcripts. Accurate transcription results are performed with data validation by repeatedly checking audiovisual recordings. Data were analyzed descriptively, describing the coexistence of dairy farming-based mode of production that supports the use of biogas as a renewable energy source. The data analysis model is divided into three main components [10] namely: (1) data reduction, selecting, and simplifying rough data obtained in the field; (2) data presentation, i.e. the presentation of data is carried out using tables or matrices to make it easier to see what is happening and related to the research theme; and (3) drawing conclusions by verifying throughout the research periodically in order to obtain valid data or information.

3. Results and Discussions

3.1. History of Dairy Farms in Enrekang Regency

The development of dairy farming in Enrekang Regency has been through a long process. The long process is seen from the passage of time and the changes that occur in it. The dairy farming in Enrekang Regency is divided into two stages of development, namely Phase I (1980-2001 period) is called the stagnation period and Phase II (2002-present period) is called the period of population increase and development.

The first period (1980/1981-2001). In the first period, the central government issued cow in the early 1980s. The goal of releasing cow is to enable domestic farmers to increase milk production. Besides, increasing the contribution of dairy cows is supported by demand for dairy products from the community. In 1980, two types of dairy cows at the beginning of development, Sahiwal and Santa Gertrudis from Australia through the president's assistance in the "Crash program". Of the two types of cow, only Sahiwal cow can survive even though the development is not so fast. At that time, the spread of Sahiwal and Santa Gertrudis cow was located in Juppandang, Galonta, and Cendana Village where there was no division yet so they still joined in Enrekang District. Over time, in 1994/1996 the development of Sahiwal cow and Santa Gertrudis at that time suffered a setback due to the lack of introduction of technology, inadequate transportation access, extensive maintenance systems and electricity facilities that were not yet available.

The second period (2002-present). The development of dairy cows is only Sahiwal despite stagnant developments, therefore the government adopted a policy of assisting the Livestock Service Office of South Sulawesi Province, around 2-3 Friesian Holstein cows to the 20 surviving farmers. In 2002, the government introduced technology in the form of Frisian Holland Cow to alleviate poverty through the direct community assistance government program that was channeled through groups in cash. Enrekang District Livestock and Fisheries Office the funds were facilitated by the in purchasing dairy cows on the island of Java. The program is called the "sharing system" where the source of funds comes from the Regional Budget and farmers (50:50). Besides, some breeders go directly to Java to obtain Friesian Holstein cows and forage feed seeds with independent funds.

In 2004, in line with the Enrekang Regency strategic plan that outlined regional capacity development, the main program that was pushed was to increase community knowledge about superior sex seed technology of production in line with expectations with good milk quality through the introduction of proven technology in empowering communities, and capacity building programs people's economic institutions. Through IPTEKDA IX, LIPI Research Center for Biotechnology develops sexing sperm-based dairy farming technologies that can improve the quality of milk in dangke production. The Local Government in collaboration with the Indonesian Institute of Sciences through Hasanuddin University is providing dairy cows to outstanding breeders.

In 2006, there was a financing program provided by BRI bank in the form of people's business credit (KUR), where every 6 months farmers were required to pay interest. This BRI program is driving the acceleration of the dairy cow procurement process. Besides, the central government assists outstanding livestock farmers groups in the form of cash and dairy cows. In 2010, the government regulation was changed to a social assistance program through direct assistance to farmer groups from the APBD and APBN. To date, the dairy cows raised in Enrekang Regency are derived from Friesian Holstein dairy cows obtained from Java which have more or less adapted to the local environment. That is the forerunner of developing dairy cows in Enrekang Regency

3.2. Coexistence of Dairy Farm Based Mode of Production

The development of a dairy farming in Enrekang Regency is inseparable for a long time. With this basis can be analyzed mode of production based on the periodization of events. The periodization of events, in this case, is a historical review of the development of the mode of production of dairy farming. It aims to map the periodization of events from time to time in the development of dairy farming es. The division of the period is based on the dominant factor affecting the livestock business mode of production so that changes occur.

3.2.1 Modes of Production in the Period 1980-2001. This period is the beginning of the establishment of a dairy farming, beginning with the import of Sahiwal and Santa Gertrudis cow. In this period only one mode of production is available, namely the subsistence mode of production. The initial orientation of the breeder household in developing dairy farms is none other than to meet their needs from the sale of the dangke. The distribution of dairy cow in Enrekang Regency at this time is not as much as it is now. The main commodity at this time is only dangke products. The subsistence mode of production is articulated as dairy farming, subsistence-oriented production with households as production units. The cultivation technology and tools used in dairy farming are still traditional. Labor relies on families so that relations of production are more likely towards egalitarian/ kinship relations. Regarding aspects of the mode of production are described in table 1.

Table 1. Mode of production in the period 1980-2001 in Enrekang Regency

Aspects of Mode of Production	Subsistence
A. Force of Production	
1 Technology of production	
Production tools	Sahiwal, Santa Gertrudis and land
Feed	Local
Maintenance system	Extensive
Waste Treatment	Natural Fertilizer
Knowledge	Local and original
2 Orientation of production	Subsistence
B. Relation of production	
1 Division of labor	No specialization
2 Relations in Production Organization	Egalitarian

Table 1 shows that the articulation of the mode of production of dairy farming was marked by the force of production and the relations of production that developed in Enrekang District during that period. The technology of production is still traditional, which is part of the force of production. The main production equipment is dairy cow. The first types of dairy cows developed in Enrekang in the 1980s were Sahiwal and Santa Gertrudis. At that time, the maintenance system was carried out extensively, using only crates as a feed and sickle to cut the forage that was consumed directly by livestock. The lack of technology that causes the natural mating system only relies on bulls from Bali cow or commonly known as beef cow so that their derivatives include beef cow and eventually the Sahiwal and Santa Gertrudis cow are depleted. While the feed used today only relies on grass growing under brown trees. Besides, the bran used is sent from a local factory. The milking system at that time was still manual using only minimal technology. At that time, biogas technology was not yet known, so the waste that was wasted was only used as a natural fertilizer. Knowledge is still limited in the dairy farming. On the other hand, dairy cows at that time were used as a labor to help farmers tilling rice paddies or milked to obtain milk production. The public is already familiar with dangke, namely, dangke from buffalo. The price of the dangke at the time was IDR 250 - 500. In this period, farmers only carry out production processes to meet subsistence needs.

In the relations of production in this period, the division of labor was dominated by men, especially in the maintenance of dairy cow because at that time the maintenance of dairy cows was done extensively. Besides, farmers also use cow power as rice plow. While women only help in the processing of milk into dangke. The above description shows that the actual work specialization has not yet been realized. The absence of job specialization in the 1980s-2001 period was related to the introduction technology of production. Farmers also do not yet understand how to raise the Sahiwal and Santa Gertrudis dairy cows which cause cow to be not resistant to disease and produce milk that is not proportional to their livestock production capabilities. Relations of production refers to the form of kinship relationships, in this case, the farmers carry out the maintenance process until the marketing process dangke still use family labor. Relations of production is no hierarchical but egalitarian. That is because the production unit and labor force used are nuclear family labor, which is the smallest unit in a community.

3.2.2. Modes of Production in the 2002-Present Period. The modes of production that developed in Enrekang District in this period were divided into subsistence and commercial articulated by dairy farming. Regarding aspects of the mode of production are described in table 2.

Table 2. Mode of production in the period 2002-present in Enrekang Regency

Aspects of Mode of Production	Subsistence	Commercial
A. Force of Production		
1 Technology of production		
Production tools	<i>Friesian</i> Holstein	Friesian Holstein cross-bred (PFH)
Feed	Local	Factory
Maintenance system	Semi Intensive	Semi Intensive
Waste Treatment	Plastic Biogas dan manure	Fixed-dome biogas, manure and urine
Knowledge	Local	Training and extension program
2 Orientation of production		
	Subsistence	Commercially marketed
B. Relation of production		
1 Division of labor		
	No specialization	No specialization
2 Relations in Production		
Organization	Egalitarian	Egalitarian to hierarchy

Table 2 shows that the mode of production articulated as a dairy farming that developed at this period is still ongoing. The current articulation of dairy farming is different from the previous period, the difference is the use of technological tools. The force of production relies on the ability of capital to move production. Dairy cows as the main force of production are followed by land in grazing or providing forages, as well as pens prepared for cow. Likewise, the relations of production between livestock business production is egalitarian. During this period, the government began to improve the dairy farming system by introducing technology in the form of FH cow assistance in the form of sharing systems to dairy farmers. The sharing system is government regulation in the current period in assisting with dairy cow through livestock farmer groups where the source of funds comes from the regional expenditure budget of Enrekang Regency with dairy farmers (50:50). In this period there were many changes in the development of dairy farming including the crossing system through artificial insemination technology that made the beginning of modernization in the field of dairy farming.

The force of production formed in this production consists technology of production which consists of the means of production needed in the amount of agricultural control and the extent of land intended for agriculture and agriculture as a forage feed. At the beginning of this period, the dairy farming was still a side income instead of the main occupation. However, along with its development, the dairy farming has become the main occupation. Dairy cows that were raised at the beginning of this period are Friesian Holstein cows which are one of the sub-tropical cow's nations imported from Java. The land used is forage land consisting of elephant grass obtained in the environment around the riverbank. While the supporting equipment in this initial period were buckets, water hose, brushes, broomsticks. Cages made in this early period are still traditional with walls that are used of wood while the roof uses tents.

At the beginning of this period, milking was generally still traditional is still using the hands and fingers. Before milking, the importance of sanitizing cages, dairy cows and equipment This is important so that milk that is milked is protected from contamination of microorganisms and manure. Besides, in 2002 the government introduced a waste treatment technology known as biogas technology. The biogas used is made of plastic digester obtained from the assistance of the Department of Mining and Energy in collaboration with the Department of Animal Husbandry and Fisheries in Enrekang Regency where properly processed cow feces will benefit farmers. Biogas can be made with easily available materials, another advantage of biogas technology is that it is used for cooking purposes and keeps the cage clean and away from the smell of feces and urine. Generally, the goal of becoming a dairy farmer at the beginning of this period is to get a steady income to achieve the sustainability of his business to support himself and his family compared to his previous job.

The division of labor is only done by the nuclear family, meaning the role of fathers and mothers and children is involved in activities in the cage, looking forage feed, milking and also cleaning cows and cages, processing and marketing dangke. Household production units that are managed by a simple business with local knowledge. The labor force involved in the dairy farming is the family structure. Family encouragement is a stimulus received by every farmer from a family member in running a dairy cow business to be a source of livelihood.

In this period, the commercial mode of production developed when farmers had above 5 of cows. Examining the commercial modes of production is inseparable from two important points, namely the force of production and the relations of production. Based on information obtained about the force of production in commercial modes of production, among others: the means of production in the form of dairy cow whose ownership is greater than subsistence. This is because farmers have begun to consider that the production of milk processed into dangke already has a sale value and can be an additional financial source. Farmers can be classified according to their livestock ownership. If the farmer has a large of livestock, then the land is also large enough to be used to provide a cage, feedlot, and land for forage grass. The difference that arises in each mode of production that develops is the mastery of livestock owned, both male and female dairy cows, calves or lactating dairy cows. Changes

to the cow owned by the breeder are the cage separation of cow and calves. Cages, places to eat and drink are made permanently with an area of 20 x 30 m for 30 cows and the roof is coated with zinc.

In addition to the type of cow, supporting equipment used in the development of dairy cow, several tools have changed: (1) Chopper is a machine for cutting forages. But there are still breeders who don't have this tool and use sickles to cut feeds; (2) Places to eat and drink are made permanent by the side of the cage; (3) Milkcan replace buckets for collecting milk which has obtained from the regional government. (4) Transportation includes pickup cars, motor viar, and motorbikes. This means of transportation replaces the cart used for transport production facilities both forage, concentrate and manure in the environment in livestock; (5) Biogas installation made of concrete as a place to collect livestock manure. In addition to equipment, production materials are also used for feeding dairy cows. Feed ingredients determine the level of production and productivity of dairy cows. The feed has the highest contribution of around 60-70% because feed is the main source of energy for dairy cow. Feed material used in the form of 1) Forage grass increases its land in line with the development of dairy cow business results. Elephant grass has a fairly high annual production and when it is still young its nutritional value is quite high. However, during the dry season, the provision of forages is the biggest obstacle in the maintenance of dairy cows, especially in Cendana District. Therefore, to meet the needs of feed, farmers utilize agricultural waste in the form of rice straw obtained from outside Enrekang Regency (Sidrap); 2) Concentrated feed is feed given to increase the amount of dairy cow milk production. If in the past farmers had not utilized agricultural waste, after 2010 farmers had learned from experience to utilize agricultural waste both during the dry and rainy seasons. The difference after several years of trying dairy cow, breeders more often use agricultural waste as animal feed, especially in the rainy season, dominant elephant grass is used as a good source of fiber while the dry season, the use of rice straw and corn is more dominant as a source of fiber in Cendana District.

The development of equipment and production materials also changed the way work became more efficient and was able to increase milk production. Before modern equipment was used, the forage cutting process was carried out manually using a sickle. However, since farmers use the chopper, all the forages will not be consumed by dairy cows or in other words, about 90% will be consumed by livestock. Besides, transportation facilities that used to be used only use carts to transport forage from land to be replaced by motorbikes, Viars or pick-up cars. Then, the milk reservoirs that initially used buckets but were replaced by Milkcan be obtained from the assistance of the Enrekang District Livestock and Fisheries Service. This new method is more efficient than the old way. The maintenance of dairy cows for breeders in Enrekang Regency is increasingly intensive based on experience. The learning process takes place in line with technological developments. Many farmers learn from the experience of raising dairy cows where in the dry season or the rainy season can use agricultural waste as animal feed. Then, collecting milk using Milkcan is guaranteed to be cleaner than using a plastic bucket. Besides, farmers use livestock manure with the use of biogas from the help of the BIRU program and treatment of organic fertilizer waste. The orientation of cow farming in this area aims to make dairy farmers get fulfillment of life needs, capital gains such as, buying rice fields, gardening, as well as savings in old age, improving the family's economic status, sending their children to university and developing businesses in other sectors from the results of raising dairy cows.

In the development of this period, the labor force used in the dairy farming was divided into family and outside family labor. Family labor consists of husband, wife, and children while non-family labor consists of male labor. The type of work done is looking for grass, feeding and drinking livestock, cleaning the cage, milking, processing, and marketing dangke. This labor is given IDR 1.500.000 /person/month. Also, successful marketing if the production can be accepted by buyers in this case dangke consumers. In the second period, subsistence and commercial modes of production occurred in the process of developing dairy farming. The subsistence mode of production refers to the use-value so that the dangke production results are only used for purposes in survival. Furthermore, the commercial mode of production leads to exchange rates, so the value of a dangke and its derivative products can be exchanged for something of value. There are two marketing channels, namely directly to consumers or through collecting traders. Dangke sales increased during the fasting month and Eid, the price of

dangke sold ranges from IDR 35.000 to 40.000 per seed. This price increase occurred because of the large demand for dangke from consumers. Also, other sources of income from raising dairy cows are the sale of calves and rejected cows which are marketed outside Enrekang areas such as Sidrap, Pinrang, Polmas and Toraja.

The structure relations of production, in this case, is family, so no gap and still egalitarian between nuclear family members. Unless the farmers are assisted by others whether they are still in a family/relative or outside it, surely the structure relations of the production will change to the hierarchical potential. The commercial mode of production refers to the scale of ownership of dairy cow (small, medium and large). There is no pure hierarchy occurring in this mode of production, a tendency to exist but not dominant and it is found in large-scale livestock ownership. Seeing the periodization in the formation of modes of production reflects the dynamics or transformation in the development dairy farming.

3.3. Discussion

In the context of the force of production can be discussed as follows. The land is a part technology of production. The results of our study indicate the use of ex-agricultural land is used for dairy farming. This finding is supported by [11] that land is an important investment in which each institution has its pattern in land management and has real rules that apply from generation to generation and cannot be changed by anyone. In other studies where changes in livelihoods due to the conversion of land use from agriculture to various non-agricultural jobs led to an increase in household income [12-14]. Besides, our results show that feed is used by utilizing the potential of local feed both during the rainy season, the dry season and the harvest season. An earlier study by [15] reported similar findings in the central and non-central areas of dairy farming in Enrekang District that the use of straw and corn was only carried out during the dry season. Peanut straw is used by all farmers in the central area during the harvest season (end of the rainy season) because it can significantly increase milk production. This finding is supported by research that corn silage is the main feed for dairy farming and has a higher cost ratio. Other research shows that it is necessary to utilize animal feed and supplements available from the local feed. However, farmers need to have adaptation skills by participating in farmer groups to be able to process good animal feed.

In addition to soil and feed, our results show cows used from Java that are crossed from Friesian Holstein. Cows have great potential to be developed because they can produce higher milk. This is supported by characteristics such as geographical, ecological, and soil fertility. This finding is supported by [16] Friesian Holstein has higher lactation milk production than Norwegian Red (NR). Ecological changes impact the sustainability of waste treatment technology [17]. The use of fertilizer has been going on for a long time and is passed down from generation to generation [18]. Production equipment and parts of technology of production. Our results show that the pattern of dairy farming is still traditional. This can be seen from other simple production equipment. This finding is supported by which shows the scale of farmers who are interested in easily implemented technologies that have direct benefits. Furthermore, knowledge is part of the power of production in the development of dairy farming. The results of our study prove the knowledge gained from generation to generation, comparative studies, training, and counseling. This finding is supported by, knowledge and technology need to be transferred from research to training through education, training, demonstrations and guidance services for dairy farmers. Where other research shows the power that drives farmers to make innovative choices.

Our results show that there is a change in orientation of production from subsistence (own consumption) to commercial (market sales). This finding is supported by, that household orientation transition from subsistence to commercial. Other studies that point to infrastructure development and accessibility (market access, support, and services) are important drivers of agricultural commercialization in the highlands. This leads to a change in upland livelihoods towards the market, with implications for household demographics, socioeconomic position, and income [19].

In the context of relations of production can be discussed as follows. The results show that there is a simple division of labor in the dairy farming. Labor that plays a role in raising dairy cows on a family-scale farm, in general, is in addition to the involvement of the head of the family as adult male labors, as well as family members such as wives and children who participate in helping to care for dairy cows, starting from looking for and providing forages, concentrates, giving water, bathing cows, cleaning cages, milking and marketing. The same applies to the division of labor's family outside. This finding is supported by [20] that the relational approach will contribute to overcoming the situation and stability and allow the transformation of changes in work relationship patterns. Interest in both sexes in training related to livestock farming and management approaches shows the potential to improve household welfare and reduce gender differences. The results showed that there was a transition in social relations in production organizations. Judging from the social relations in the organization of production based on morals in the family workforce. Use of family labor to reduce production costs. As business scale increases, farmers use assistance from outside the family with a wage system. This finding is supported by that the existence of wage labor and family labor can complete management tasks (specifically for the head of agriculture and family labor) and technical operations (the only operations carried out by wage labor).

4. Conclusions

Based on the results and discussion, conclusions among others: the development of dairy farming in Enrekang Regency can be classified based on the periodization are the first period (1980-2001) and the second period (2002-present). In the period 1980-2001, only subsistence mode of production and the 2002-present period saw the emergence of two modes of production namely the subsistence and commercial. Judging from the characteristics of simple technology of production and orientation of production which are only for subsistence and commercial needs, the force of production is non-capitalistic characteristics. Then judged by the characteristics of the low division of labor and relations of production organizations based on a combination of morality and rationality. Thus, the mode of production of dairy farming is a non-capitalistic.

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