Smallholder farmers’ perceptions and future aspirations toward dairy farming development in Bandung District, West Java

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Abstract. Dairy farming has an essential role in meeting the ever-increasing demand for milk. However, efforts to develop dairy farming in Indonesia are still facing various obstacles. This paper aims to analyze farmers' perceptions and expectations toward developing dairy farming and its sustainability, along with its constraints. The data used in this paper are part of the IndoDairy Smallholder Household Survey database conducted between July and September 2017, consisting of 300 smallholder dairy farm households randomly selected from KPBS Pangalengan members. The data were analyzed using descriptive statistics and clustering analysis. The results show that the majority of dairy farmers (>50%) rated as ‘good’ the availability of extension services, availability of veterinary services, availability of veterinary medicines, availability of credit, and availability of concentrates; rated as ‘fair’ prices paid by buyers for milk, the number of milk buyers, and quality of the grass and forages; and rated as ‘bad’ the price of concentrates and the availability of land to purchase. In contrast, most farmers perceived the availability of land to purchase and the price of concentrates as ‘bad.’ As much as 90.3% of farmers expected to increase their dairy farm operations. The majority of dairy farmers (94%) showed their willingness to participate in training in the village, especially in animal husbandry (31.2%). This study strongly suggests that the government facilitates an increased supply of quality concentrate feed at affordable prices and land availability for dairy farming development.

1. Introduction
Dairy farming has an important role in meeting the ever-increasing demand for milk due to population growth and awareness of the importance of consuming nutritious food. Currently, domestic milk production can only meet 18% of national consumption, while the remaining 82% is supplied from imports [1]. However, efforts to develop dairy farming in Indonesia are still facing various obstacles. These problems are mainly because dairy farming in Indonesia is mostly managed by smallholder dairy farmers who are not yet business-oriented. This condition causes the milk produced to have low productivity and quality. This makes the government's target to increase milk production by 40% by 2024 seems to be difficult to achieve.

About 90% of dairy farms in Indonesia are small-scale [2]. Smallholder dairy farming has an ownership scale of 1–4 heads and low fresh milk production, 10 liters/head/day [3,4]. Some of the
quality of domestic fresh milk does not meet the SNI Fresh Milk standard (TPC > 1 million CFU/ml, TS < 11.3%) [5]. The low productivity of dairy smallholder farming and the low quality of milk produced are mainly due to technical and management problems [2,4,6]. These problems, among others, include the lack of capital and knowledge/skills of farmers, which include aspects of reproduction, feeding, milking, environmental sanitation, post-harvest management, and disease prevention. These are exaggerated by the high cost of feed, limited land for dairy farming development and forage production, and low income so that dairy farmers are unable to expand their dairy farm business. Studies show a positive relationship between the cooperative service performance (milk marketing, finance, technical assistance, and education/training) with the performance of dairy farms of cooperative members [7].

This paper aims to analyze farmers’ perceptions and expectations toward developing dairy farming and its sustainability, along with its constraints. Since farmers’ behavior and decisions can be affected by their perceptions and attitudes [8], these variables will help understand farm development heterogeneity and show the significance of a subjective approach to opportunity detection in farm development [9]. With this information, policymakers will be able to identify the problems directly and at the same time respond to the future aspirations of smallholder dairy farmers. Therefore, it is expected that they would formulate policies for developing small-scale dairy farming and encourage increased fresh milk production followed by a decent price policy.

2. Materials and methods

2.1. Materials

The data used in this paper are from the IndoDairy Smallholder Household Survey (ISHS) database, which was collected as part of a collaborative research project between the Indonesian Center for Agricultural Socio Economic and Policy Studies (ICASEPS) and the University of Adelaide funded by the Australian Centre for International Agricultural Research (ACIAR). Data were collected from 600 smallholder dairy farm households in Bandung, Garut, Cianjur, and Bogor Districts during July–September 2017 through in-depth interviews using structured questionnaires. In Bandung District, 300 respondent farmers who took part in the survey were chosen randomly from among KPBS Pangalengan dairy farmer members after excluding those who no longer had cows. They are distributed in two subdistricts, i.e., Pangalengan and Kertasari. KPBS Pangalengan has around 5,500 dairy farmer members, spreading in three subdistricts, i.e., Pangalengan, Kertasari, and Pacet, with a total dairy cow population around 13,000 heads, producing around 80 tons of fresh milk per day.

2.2. Methods

The data analysis method used in this study was descriptive statistics and clustering analysis. The descriptive statistic analysis focused on variables that influence households’ dairy farming practices and variables that reflect household aspirations toward dairy farming development in the future, such as dairy farm operations, training needs, and coping with problems and constraints. Descriptive statistics used were percentages to know the size of the concentration in the data group.

\[ \%_i = \frac{n_i}{N_i} \times 100\% \]

Meanwhile, the clustering analysis used was the Ward’s method specifically for analyzing farmers’ perceptions toward variables that influence households’ dairy farming practices. In this analysis, the respondent farmers who answered ‘don’t know’ or ‘no answer’ were excluded. The Ward’s method is an agglomerative clustering method used to obtain groups with the most negligible possible internal variance. This method uses a complete calculation and maximizes homogeneity within one group [10]. It is based on the sum square error (SSE) criterion to measure the homogeneity between two objects based on the minimum number of squares of errors, calculated with the following formula:

\[ SSE = \sum_{i=1}^{n} (x_i - \bar{x})' (x_i - \bar{x}) \]

where \(x_i\) is a column vector containing object value \(i\) and \(\bar{x}\) is the average value of objects in the cluster.


Ward method combines two clusters, A and B, by minimizing the increase in SSE defined as the distance between cluster A and cluster B

\[ I_{AB} = SSE_{AB} - (SSE_A + SSE_B) \]

where \( I_{AB} \) is a distance between cluster A and cluster B.

Cluster analysis was carried out using the STATA application to obtain a dendrogram as a result of Ward’s cluster method.

3. Results and Discussion

3.1. Dairy farmers’ perception toward variables influencing dairy farming

Several aspects considered affecting the development of the smallholder dairy farming in the research location include the availability, quality, and prices of essential inputs and services required for dairy farming. Farmers were asked to rate the following aspects in one of three categories, i.e., ‘good’, ‘fair’, and ‘poor’, based on each farmer’s perceptions. However, some farmers answered ‘do not know’ (or no answer or N/A) when they could not provide an assessment.

Table 1 depicts how farmers rated various aspects related to their dairy farm business at the time of the survey (2017) while excluding the farmers that could not provide an assessment. The majority of dairy farmers (>50%) rated the following aspects as ‘good’: availability of extension services, availability of veterinary services, availability of veterinary medicines, availability of concentrates, and availability of credit. The following aspects were rated as ‘fair’: availability of dairy nutritional information, quality of the grass and forages, and the number of milk buyers. However, most of them rated the availability of land to purchase and the price of concentrates as ‘bad’.

Table 1. Dairy farmers’ perception on current prices and the availability and quality of inputs and services in Bandung District, 2017.

| Code | Variable | Farmers’ perception (%) |
|------|----------|------------------------|
|      |          | Good | Fair | Bad | Total |
| V1   | Availability of land to purchase (n=294) | 11.6 | 33.0 | 55.4 | 100 |
| V2   | Roads in your district (n=300) | 38.0 | 31.7 | 30.3 | 100 |
| V3   | Availability of extension services (n=296) | 61.8 | 29.4 | 8.8 | 100 |
| V4   | Availability of dairy nutritional information (n=280) | 44.6 | 51.1 | 4.3 | 100 |
| V5   | Availability of technologies to improve milk yields (n=278) | 48.9 | 43.2 | 7.9 | 100 |
| V6   | Availability of veterinary services (n=300) | 81.7 | 17.7 | 0.7 | 100 |
| V7   | Availability of veterinary medicines (n=285) | 69.5 | 29.1 | 1.4 | 100 |
| V8   | Availability of concentrates (n=300) | 71.3 | 27.7 | 1.0 | 100 |
| V9   | Price of concentrates (n=299) | 5.4 | 40.5 | 54.2 | 100 |
| V10  | Availability of grass and forages (n=299) | 31.4 | 36.5 | 32.1 | 100 |
| V11  | Quality of the grass and forages (n=299) | 39.1 | 51.2 | 9.7 | 100 |
| V12  | Availability of credit (n=293) | 69.3 | 28.0 | 2.7 | 100 |
| V13  | Availability of marketing information (n=258) | 32.6 | 56.2 | 11.2 | 100 |
| V14  | Number of milk buyers (n=254) | 27.2 | 64.2 | 8.7 | 100 |
| V15  | Prices paid by buyer for milk (n=300) | 32.7 | 49.7 | 17.7 | 100 |

These results are in accordance with those of Ward’s cluster analysis. The dendrogram resulted from Ward’s cluster analysis is presented in Figure 1. Cluster 1 represents a group of variables that get a ‘good’ rating from farmers; cluster 2 represents a group of variables that get a ‘fair’ rating from farmers; while cluster 3 is a group of variables that get a ‘poor’ rating by farmers. The arrangement is as follows: Cluster 1 consists of the availability of extension services, availability of veterinary services, availability of veterinary medicines, availability of concentrates, and availability of credit. Cluster 3 consists of the availability of land to purchase and the price of concentrates. Meanwhile, the other variables belong to cluster 2.
For smallholder dairy farmers, extension services are critical in improving their knowledge and providing reinforcement to farmers to be more positive toward change and acceptance of innovation and be skilled in carrying out their duties [11]. The survey revealed that most farmers (61.8%) perceived that the availability of extension services was ‘good’. Meanwhile, most farmers also rated the availability of veterinary services (81.7%) and veterinary medicines (69.5%) as ‘good’, which was critical in keeping the dairy cows healthy and producing good quality milk. Based on these results, the dairy cooperative has a good concern about these aspects, showing a good sign for further development of dairy farming in the area.

Figure 1. Dendogram of Ward’s cluster analysis.

Access to credit is greatly needed for developing smallholder dairy farming in Indonesia due to limited capital [12]. It is critical since access to credit is one of the key drivers to smallholder dairy farmers’ sustainable innovation performance [13]. Table 1 shows that most dairy farmers (69.3%) in Bandung District also rated the availability of credit aspect as ‘good’. This ‘good’ perception was supported by the fact that KPBS Pangalengan provides credit through Bank Perkreditan Rakyat (BPR) Bandung Kidul, a part of the management of savings and loan funds and capital facilities needed by dairy farmers.

Dairy farming is a land-based business. Therefore, the availability of land is essential for dairy farm expansion. Table 1 shows that the majority of the dairy farmers (55.4%) rated the availability of land to purchase as ‘poor’. Due to limited landholding, most of farmers only managed 2–3 heads of dairy cows and could not expand their farms. They usually sold calves due to limited shed capacity. Some farmer groups managed dairy farms on the idle land that they borrowed from the owners. However, once the owners ask for their land back, the farmers should be ready to return the land and no longer manage it. Therefore, farmers expect the government’s help to legally and temporarily use the idle plantation and forestry lands at affordable costs of renting. Farmers also expect the government to grant them the rights to use the abandoned forestry and plantation lands.

The majority of respondents (71.3%) rated the availability of concentrates as ‘good.’ However, the concentrate price was rated as ‘poor’ by most respondents (54.2%) due to the considerably high price of concentrates. In terms of availability, KPBS Pangalengan provides two types of concentrates: RC Regular and RC Super. RC Super is quality-adjusted to the nutritional needs of lactating cows, so it is expected that it can improve both quantity and quality milk produced. However, the farmers considered its price as high, so some could not afford to provide it adequately according to their needs. They tried to compensate it with grass and forages. However, only 31.4% of them perceived that the availability of grass and forages was ‘good.’ Limited landholding has caused only a few dairy farmers to plant grass on their land. At the same time, the farmers made use of the grass and forages that grow wild on
idled/abandoned land. In some cases, the limited availability of grass/forage for feed can hold the farmers from expanding their farm herd size [14].

3.2. Farmers’ aspirations toward dairy farming development

3.2.1. Dairy farm operations. The respondents were questioned about their plans for the future of their dairy farm operations. As much as 90.3% of farmers expected to increase their dairy farm operations, while other 7.7% planned to have the same dairy farm size (Table 2). Out of the total farmers with the future aspiration to expand their dairy farm operation size, 47.2% expected to have a herd size with about 6–10 heads of cattle, 27.3% with 1–5 heads, 17.7% with 11–20 heads, and so on (Table 3). A 7-10 dairy cows’ business scale is considered ideal for smallholder dairy farmers in Indonesia [5]. However, some studies show that the level of production factor used in dairy farming is constant returns to scale. In this condition, the increase in the dairy farming production scale will provide incentives to dairy farmers if output (milk) prices increase more significantly than production factor prices [15,16]. Therefore, fresh milk price is a key factor for dairy farming development, and since only 32.7% of the farmers rated prices paid by buyers for milk as good (see Table 1), milk price should be of concern to the government. Since its quality determines milk price, efforts to improve milk quality should be the main focus in developing smallholder dairy farming businesses and encouraging various other technical aspects to increase the amount of production.

| Future aspiration      | N | %  |
|------------------------|---|----|
| Remain the same        | 23| 7.7|
| Expand                 | 271| 90.3|
| Quit                   | 2 | 0.7|
| Other                  | 4 | 1.3|
| Total                  | 300| 100.0|

Table 2. Future aspiration of farmers with respect to dairy farm operation size.

| Herd size           | N  | %  |
|---------------------|----|----|
| 1–5 heads           | 74 | 27.3|
| 6–10 heads          | 128| 47.2|
| 11–20 heads         | 48 | 17.7|
| 21–30 heads         | 10 | 3.7 |
| 31–40 heads         | 3  | 1.1 |
| 41–50 heads         | 6  | 2.2 |
| >50 heads           | 2  | 0.7 |
| Total               | 271| 100.0|

Table 3. Future aspiration of farmers with respect to dairy farm herd size.

3.2.2. Training needs. In order to support the farmers with training that would help them achieve their dairy farming ambitions, the farmers were asked if they would be willing to participate in a farmer training day/workshop in the village and to define the areas in which they would like to obtain training to improve dairy production practices. Training, as well as access to information and networking, and access to credit are the key drivers to achieving smallholder dairy farmers’ sustainable innovation performance [13].

The majority of dairy farmers (94%) showed their willingness to participate in a farmer training day/workshop in the village. Farmers feel they must have more expertise and increase their knowledge...
in dairy farming, so they still need training. Moreover, farmers feel that it is preferable if the extension is not only with providing theory but also by practice and comparative studies to more advanced farms. They indicated a strong desire for training to increase their capacity in animal husbandry (31.2%), cattle nutrition and feed management (19.0%), and farm business management (19.8%) (Figure 2).

**Figure 2.** Training requirements and expectations of dairy farmers in Bandung District, 2017.

### 3.3. Constraints faced by farmers

Smallholder dairy farming is often faced with some obstacles/constraints that can threaten the sustainability of the dairy farm business. These constraints, among others, include technical, managerial, product management, and marketing. Failure to address these constraints might lead to farmers not being willing to motivate their next generation to follow their profession as dairy farmers [17]. This condition could worsen because most young farmers believe that working on dairy farms requires time and effort; is difficult, messy, pays poorly; and does not provide future employment opportunities [18].

The farmers were asked about significant constraints to the dairy industry from the dairy farmer's perspective. (Note: farmers were asked to identify up to three constraints). The figures in Figure 3 illustrate the proportion of all constraints identified by farmers in Bandung District.

**Figure 3.** Dairy farmers’ perceptions of significant constraints facing the dairy industry in Bandung District, 2017.
Adequate feed resources (25.3%) were the top constraint identified by dairy farmers. For the farmers, feed must be fulfilled, not only the quantity but also the quality, especially the nutritional content. The fulfillment of feed quality is fulfilled from forages and various other supplementary foods, such as the fulfillment of concentrates and other types of feed, which can directly benefit increased milk production. However, the need for quality feed requires a large amount of money, especially in the fulfillment of concentrates, supplements, and other manufactured feed ingredients. The high price of quality feed is an obstacle for the farmers. They must rearrange how the financing for feed purchases and the entire maintenance process can be carried out to continue their dairy farm business.

Farmers also identified a range of other constraints, including access to high-quality cattle breeds, personal knowledge limitations regarding dairy farming, access to capital, animal health issues, low milk prices, and feed quality issues.

4. Conclusions

The price of concentrates and the availability of land are the most significant constraints faced by the smallholder dairy farmers in the working area of KPBS Pangalengan in Bandung District, which may hinder the development of the dairy farm business in that location. In order to support the dairy farm business development in Pangalengan and Indonesia in general, the government should facilitate the provision of good quality concentrates at more affordable prices.

Dairy farming is a land-based business, and therefore, the availability of land is essential for dairy farm expansion. Due to limited landholding, most dairy farmers could not expand the scale of their farms. Limited landholding has also caused most dairy farmers to get grasses and forages that grow wildly on forest and plantation land. To encourage smallholder dairy farmers to expand their business, the government should facilitate farmers to legally and temporarily use the abandoned plantation and forestry lands at affordable costs of renting. The government may also consider granting farmers living around the forests and plantation area the rights to use or cultivate those abandoned lands to expand their dairy farming business.

The smallholder dairy farmers in the Pangalengan-Bandung District still need guidance and training to improve business management and development orientation. For this reason, there is a need for synergy and coordination among the related institutions. These synergy and coordination are needed, especially in increasing fresh, quality, and sustainable milk production and reasonable prices for farmers. It is hoped that this process will not only be able to meet the needs for high-quality national fresh milk but also improve the welfare of smallholder dairy farmers.

Acknowledgement

This paper is prepared in conjunction with a collaborative research project entitled “Improving milk supply, competitiveness and livelihoods of smallholder dairy chains in Indonesia (IndoDairy)” funded by the Australian Centre for International Agricultural Research (ACIAR) (AGB/2012/099). The authors wish to thank the Indonesian Agency for Agricultural Research and Development (IAARD) and the Indonesian Center for Agricultural Socio Economics and Policy Studies (ICASEPS) of the Ministry of Agriculture, the University of Adelaide, and other collaborating partners, and in particular ACIAR for funding this collaborative research project.

References

[1] Pusdatin 2019 *Buku Outlook Komoditas Peternakan: Susu Sapi* (Jakarta: Pusdatin)
[2] Widyobroto B P 2017 Mayoritas usaha persusuan dikelola secara tradisional *BeritaSatu*
[3] Nurtini S and Muzayyanah M A U 2014 *Profil Peternakan Sapi Perah Rakyat di Indonesia* (Yogyakarta: Gadjah Mada University Press)
[4] Anggraeny C C 2019 *Analisis Strategi Pengembangan Usaha KPBS Pangalengan, Bandung, Jawa Barat* (Bogor: IPB University)
[5] Trobos 2020 *Bukan (Lagi) Bapokting Trobos Livestock 249*
[6] Santosa S, Setiadi A and Wulandari R 2013 Analisis potensi pengembangan usaha peternakan
sapi perah dengan menggunakan paradigma agribisnis di Kecamatan Musuk Kabupaten Boyolali Bul. Peternak. 37 125–35

[7] Asmara A, Purnamadewi Y L and Lubis D 2017 The relationship analysis between service performances of milk producer cooperative with the dairy farm performance of members Media Peternak. 40 143–50

[8] Fruscalso V, Antillón G and Hötzel M 2017 Smallholder family farmers’ perceptions, attitudes and choices regarding husbandry practices that influence performance and welfare of lactating dairy calves Ciência Rural. St. Maria 47 e20170184

[9] Methorst R, Roepb D, Verhees F and Verstegeng J 2017 Differences in farmers’ perception of opportunities for farm development NJAS - Wageningen J. Life Sci. 81 9–18

[10] Rencher C A 2002 Methods of Multivariate Analysis, 2nd ed. (Canada: John Wiley and Sons)

[11] Yunasaf U and Tasripin D S 2011 Peran penyuluh dalam proses pembelajaran peternak sapi perah di KSU Tandangsari Sumedang J. Ilmu Ternak 11 98–103

[12] Widiati R, Prasetyo T, Suranindyah Y, Nurtini S, Supriyadi and Harsanto I 2010 The performance of credit program for smallholder’s dairy cattle development in Indonesia Proc. Int. Sem. Trop. Anim. Prod. Community Empowerment Tropical Anim. Ind. 5 753-8

[13] Chindime S, Kibwika P and Chagunda M 2017 Determinants of sustainable innovation performance by smallholder dairy farmers in Malawi ed P González-Redondo Cogent Food Agric. 3 1379292

[14] Ariningsih E, Saliem H P and Erwidodo 2019 Sales and marketing of fresh milk by smallholder dairy farmers in West Java IOP Conf. Ser.: Earth Environ. Sci. 372 012056

[15] Asmara A, Purnamadewi Y L and Lubis D 2016 Keragaan produksi susu dan efisiensi usaha peternakan sapi perah rakyat di Indonesia J. Manaj. Agribisnis 13 14–25

[16] Hadiana M, Daud A and Utami A 2019 Analisis efisiensi penggunaan faktor-faktor produksi pada peternakan sapi perah (Survei pada peternak sapi perah, Kecamatan Pangalengan Jawa Barat) J. Sos. Bisnis Peternak. 1 11–9

[17] Thirunavukkarasu D, Narmatha N, Doraisamy K A, Saravanakumar V R and Sakhthivel K M 2019 Future prospects of smallholder dairy production: pragmatic evidence from crop-livestock farming systems of an economically transforming state in India Cuad. Desarro. Rural 16

[18] Firman A, Paturochman M, Budimulyati S L, Hadiana M H, Tasripin D, Suwartapradja O S and Munandar M 2019 Succession decisions in Indonesia family dairy farm business Livest. Res. Rural Dev. 31 #136