

# Analysis of the local resource-based dairy cattle development in Central Java

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## Analysis of the local resource-based dairy cattle development in Central Java

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### ABSTRAK

Penelitian bertujuan menganalisis pengembangan sapi perah berbasis potensi sumberdaya lokal untuk peningkatan produksi dan kualitas susu di Jawa Tengah. Metode penelitian dilakukan secara survai. Penentuan lokasi penelitian dilakukan secara purposive sampling, diambil 2 Kabupaten, yaitu Kabupaten Boyolali dan Semarang. Setiap kabupaten dipilih 2 kecamatan sebagai sampel berdasarkan jumlah populasi sapi perah terbanyak. Masing-masing kecamatan diambil 3 kelompok tani ternak (KTT) sehingga secara keseluruhan ada 6 KTT setiap kabupaten. Sampel peternak sapi perah ditentukan secara acak sederhana, sebanyak 10 peternak setiap KTT, sehingga secara keseluruhan ada 120 peternak. Analisis data dilakukan dengan metode deskriptif, analisis location quotient (LQ) dan analisis statistik model regresi linier berganda. Sebagai variabel dependen produktivitas susu dan kualitas susu (Y1,2) dan variabel independen terdiri dari sumberdaya manusia (x1), sumberdaya lingkungan (x2), sumberdaya modal (x3), sumberdaya kewirausahaan (x4), sumberdaya teknologi (x5), sumberdaya kelembagaan (x6) dan sumberdaya infrastruktur (x7). Hasil analisis LQ populasi sapi perah, ketersediaan pakan hijauan dan limbah pertanian serta penyerapan tenaga kerja sangat potensial (LQ>1). Faktor sumberdaya lokal secara bersama-sama sangat nyata ( $P<0,01$ ) berpengaruh terhadap produksi dan kualitas susu sapi perah. Hasil ini menunjukkan bahwa pengembangan usaha sapi perah perlu memperhatikan potensi sumberdaya lokal agar dicapai peningkatan produksi dan kualitas susu.

*Kata kunci : kualitas susu, produksi susu, sapi perah, sumberdaya lokal*

### ABSTRACT

The objectives of this research were to analyze the local resource-based development of dairy cattle in order to improve the production and quality of milk in Central Java. The research was carried out by survey method. The research locations (Boyolali and Semarang) were chosen using purposive sampling method. In each regency was determined 2 sub district locations in which having the largest dairy cow population and 3 Dairy Cattle Farmer Associations (DCFA) in every sub district. Dairy farmers were sampled randomly, 10 farmers in every DCFA. Therefore, there were 120 dairy cattle farmers for sample. Data were analyzed using descriptive methods, location quotient (LQ) analysis and multiple linear regression statistical model. The dependent variables were yield and quality of milk (Y1,2) and the independent variables were human resources (x1), environmental resources (x2), capital resources (x3), entrepreneurship resources (x4), technology resources (x5), institution resources (x6) and infrastructure resources (x7). The LQ analysis showed that dairy cattle population, availability of forage and agricultural waste, and absorption of labour were very potential (LQ>1). Local resources significantly affected ( $P<0.01$ ) the production and quality of dairy cattle milk. These results suggest that the development of dairy cattle business needs to consider the potential of local resources in order to

improve the production and quality of milk.

*Keywords: dairy cattle, local resources, milk production, milk quality*

## INTRODUCTION

Local dairy cattle business in Indonesia in recent years has not been developed yet because of various internal and external factors, which lead to low farming productivity and the income of dairy cattle farmers. The performance of dairy cattle production at the time of this study only reached 7-10 liters/head/day. Improper management, zoo-technique and managerial aspect of the business have caused low milk yield and its quality, farm productivity and efficiency have caused low income for dairy cattle farmers.

Indonesia is a potential country of human and natural resources to develop local dairy cattle farm-based milk industry. However, the milk industries in Indonesia have not been able to supply the need of milk, therefore currently Indonesia is one of the major importer country for milk. Milk imports accounts for 75% of total national milk supply and the rest 25% is from local milk production (Firman, 2010). The impact of imported milk are: 1) Local dairy farmer loses national consumer market share, which in turn reduces their income, and 2) World milk price, which tends to be lower than that of the local, poses marketing challenges for local dairy farmers and further decreases the business opportunities. Majority of farmers reared dairy cattle for selling milk as the source of income.

Due to the low dairy cattle milk yield, Indonesian government is currently running a milk revitalization program until 2014 with its main objective to improve production and productivity of dairy. The government expected the milk yield levels to reach 15 liters/head/day. Another program related to the development of milk industry is the issue of Presidential regulation No. 28 Year 2008 on National Industrial Policy which emphasizes the improvement of productivity, ownership cattle population, milk quality, nutrition improvement for cattle as well as improvement of human resources, partnership between milk industry and cooperation, access to capital and the increase in milk consumption. However, the existing policies have not been able to significantly improve dairy cattle population and milk yield until now.

The low national milk production is also caused by the small scale cattle ownership of local

farmers, poor feeding practices with low quantity and quality of fodder, poor pen hygiene, limited post-harvest management and product marketing (Mukson *et al.*, 2010; Yulianto, 2011). Those situation in the local dairy cattle farming gives impact to the low investment, productivity, efficiency and income, as well as poor business competitiveness. On the other hand, potential local resources such as environment, manpower, institutions, technology, capital and entrepreneurship of dairy cattle farms tended to promise better future if being managed well in order to improve dairy cattle business. A study by Suzuki *et al.* (2006) on the productivity of dairy cattle and social profiles of dairy cattle farmers in North Vietnam showed that difference in the management and productivity of local dairy cattle farms can be attributed to the difference in environmental factors. In addition, environmental differences can affect access to financial and counseling institutions as well as governmental support.

In order to improve productivity and efficiency of dairy cattle farms and their competitiveness in the business, technology and zoo-technique of farms (breeding, feeding, and reproduction), management must be seriously managed. Based on the background and issues stated above, there is a need for a study aimed to analyze the potential of local resources which impact on milk yield and to analyze the direction and strategies of dairy cattle business development to support milk self-sufficiency in Central Java.

## MATERIALS AND METHODS

The studies were carried out in the centers of dairy cattle development areas in Central Java, namely Semarang and Boyolali regencies. Survey method was employed for the research by collecting data from dairy cattle farmers sample using questionnaire (Singarimbun and Efendi, 1989). The research locations (Boyolali and Semarang) were chosen using purposive sampling method. In each regency was determined 2 sub district locations in which having the largest dairy cow population and 3 Dairy Cattle Farmer Associations (DCFA) in every sub district. Dairy farmers were sampled randomly, 10 farmers in

every DCFA. Therefore, there were 120 dairy cattle farmers for sample. The research location and the samples are presented in Table 1. Data observed were the identity of respondents, description of dairy cattle farming and profile of local resources, whereas secondary data were collected from various institutions relevant to the subject of this research. Local resources are defined as resources in the location of the research which are used in the activities of dairy cattle farming, such as manpower, natural resource, technology, institution and infrastructure. Resources profiles were measured by employing Likert scale techniques, with scales of 1=very poor, 2=poor, 3=medium, 4=good and 5=very good (Indriana and Supomo, 2002). Each resource factor contain five questions, so total questions were 30 items. The data obtained were analyzed descriptively and statistically using Location Quotient (LQ) based on cattle population, feed availability, and employment provision indicators, as explained in Hendarto (2000) by the following formula:

$$LQ = \frac{\sum PSRR : \sum PSRC}{\sum TSRR : \sum TSRC} \dots\dots\dots (1)$$

where :

∑ PSRR : Partial sum of resource factor in the Regency

∑ PSRC : Partial sum of resource factor in the Central Java

∑ TSRR : Total sum of resource factor in the Regency

∑ TSRC : Total sum of resource factor in the Central Java

LQ Criteria:

If LQ > 1 = potential

If LQ = 1 = balanced

If LQ < 1 = not potential

To discover how local resources factor influenced milk production and quality, analyses were performed using multiple linear regression model as stated by Ghozali (2006), as follows:

$$Y_{1,2} = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + e \dots\dots\dots (2)$$

Each variable in the analysis above are defined as  $Y_{1,2}$  = Milk production/quality of dairy farmers,  $a$  = constant,  $b_1, b_2, \dots, b_n$  = regression coefficient,  $x_1$  = human resources,  $x_2$  = environmental/natural resources,  $x_3$  = capital resources,  $x_4$  = entrepreneurship resources,  $x_5$  = technology resources,  $x_6$  = institutional resources,  $x_7$  = infrastructure resources and  $e$  = stochastic deviations.

An F test was then performed to test the multiple linear regression model with significance value of 1%, 5% and 10%. The t-test was performed to partially determine the influence of various independent variables toward the dependent variables.

Table 1. Location and Sample Population

| Regency  | Sub District | Name of Dairy Cattle Farmer Association (DCFA) | DCFA Sample Population (farmers) |
|----------|--------------|--|----------------------------------|
| Semarang | a. Getasan   | - Sari Puspita<br>- Rias<br>- Ngudi Rahayu     | 30                               |
|          | b. Tengaran  | - Sidodadi<br>- Taruna Karya<br>- Sido Maju    | 30                               |
| Boyolali | a. Musuk     | - Sido Makmur<br>- Maju Mulyo<br>- Margo Mulyo | 30                               |
|          | b. Cepogo    | - Tani Mulyo<br>- Margo Mulyo<br>- Tani Makmur | 30                               |
| Total    |              |  | 120                              |

## RESULTS AND DISCUSSION

### General Description of Dairy Cattle Potential

Boyolali and Semarang Regencies are areas in Central Java with great potential for dairy cattle development. The population of dairy cattle in Boyolali Regency is the biggest in Central Java with a total population of 61,878 heads (Dinas Peternakan dan Kesehatan Hewan Propinsi Jawa Tengah, 2014) and the second biggest population exists in Semarang Regency with 22,408 heads of dairy cattle (Table 2).

Milk production is the primary goal in the effort of dairy cattle farming. In 2013, Boyolali and Semarang Regency produced 46,906,494 liters and 27,530,007 liters of milk respectively. The two areas contributed 73.0% of the total milk yield in Central Java. In 5 years (2009-2013) the milk yield volume in Boyolali has grown as much as 7.15%, exceeding the average milk yield volume growth in Central Java (1.73%), whereas the milk yield volume in Semarang Regency dropped by 1.42%.

The dairy cattle population in Boyolali Regency and Semarang Regency during 5 years has increased about 2.99%, where as an 8.30% decreasing in population was noted in Semarang Regency as well as the 1.42% population decrease in the region of Central Java.

Dairy cattle development potential was analyzed using LQ analysis. LQ Analysis takes into account dairy cattle population, availability of feed and absorption of labour as parameters. Results of the LQ analysis in Boyolali Regency

and Semarang Regency (Table 3) show that LQ for dairy cattle population was 7.2 and 4.46 respectively, feed availability was 1.12 and 1.26, respectively, and absorption of labour was 6.97 and 4.28, respectively. All of three analyzed parameters have met the value of  $LQ > 1$ , which means that Boyolali and Semarang Regencies were the base and potential areas for dairy cattle development (Hendarto, 2000).

### Characteristics and Identity of Dairy Cattle Farmer

Based on criteria of age, educational background, main occupation and business experience, the profiles of dairy cattle farmer are summarized in Table 4. Table 4 shows that the majority of the respondents was in the productive age category of 31-55 years old (78.22%). The rest of the population was in the ranges of 20-30 years old (6.5%) and above 55 years old (15.05%). The fact that most of farmers were still in their productive age is expected to positively contribute to the optimal development of the business. Farmers of productive age possess better physical capabilities than those of non-productive age. Based on their educational background, most of dairy cattle farmers in this research was came from relatively low educational background that was Elementary School (55.02%) and Higher Education (5.00%). The main occupation of the respondents was mostly farmers (55.38%), and dairy farming was sideline for the majority of the respondents. The average numbers of owned dairy cattle of the respondents were relatively small

Table 2. Dairy Cattle Population and Milk Yield by Year in Boyolali and Semarang Regencies (2009 – 2013)

| Year   | Boyolali Regency               |                    | Semarang Regency               |                    |
|--------|--------------------------------|--------------------|--------------------------------|--------------------|
|        | Dairy Cattle Population (head) | Milk Yield (Liter) | Dairy Cattle Population (head) | Milk Yield (Liter) |
| 2009   | 62,038                         | 35,910,000         | 35,451                         | 30,039,838         |
| 2010   | 62,480                         | 42,522,500         | 37,999                         | 34,568,345         |
| 2011   | 87,793                         | 46,260,000         | 36,962                         | 34,761,635         |
| 2012   | 88,533                         | 46,775,509         | 39,017                         | 34,386,871         |
| 2013*) | 61,887                         | 46,906,493         | 22,408                         | 27,530,077         |
| r (%)  | 2.99                           | 7.15               | 8.30                           | 1.35               |

Source: Dinas Peternakan dan Kesehatan Hewan Propinsi Jawa Tengah (2014); \*) Result of farm census statistic 2013

Table 3. Annual LQ Value Parameters for Development of Dairy Cattle in Two Regencies

| Parameters              | LQ Value         |                  | Note     |
|-------------------------|------------------|------------------|----------|
|                         | Boyolali Regency | Semarang Regency |          |
| Dairy Cattle Population | 7.20             | 4.46             | Base     |
| Feed Availability       | 1.12             | 1.26             | Base     |
| Prime grass             | 1.21             | 1.09             | Base     |
| Field grass             | 0.67             | 0.85             | Non-base |
| Rice hay                | 1.26             | 1.94             | Base     |
| Corn hay                | 1.36             | 1.16             | Base     |
| Absorption of labour    | 6.79             | 4.28             | Base     |

Table 4. Characteristics of Dairy Cattle Farmers

| Criteria                                     | Boyolali Regency<br>(n=60) | Semarang Regency<br>(n=60) |
|--|----------------------------|----------------------------|
| Age (years)                                  |                            |                            |
| · 20-30                                      | 5 (8.33%)                  | 3 (5.00%)                  |
| · 31-55                                      | 50 (83.34%)                | 44 (73.30%)                |
| · > 55                                       | 5 (8.33%)                  | 13 (21.70%)                |
| Education (peoples)                          |                            |                            |
| · Elementary school                          | 35 (58.34%)                | 31 (51.70%)                |
| · Junior-high school                         | 4 (6.66%)                  | 15 (25.00%)                |
| · High school                                | 19 (31.66%)                | 10 (16.70%)                |
| · Higher education                           | 2 (3.34%)                  | 4 (6.70%)                  |
| Primary Occupation (peoples)                 |                            |                            |
| · Farmer                                     | 43 (71.66%)                | 24 (40.00%)                |
| · Dairy Farmer                               | 7 (11.66%)                 | 30 (50.00%)                |
| · Seller                                     | 2 (3.34%)                  | 2 (3.30%)                  |
| · Miscellaneous                              | 8 (13.34%)                 | 4 (6.70%)                  |
| Average number of Dairy Cattle Owned (heads) |                            |                            |
| · 1-2  | 33 (55.00%)                | 48 (80.00%)                |
| · 3-4  | 18 (30.00%)                | 10 (16.70%)                |
| · >4   | 9 (15.00%)                 | 2 (3.30%)                  |
| Milk Yield (liters/head/day)                 |                            |                            |
| · 5 - 8                                      | 32 (53.34%)                | 23 (38.30%)                |
| · 9 - 12                                     | 26 (43.33%)                | 19 (31.70%)                |
| · >12  | 2 (3.33%)                  | 18 (30.00%)                |
| Farming Experience (years)                   |                            |                            |
| · 1- 10                                      | 10 (16.67%)                | 16 (26.70%)                |
| · 11- 20                                     | 30 (50.00%)                | 22 (36.70%)                |
| · >20  | 20 (33.33%)                | 22 (36.70%)                |

N = the number of sample

about 1-2 heads (67.5%), 3-4 heads (23.35%) and >4 heads (9.15%). The low number of dairy cattle ownership of the respondents can impact the low milk yield in the ranges of 5-8 liters/day (45.82%), 9-12 liters (37.51%) and >12 liters (16.66%). Many respondents were quite experienced in the dairy cattle business with an average of 11-20 years (43.35%). However, their experience in manage the business cannot guarantee to increase milk yield as expected, and to keep the existing genetic potential as well. According to Lestariningsih *et al.* (2008), the work experience in the field of dairy farming influenced business skills.

**Profile of Local Resources for Development of Dairy Cattle**

Based on the profiles of local resources, most of the resources in the research locations were determined sufficiently to develop dairy cattle (Table 5). This condition can influence the performance of dairy cattle farms, especially to the milk yield and quality. The current average milk yield was 9.76 liters/head/day, which was still far below the target for milk revitalization of 15 liters/head/day. The reasons for low milk product were caused by lack of business management, breeding technology, forage availability, money to buy concentrate, and land for cultivating forages (Yusdja, 2005). Ekou (2014) mentioned that dairy farming could support economy in the potential rural area to provide rural employment and regular income to many resources-poor households. However, milk production is largely still subsistence. Therefore, there is a huge potential to increase dairy production and productivity in Boyolali Regency and Semarang Regency.

**Analysis Local Resources Factors and Milk Yield**

Analysis of local resources factor to improve the milk yield of dairy cattle employing multiple linear regression model, with a dependent variable (Y = milk yield) and independent variables, comprising of  $x_1$  (human resource),  $x_2$  (environmental resource),  $x_3$  (capital resource),  $x_4$  (entrepreneurship resource),  $x_5$  (technology resource) and  $x_6$  (institutional resource) showed that overall independent variables significantly ( $P < 0.01$ ) affected milk yield of dairy cattle. This result showed that improvements of various resource factors must be done in order to improve the milk yield of dairy cattle. The results of multiple linear regression analysis are presented in Table 6.

Based on these results, it is apparent that capital, technology application and institutional resources variables give positive and significant impact toward milk yield. Most of the dairy cattle farmers possessed little capital, few dairy cattle and difficulties in accessing additional capital. This result shows that improvements of various resources factors must be done in order to improve the milk yield of dairy cattle. This result is in line with Nuraeni and Purwanto (2006) research which mentioned that natural resources, human resources and supporting infrastructure influenced the development of dairy cattle in Sinjai Regency. Capital was needed to increase the number of dairy cattle owned, support the operational cost, and purchase the facilities such as: milk can to make better farm. Farming technology and business management, particularly in feeding (concentrate) quality and quantity were still limited. Farmers mostly used low-quality of concentrates (protein content was

Table 5. Local Resources Profiles for Development of Dairy Cattle

| Local Resource Factor | Boyolali Regency | Semarang Regency | Aggregate      |
|-----------------------|------------------|------------------|----------------|
| Human Resource        | 12.9 (medium)    | 15.16 (medium)   | 14.03 (medium) |
| Environment           | 14.8 (medium)    | 15.35 (medium)   | 15.07 (medium) |
| Capital               | 13.6 (medium)    | 14.38 (medium)   | 13.99 (medium) |
| Entrepreneurship      | 14.8 (medium)    | 15.13 (medium)   | 14.96 (medium) |
| Technology            | 13.9 (medium)    | 16.11 (good)     | 15.00 (medium) |
| Institution           | 12.7 (medium)    | 15.11 (medium)   | 13.90 (medium) |
| Infrastructure        | 13.1 (medium)    | 15.16 (medium)   | 14.10 (medium) |

Very poor : 1-5, Poor : 6-10, Medium : 11-15, Good : 16-20 and Very good: 21-25

Table 6. Local Resource Factors Influencing Milk Yield

| Milk Quality Variables         | Regression Coefficient | Significance |
|--------------------------------|------------------------|--------------|
| Constant                       | 7.220                  |              |
| Human resource (x1)            | -0.166                 | 0.157        |
| Environmental resource (x2)    | 0.096                  | 0.482        |
| Capital resource (x3)          | 0.143                  | 0.094*       |
| Entrepreneurship resource (x4) | 0.141                  | 0.169        |
| Technology resource (x5)       | 0.169                  | 0.075*       |
| Institutional resource (x6)    | 0.164                  | 0.051*       |
| F <sub>calculation</sub>       | 9.892                  | 0.00***      |
| R <sup>2</sup>                 | 0.400                  |              |

\*\* highly significant (1%), \*\* significant (5%), significant (10%)

less than 10%) because of cheap and more affordable. The availability of forage was also scarce during dry season and the food technology has not been applied yet. Turinawe *et al.* (2012) research showed that the usage of fiber-enriched feed technology has more significantly positive impact on the profit margin than the use of all-natural feed. Studies by Ngongoni *et al.* (2006) and Ouédraogo *et al.* (2008) confirmed that the adoption of better farm management system can improve dairy cattle production.

Partially for capital factor showed that 1 level increase capital translates into 0.143 of milk yield improvement, whereas 1 level increase in technology translates into 0.169 increase of milk yield. Moreover, that 1 level increase in institutional resources translates into 0.164 increase of milk yield. Human resource factor did not have significant influence and having negative impact toward the increase of milk production, which means that more farmers may not necessarily increase the milk production. Those information is important for “Village Unit Cooperative/KUD”, milk industry, the government, and others to encourage the improvement of dairy cattle business by giving subsidies to the farmers. Institutional factor have contributed positive value, which means that the improvement of institutions, such as marketing institutions, the role of DCFA and milk cooperation can encourage the improvement of dairy cattle farms productivity. This result is in line with what Staal *et al.* (2007) wrote, in that introduction of policies in support of dairy production and access to better technology can

improve the competitiveness of dairy sector, which in turn help to elevate economical condition of dairy farmer households. In addition, the study also stated that these supporting interventions usually lead to more cost-effective, industrial production model, which will further improve milk yield and income of the farmers, provided that these advances are supported with the capability of the dairy farms and their farmers to adapt to the occurring changes in resources factor. The value of determinant coefficient (R<sup>2</sup>) of 0.40 means that the improvement of dairy cattle productivity was influenced by the resources factor as much as 40.0%, and the rest 60.0% was influenced other factors outside the model. The rest factor which not observed in the study was low milk price, which have negative effect on dairy cattle development.

#### Analysis of Local Resources Factors and Milk Quality

Factors which influenced the quality of milk were production-level resources and infrastructure, such as limited milk pool and milk can as well as other production tools. The results of multiple linear regression analysis are presented in Table 7. Based on these results, it is apparent that technology and infrastructure resource variables give positive and significant impact toward milk quality. According to Sudjatmogo (2010), some fundamental issues that need to be overcome are: 1) low population of dairy cattle compared with milk demand in domestic market, 2) in-efficiency of business management of on farm sector, 3) low standard of

Table 7. Local Resources Factors Influencing Milk Quality

| Milk Quality Variables         | Regression Coefficient | Significance |
|--------------------------------|------------------------|--------------|
| Constant                       | 12.594                 |              |
| Human resource (x1)            | -0.408                 | 0.00**       |
| Environmental resource (x2)    | 0.128                  | 0.331        |
| Capital resource (x3)          | 0.023                  | 0.779        |
| Entrepreneurship resource (x4) | -0.052                 | 0.596        |
| Technology resource (x5)       | 0.324                  | 0.002**      |
| Institutional resource (x6)    | 0.010                  | 0.899        |
| Infrastructure resource (x7)   | 0.187                  | 0.032*       |
| F <sub>calculation</sub>       | 6.816                  | 0.001**      |
| R <sup>2</sup>                 | 0.30                   |              |

\*\* Highly significant (1%), \* Significant (5%)

animal health, and 4) low standard the adequacy of animal feed. The value of determinant coefficient ( $R^2$ ) of 0.30 means that the improvement of milk quality was influenced by the resources factor as much as 30.0%, and the rest 70.0% was influenced other factors outside the model. These conditions that caused the production and quality of milk farmers was still low. According to SO'Donnell *et al.* (2011), dairy development was influenced by the amount of milk quota arrangements, land area, the price of milk, the rules established and labor. The results of the analysis are presented in Table 7.

### CONCLUSION

Milk production in Central Java is low, with an average of 5-8 liters/day (45.82%), 9-12 liters (37.51%) and >12 liters (16.66%). Local resources factor has been categorized as sufficient, which cannot contribute enough to encourage both the yield and quality of milk. All of the local resources factors pose significant impact toward the productivity and quality of milk from dairy cattle. The most significant factors to improve the milk yield are the access to additional capital and the application of technology/business management. The most influential factors to improve the quality of milk are human resource, technology and institutional factors, especially the improvement of dairy cattle nutrition and improvement of capital owned by dairy cattle farmer.

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