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ANALYSIS OF POTENTIAL DEVELOPMENT OF DAIRY CATTLE AGRIBUSSINESS AND RELATED PRODUCTION FACTOR WITH MILK PRODUCTION IN SEMARANG

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ABSTRACT

This study aims to analyze the development potential of dairy cows and the relationship of social, economic, and technical factors with milk production in the city of Semarang. The research was conducted by survey method. Two districts with the highest dairy cattle population were selected to determine the location, namely Gunungpati and Mijen Districts. Sampling was carried out by simple random sampling of 65 farmers. The data obtained were analyzed using Location Quotient (LQ) and Dynamic Location Quotient (DLQ) methods to see the potential for dairy cattle development. Spearman rank correlation analysis was used to determine the relationship between social, economic, and technical factors (age of breeder, the experience of raising livestock, education level, number of lactating cows, the month of lactation, forage feed, and concentrate feed) to milk production. The results showed that the Districts of Gunungpati and Mijen had LQ values of 1.649 and 0.926, respectively, and DLQs of 1.0329 and 1.0327. It can be interpreted that Gunungpati District is the base area and the criteria for excellence, while Mijen District is the non-basic area and the mainstay criteria. The relationship of various social, economic, and technical factors showed that the age of the breeder, the number of lactating cows, forage feed, and concentrate feed had a solid relationship ($P<0.01$) on milk production. While the experience of raising livestock, education level, and months of lactation did not have a significant relationship ($P>0.05$) on milk production. These results concluded that the two research areas still have the potential to be developed, and technical factors have an essential role in increasing milk production.

Keywords: *dairy cow, location quotient, milk production, rank spearman*

BACKGROUND

The dairy cattle business is one of the most profitable businesses in the livestock sector because the demand for cow's milk in Indonesia increases every year. The milk consumed can compensate for the lack of nutrients in other foods; besides, milk is easily digested and absorbed by the body (Directorate of Processing and Marketing of Livestock Products, 2002). Mandaka and Hutagaol (2005) explain that the problems faced in the dairy cattle business are divided into three sectors, namely upstream, middle and downstream. Issues in the upstream industry include low productivity, lack of availability of dairy cattle, high feed costs, small scale of ownership, and low quality of human resources. Problems in the middle sector include soft cultivation techniques and recording systems, decreased availability of land for feed production, conversion of agricultural land to non-agriculture, low business capital from banks, and cross-sectoral cooperation that has not been integrated. Problems in the downstream sector include the low price of fresh milk and consumers and the unstable selling price of calf/dairy cows.

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The development of agribusiness-based livestock is one of the alternative programs expected to answer the challenges of increasing people's income and welfare (Mandaka and Hutagaol, 2005). To get maximum profit, breeders are required to reduce production costs (Rusdiana and True2009). Santoso et al. (2013) explain that the age of the breeder, the amount of milk production, and the cost of feed have a significant effect on the dairy farmer's income. Human resources, zootechnical factors, and the number of lactating cows together significantly affect milk production (Mukson et al., 2009). Thau's research results (2004) Technical efficiency factors that affect milk production include education level, business experience, number of business loans, counseling, courses and training by farmers, and the function of livestock in the household. Semarang City is a metropolitan city in Central Java that has the potential for dairy cattle. In 2018 the population of dairy cattle in Semarang City was 1,741 heads and ranked 7th in the largest cattle population in Central Java (BPS, 2019). Gunungpati sub-district has the largest dairy cattle population with 973 heads, followed by the Mijen sub-district with 418 heads.

Associated with the potential for developing a dairy cattle business in the city of Semarang as an effort to increase the income of farmers. In this study, we tried to analyze the potential and relationship of social, economic, and technical factors, including breeder age, livestock experience, education level, number of lactating cows, the month of lactation, forage feed, and concentrate feed with milk production. The results of this study are expected to provide additional information on the management of dairy cattle businesses, especially in the city of Semarang, and as a contribution to the development of dairy cattle agribusiness.

RESEARCH METHODS

This research was conducted in the Districts of Gunungpati and Mijen, Semarang City. The two sub-districts were chosen to consider the largest population of dairy cattle in the city of Semarang. The research was conducted using a survey method, namely, taking samples from the people of dairy farmers using a questionnaire as a data collector (Singarimbun and Effendi, 1995). Sampling was done by a simple random method for as many as 65 farmers. Primary data was collected by interviewing farmers, including questions about the identity of farmers and an overview of milk production. Secondary data is obtained from the relevant agencies and agencies

Analysis of Dairy Cattle Development Potential

Analysis of the potential development of dairy cattle in the city of Semarang using LQ (Location Quotient) analysis according to Arsyad's instructions (1999) and Hendarto (2000). The LQ method is divided into two, namely: static location quotient (SLQ is often called LQ) and dynamic location quotient (DLQ).

1. Static Location Quotient (SLQ) is a comparison of the magnitude of the role of a sector or industry in a region to the magnitude of the role of that sector or industry nationally. SLQ is formulated as follows:

$$SLQ = \frac{qi/qr}{Qi/Qn}$$

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Information:
SLQ : Static Location Quotient coefficient
Qi : The population of dairy cattle in the city of Semarang
qi : Population of dairy cows in the sub-district
Qn : Total livestock population in the city of Semarang
qr : Total livestock population in the sub-district

LQ Criteria:
If LQ > 1 : Sector base/potential
If LQ = 1 : Balanced/enough potential
If LQ < 1 : Non basis/less potential

Based on the formula above, it can be explained that if the LQ coefficient is > 1, then the sector tends to export its production output to other regions or perhaps exports to other countries. Meanwhile, if the LQ coefficient value < 1, this means that the sector tends to import from the different areas or from abroad.

2. Dynamic Location Quotient (DLQ) is a modification of the SLQ by accommodating the growth rate of the economic sector from time to time. DLQ is calculated using the following formula:

$$DLQ = \left(\frac{(1+gj)/(1+Gj)}{(1+gi)/(1+Gi)}\right)t$$

Information:
DLQij : Index of potential dairy cattle in Semarang City
Gi : Growth rate of dairy cattle in the sub-district
Gi : Average growth rate of dairy cattle in the sub-district
gj : Growth rate of dairy cattle in the province of Semarang city
Gj : Average growth rate of dairy cattleSemarang city
t : The difference between the end of the year and the beginning of the year

After the results of the DLQ and SLQ calculations are known, the next step is to determine the location criteria based on the following table:

Table 1. Criteria for determining the location by taking into account LQ and DLQ

Criteria	DLQ > 1	DLQ < 1
SLQ > 1	Superior	Prospective
SLQ < 1	Mainstay	Less Prospective

Source: Mudrajad (2002)

Analysis of the Relationship of Various Social, Economic, and Technical Business Factors

Analysis to see the relationship between the various independent variables (X) and the dependent variable (Y), non-parametric statistics were used with the Spearman Rank correlation test (rs). A statistical test of the Spearman Rank correlation coefficient (rs) is used to test whether or not

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the relationship between variables is in ordinal form (Iqbal, 2004). According to Siegel (1997), the Spearman Rank correlation coefficient formula (rs) is:

$$rs = \frac{6 \sum_i^n = 1\ di^2}{N^3 - N}$$

Information:
rs : Correlation coefficient
in : The difference between the ranking of the variables
N : Number of samples

The test is continued to see the level of significance of the test if there are twin ranks both in the X variable and in the Y variable so that a t correction factor is needed (Siegel, 1997) with the following formula:

$$r_s = \frac{\sum X^2 + \sum Y^2 - \sum di^2}{\sqrt[2]{\sum X^2 \sum Y^2}}$$

$$\sum X^2 = \frac{n^3 - n}{12} - \sum T_X$$

$$\sum X^2 = \frac{n^3 - n}{12} - \sum T_Y$$

$$T = \frac{t^3 - t}{12}$$

Information:
ΣX^2 : The sum of the squares of the corrected variable X
ΣY^2 : The number of squares of the corrected variable Y
ΣT_X : The number of correction factors for the variable X
ΣT_Y : The number of correction factors for the Y variable
T : correction factor
t : Number of numbered observations the same at a certain level
n : Number of samples

In determining the level of strength of the relationship between variables, it can be guided by the value of the correlation coefficient with the following provisions (results from SPSS output):
1. The correlation coefficient value is 0.00 - 0.25 : Very weak relationship
2. The correlation coefficient value is 0.26 - 0.50 : Sufficient relationship
3. The correlation coefficient value is 0.51 - 0.75 : Strong relationship
4. The correlation coefficient value is 0.76 - 0.99 : Very strong relationship
5. The correlation coefficient value is 1.00 : Perfect relationship

RESULT AND DISCUSSION

Overview of Research Sites

Gunungpati District is one of the areas that are the foundation of the agricultural sector in Semarang. Various fields of agriculture such as food crops, plantations, and animal husbandry were developed. One livestock sector developed in Gunungpati includes beef cattle, dairy cattle, horses,

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buffalo, goats, and sheep. Mijen District is one of the sub-districts in the upper part of the city of Semarang. Mijen District is located between Ngaliyan District and Gunungpati District and is bordered by Kendal District. The total area is 57.55 km2 divided into 14 urban villages.

Mijen District is a sub-district located in the western part of Semarang City at an altitude of 228 on the water surface with an average temperature of 26-30 degrees Celsius. It is a very strategic developing area and has the potential to be developed as a trade and tourism area in the western sector with various potentials. Mijen District is one of the areas in Semarang City which has different characteristics from other regions. In addition to its location in the Upper Semarang area, the parts of the population have various potentials that can still be developed. This sub-district, which mainly functions as a conservation area, has the northern boundaries of the Gajahmungkur and Ngaliyan sub-districts, in the south the Semarang district, in the east the Semarang and Banyumanik districts, in the west the Mijen and Kendal districts.The growth of livestock population in Gunungpati District, Mijen District, and Semarang City from 2016 to 2018 can be seen in the Table 2.

Table 2. Livestock population in Gunungpati and Mijen Districts

Subdistrict	Year	Dairy cows	Beef cattle	Buffalo	Horse	Goat	Sheep
Gunungpati	2016	886	1,134	333	32	3,541	1,261
	2017	886	1,134	333	32	3,541	1,261
	2018	973	1,140	287	30	2,545	1,404
Mijen	2016	405	2,068	462	35	2,045	840
	2017	405	2,068	462	35	2,045	840
	2018	445	1,775	398	33	1,470	935

Source: BPS (2018)

Overview of Dairy Cattle Management

Based on the results of extracting information from the agricultural office of Semarang City, Gunungpati and Mijen sub-districts are the center of dairy farming in Semarang City. These two sub-districts dominate the population of dairy cattle. In addition, environmental and land conditions in the two sub-districts are still extensive and very supportive in managing dairy cows. Apart from dairy cows, various types of livestock and other agricultural activities were also developed in the two sub-districts.

Dairy cattle management is carried out individually and in groups. Farmers who carry out their activities in groups usually do not have enough land to make them independent. Of the existing breeders, most of the farmers carry out farming activities in groups. Several livestock groups occupy land provided by the government with a plot rental system. Each breeder makes a cage on the plot of land according to the number of livestock. There are permanent and semi-permanent forms of cages, depending on the breeder's ability. Breeders who make individual patterns are usually carried out on private land near the house.

The type of cattle raised in the Holstein Friesian Breed (PFH). Feeding is done by providing forage feed and additional materials (concentrates). To meet the needs of feed, farmers usually rely on grass and weeds around the farm's location. In addition, farmers also provide a stock of straw for preparation in the dry season, and forage is challenging to obtain. Cows old enough for milk production will be bred using artificial insemination (IB). IB injection or artificial mating is repeated until the cow is completely pregnant. The period of pregnant cows is for nine months; then, after that, they give birth. After giving birth, the cow can be milked for up to 10 months. Milking is done twice

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a day, in the morning around 05.00 and the afternoon around 16.00. Milking is done manually. Most farmers sell their milk to collectors, and some are sold directly. In addition, some carry out further processing. Cattle health maintenance is carried out periodically by the agriculture department. In addition, several farmers register their cows in the insurance program.

Characteristics of Respondents

All respondents are male, with the oldest age being 60 years old while the youngest is 37 years old. The highest education level of the respondents was a bachelor's degree, as much as 3.3%, while the lowest was elementary school. The respondent's most extended experience in raising livestock is 24 years, while some have just started a business for about two years. The average number of lactation cattle ownership is three heads, with the maximum ownership of 7 cows and at least one head.

Table 3. Livestock Population in Semarang City

Type of Livestock	Year			Average
	2016	2017	2018	
Dairy cows	1,585	1,585	1,741	1,637
Beef cattle	4,591	4,591	3,944	4,375
Buffalo	1,183	1,183	1,019	1,128
Horse	90	90	85	88
Goat	10,990	10,990	7,900	9,960
Sheep	2,941	2,941	3,275	3,052
Total	**21,380**	**21,380**	**17,964**	**20,241**

Dairy Farming Potential

The method to determine the level of potential in this study is LQ. This LQ method aims to identify whether Gunungpati and Mijen sub-districts have the potential to be developed for dairy farming and to find out which sub-districts are the basis for dairy cattle. This LQ method aims to analyze whether the city of Semarang has the potential to be developed for dairy farming and to determine the sub-district that is the basis for dairy cattle. The basic principle used in this regional analysis is that it is comprehensive. Various dimensional aspects in assessing aggregate areas that have the potential for agricultural products and combining multiple elements of the study, both the condition of human resources, natural resources, institutions, and government policies that are being implemented (Malika and Adiwijaya, 2017). This study uses population indicators to measure potential based on Hendarto (2002) and Amalia (2007) use the LQ method.

Table 4. Calculation Results of SLQ and DLQ in Gunungpati District

Type of Livestock	Year			Average	SLQ	DLQ	Category
	2016	2017	2018				
Dairy cows	886	886	973	915	1,65	1.03	Superior
Beef cattle	1,134	1,134	973	1,080	0.73	0.95	Less prospective
Buffalo	333	333	287	318	0.83	0.95	Less prospective
Horse	32	32	30	31	1.05	0.98	prospective
Goat	3,542	3,541	2,545	3,209	0.95	0.91	Less prospective
Sheep	1,261	1,261	1,404	1,309	1.27	1.04	Superior
Total	**7,187**	**7,187**	**6,212**	**6,862**			

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Based on the calculation results above, it can be seen that the SLQ value is 1.649 and DLQ 1.0327. This means that the development of dairy cattle in the Gunungpati sub-district is a base area and is included in the superior criteria. The potential population is also supported by the possible availability of land and feed, which is quite extensive.

Table 5. Results of DLQ and SLQ Calculations in Mijen District

Type of Livestock	Year			Average	SLQ	DLQ	Category
	2016	2017	2018				
Dairy cows	405	405	445	418	0.93	1.03	Mainstay
Beef cattle	2,068	2,068	1,771	1,970	1,63	0.95	prospective
Buffalo	462	462	398	441	1,42	0.95	prospective
Horse	35	35	33	34	1,41	0.98	prospective
Goat	2,045	2,045	1,470	1,853	0.67	0.91	Less prospective
Sheep	840	840	935	872	1.03	1.04	Superior
Total	**5,855**	**5,855**	**5,056**	**5,589**			

The above calculation shows the SLQ and DLQ values of dairy cattle in the Mijen District, respectively, 0.926 and 1.0329. These results show that dairy farming in Mijen sub-district is a non-basic area and is included in the mainstay criteria. Based on the results of the LQ analysis with the population indicators above, it can be seen that Gunungpati District is included in the category of basic or potential areas. Thus, the hypothesis can be accepted that Gunungpati District has the potential to be developed for dairy cattle. Meanwhile, Mijen District is categorized as less potential, so the hypothesis that Mijen District is a potential area is rejected. The population concentration criteria are often used to select likely regions for the development of dairy cattle. The results of this study can be refined in the following research by adding other indicators such as the production of Forage Forage. Santoso et al. (2013) used the total population of dairy cattle and forage production to calculate the potential of an area.

Relationship of Social, Economic, and Technical Factors to Milk Production

Statistical test of the Spearman Rank correlation coefficient (rs) between the variables of breeder age, livestock experience, breeder education, number of lactating cows, forage feed, and concentrate feed on milk production variables can be seen in Table 6.

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Table 6. Results of Rang Spearman's correlation test analysis

Variable X	Variable Y	
		Milk Production
Age Of Farmers	Pearson Correlation	.286*
	Sig. (2-tailed)	.027
	N	65
Farm Experience	Pearson Correlation	.149
	Sig. (2-tailed)	.256
	N	65
Farm Education	Pearson Correlation	.230
	Sig. (2-tailed)	.077
	N	65
Number Of Lactation Cow	Pearson Correlation	.875**
	Sig. (2-tailed)	.000
	N	65
Lactation Month	Pearson Correlation	.102
	Sig. (2-tailed)	.440
	N	65
Green Feed	Pearson Correlation	.880**
	Sig. (2-tailed)	.000
	N	65
Concentrate Feed	Pearson Correlation	.861**
	Sig. (2-tailed)	.000
	N	65

*. Significant correlation at 0.05 level (2-tailed).
**. Significant correlation at 0.01 level (2-tailed).

Based on the results of the analysis can be interpreted as follows:

1. Relationship between Farmer's Age and Milk Production

The relationship between breeder age and milk production shows a correlation coefficient of 0.286 with a significance value of 0.027. This means that the age of the breeder has a significant relationship at the 5% level on milk production. The above analysis results are in line with Mukson (2009), which states that the age of the farmer has a significant effect on milk production. On the other hand, the opposite is true; Santoso (2013) explains that the older the farmer, the lower his work productivity, which has an impact on the decrease in the farmer's income.

Based on the data on the characteristics of respondents, most of them are in the range of 46-50 years, as many as 20 people or 31% of the total respondents. It can be interpreted that dairy farmers are dominated by farmers with productive categories (Hastuti et al., 2008). Farmers are still physically strong and more receptive to information and technology transformation at this age. Saragih (2000) states that generation influences work productivity in types of work that rely on physical exertion.

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2. Relationship between Livestock Experience and Milk Production

The above analysis correlation coefficient between farming experience and milk production is 0.149 with a significance value of 0.256. This shows that farming experience with milk production does not have a significant relationship. The results above show that the experience of raising livestock is not directly proportional to the increase in milk production. This is possible because farmers are comfortable with conventional models and do not innovate raising livestock. In general, farmers do not make milk production their primary source of income. The income from milk production is only limited to meeting daily needs and is not business-oriented, so it is not optimal for business management.

The results above show that the experience of raising is not directly proportional to the increase in milk production. Santoso et al. (2013) explained that partially the expertise of farming does not affect farmers' income. This is possible because farmers are comfortable with conventional models and do not innovate raising livestock. In general, farmers do not make milk production their primary source of income. Income from milk production is only limited to meeting daily needs and is not business-oriented, so it is not optimal for business management.

3. Relationship between Education Level and Milk Production

The level of education of farmers affects the absorption of information and knowledge farmers. The low level of farmer education will cause farmers to have difficulty capturing information and adopting innovations. Through education, farmers will have new knowledge, skills, and innovations in running their businesses for the better (Haryanti, 2009). The education level of breeders is dominated by the junior high school (SMP) education level of 42%. At the same time, the higher education (PT) level is only 9%. This shows that the level of education of the farmers is still relatively low.

The correlation coefficient value of education level with milk production is 0.230, and the significance is 0.077. From these results, there is no significant relationship between education level and milk production. This result is contrary to Mukson (2009), which states that the level of education affects milk production. With a relatively low level of education, farmers will find it difficult to accept innovation and information transformation.

4. Relationship between the number of lactating cows and milk production

Breeders with 1-2 cows still dominate with 59%. While the most ownership is 7-8 tails by 9%. The relationship between the number of lactating cows and milk production shows a correlation coefficient value of 0.875 with a significance value of 0.000. From this value, it can be interpreted that the number of lactating cows with milk production has a solid and unidirectional relationship. With every increase in lactating cows, milk production will also increase.

The regression coefficient for the variable number of lactating cows is 0.873, which means that every 1% increase in the number of cows will increase milk production by 0.873.% of the average output. The study results above align with Mukson et al. (2009), which state that HR factors, zootechnical, and the number of lactating cows together have a very significant effect on milk production. The number of lactating cows ownership is very influential on the farmer's business because it will determine the number of milk products produced. Daryanto (2007) stated that the right

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of lactation cows with 1-3 heads could only be used to meet daily and operational needs. About 10-12 lactating cows are needed to reach economies of scale.

5. The Relationship between Lactation Month and Milk Production

The lactation month is when the milking process is carried out to coincide with the time of visiting or conducting a survey in this study. From the analysis results above, the correlation coefficient between the months of lactation and milk production is 0.107 with a significance value of 0.440. From this value, it can be interpreted that the month of lactation does not have a significant relationship with milk production.

6. Relationship between Forage Feed and Milk Production

Forage feed is feed given in the form of green grass given to dairy cows. Forage is the main feed for dairy cows. Forage has a relatively low energy content but is a good source of vitamins and minerals for dairy cattle. Feeding was done twice a day in the morning and afternoon with an average of 40 kg/day. In contrast to Karuniawati (2012), in Bogor Regency, the provision of forage feed to dairy cows is only 38.69 kilograms of livestock per day.

Alpian (2010) and Apriani (2011) state that the most influential factor on milk production in dairy cows is the provision of feed in the form of forage and concentrate feed. The correlation coefficient value between forage feed and milk production is 0.880, with a significance value of 0.000. The number of positive correlation coefficients indicates a unidirectional relationship between the two variables. Thus it can be interpreted that forage feed has a very close relationship to milk production. The addition of forage feed will be directly proportional to the increase in milk production. In sync with Gultom and Suharno (2014), who explained that forage feed affects milk production.

7. Relationship of Concentrated Feed with Milk Production

Concentrated feed is animal feed from grains and agricultural wastes such as corn, groats, bulgur, and farming by-products from factories such as bran, bran, coconut meal, peanut meal, and molasses. Breeders give concentrate to dairy cows an average of 3 kg/day. From the analysis above, the correlation coefficient between concentrate feed and milk production is 0.861, and the significance value is 0.000. The number of positive correlation coefficients indicates a unidirectional relationship between the two variables. It can be interpreted that concentrate feed has a very close relationship with milk production. The addition of concentrate feed will increase milk production. This is in line with the statement of Mukson et al. (2009), Karuniawati (2012) and Anisa (2008).

CONCLUSION AND SUGGESTION

Based on the objectives and results of the discussion in this study, the following conclusions can be drawn:

1. Gunungpati sub-district is a base area or potential area and is included in the superior criteria with a value of LQ > 1 and DLQ > 1. Meanwhile, the Mijen sub-district has an LQ value < 1 and DLQ < 1, so it does not include a potential area or base area and is included in the mainstay criteria in cattle development. Milk in the city of Semarang.

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2. The relationship of various social, economic, and technical factors showed that the age of the breeder, the number of lactating cows, forage feed, and concentrate feed had a solid relationship (P<0.01) on milk production. While the experience of raising livestock, education level, and months of lactation did not have a significant relationship (P>0.05) on milk production. These results concluded that technical factors are essential in increasing milk production.

Based on some of the conclusions above, the author feels the need to provide some suggestions as follows:

1. There is a need for additional education from the competent and competent authorities in the form of formal and informal education related to dairy cattle management so that they can be maximized in managing the dairy cattle business.
2. Further research needs to be done to see the motivation of farmers in carrying out livestock activities. So that it can be seen whether the motivation for raising livestock is business-oriented or just daily activities.

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