



Factsheet 13.5: Profitability Comparison - Milk Productivity, Price and Quality

Background

In the previous factsheet, differences between dairy farm labour across the profit quartiles were considered. In this factsheet, the characteristics of the IndoDairy Smallholder Household Survey (ISHS) based on profit quartiles will be further studied, focusing on milk production, price and quality.

Milk productivity

Detailed milk production statistics are presented in Table A1 in the Appendix. The section below summarises characteristics that were and were not different between quartiles.

Significant difference

The following characteristics were significantly different between profit quartiles ($p < 0.05$):

Milk produced per lactation

- Milk produced per lactation was calculated based on a 300-day lactation.
- In the previous factsheets, it was shown that milk production per cow per day was significantly higher in Quartile 4 (Q4) (most profitable) and progressively decreased in the other quartiles. This translated to approximately 1,000 litres difference in a

cow's lactation between Quartile 1 (Q1) and Q4, as shown in Table 1.

Milk produced per labour unit

- Milk production per labour unit is an efficiency measure based on the amount of milk one person can support in a year.
- Farmers in Q1 (least profitable) were producing the least amount of milk per time spent on dairy farming activities, with on average 7,650 litres per person per year.
- Farmers in Q4 (most profitable) were producing significantly more milk (12,000 litres per person per year), approximately 50% more milk than Q1.

Table 1. Milk production per cow.

Quartiles	Litres per day	Litres per lactation
Quartile 1	13.83	4,148
Quartile 2	14.14	4,242
Quartile 3	15.11	4,531
Quartile 4	17.16	5,148

Milk produced per hectare per year

- Milk produced per hectare evaluates the efficiency of production based on the land area used for dairy farming practices.
- There was a significant difference between Q1 and Q4.
- The total land used for dairy farming practices (for grazing cattle or growing fodder crops) was slightly higher in Q1 (0.23 ha). However, these farmers were producing significantly less milk. This translates to approximately 823,000 litres per hectare per year.
- Compared to Q4, who manage less land (0.20 ha) and were producing more milk; they were able to produce 1,692,000 litre per hectare per year, more than double that of Q1.
- This means farmers who were more profitable were using their land more efficiently and producing significantly more milk.

The difference in milk productivity measures was significant across the profit quartiles, with the most profitable farmers using their resources, including their stock, land and time input, more efficiently.

Slight difference

The following characteristics trended towards significance between profit quartiles ($p < 0.10$):

Total farm milk production

- As previously described, total farm milk production per day did not significantly differ between profit quartiles.
- However, Q1 were producing the least amount of milk per day (37.4 litres).
- The difference in milk production between farmers in Q1 and other quartiles was not significant, with farmers in Q3 and Q4 producing 3-4 litres more per day.
- Despite having the largest herd size (7.3), Q1 farmers were producing the smallest amount of milk as total farm unit. This was likely due to these farmers having the lowest production per cow and the smallest proportion of milking cow of the total herd (47.2%), as described in Factsheet 13.1.

No difference

The following characteristics were not significantly different between profit quartiles ($p > 0.10$):

- Seasonal difference in milk production

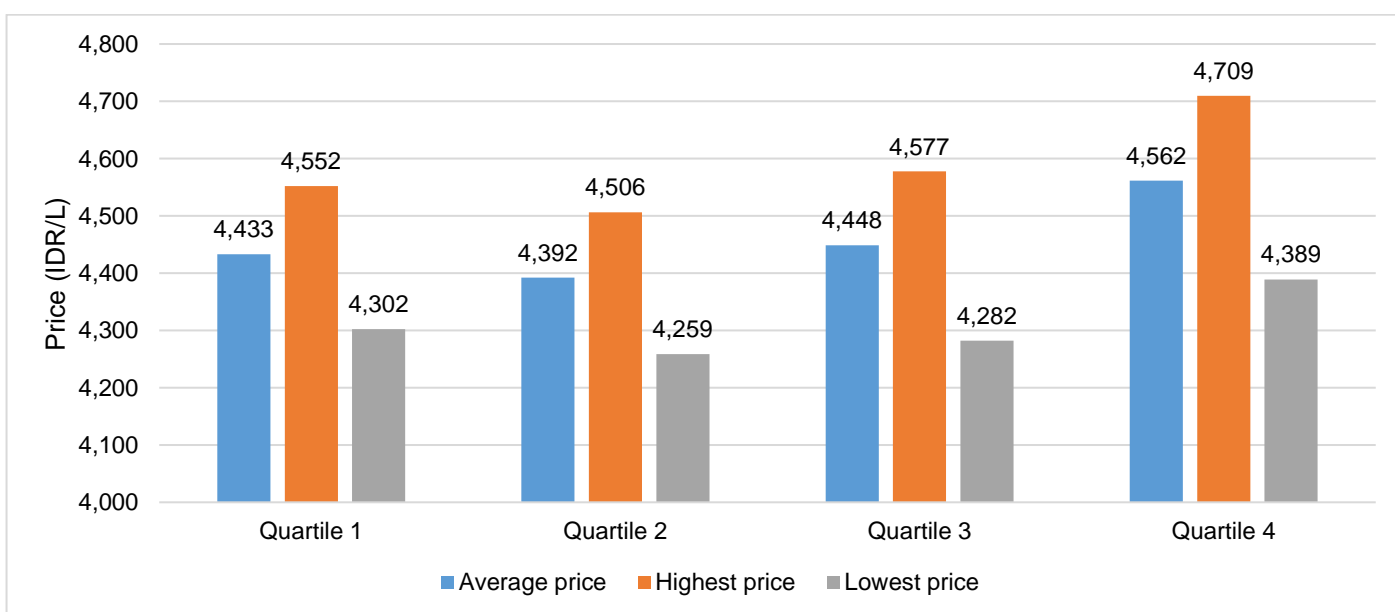


Figure 1. Farm-gate milk price across profit quartiles.

Milk price and agreements with buyers

Detailed milk price statistics and agreements with milk buyers are presented in Table A2 and A3 in the Appendix, respectively. The section below summarises characteristics that were and were not different between quartiles.

Significant difference

The following characteristics were significantly different between profit quartiles ($p < 0.05$):

Milk price

- Farmers were asked what the average, highest and lowest milk price they received per litre of milk.
- Average farm-gate milk price was significantly different between quartiles ($p < 0.05$), with Q4 receiving the highest amount (4,562 IDR or USD 0.32 per litre).
- Between the quartiles, there was a consistent trend for the average, highest and lowest received by farmers (illustrated in Figure 1).
- Q2 (low to medium profits) received lowest milk price, suggesting a significant driver for these farmers' profitability was the price received, compared to farmers in Q1 who were producing the least amount of milk.

Farmers' awareness of milk quality determining price

- While most farmers' reported milk price was determined by quality (87%), the proportion was highest in Q2 (95%), the same farmers who received the lowest price.
- The lowest proportion was reported in Q1 (79%).

No difference

The following characteristics were not significantly different between profit quartiles ($p > 0.10$):

- Form of contract with buyers
- Specific milk quality factors most important for the buyer
- Milk processing on farm

Farmers' knowledge of milk quality factors

Farmers were asked about their knowledge and awareness related to a number of factors related to milk quality, including their understanding of the concept; if they knew the measurement for their farm; and either, what the average is for their farm or why they can't find out the measurement. The responses are summarised in Table A4 in the Appendix.

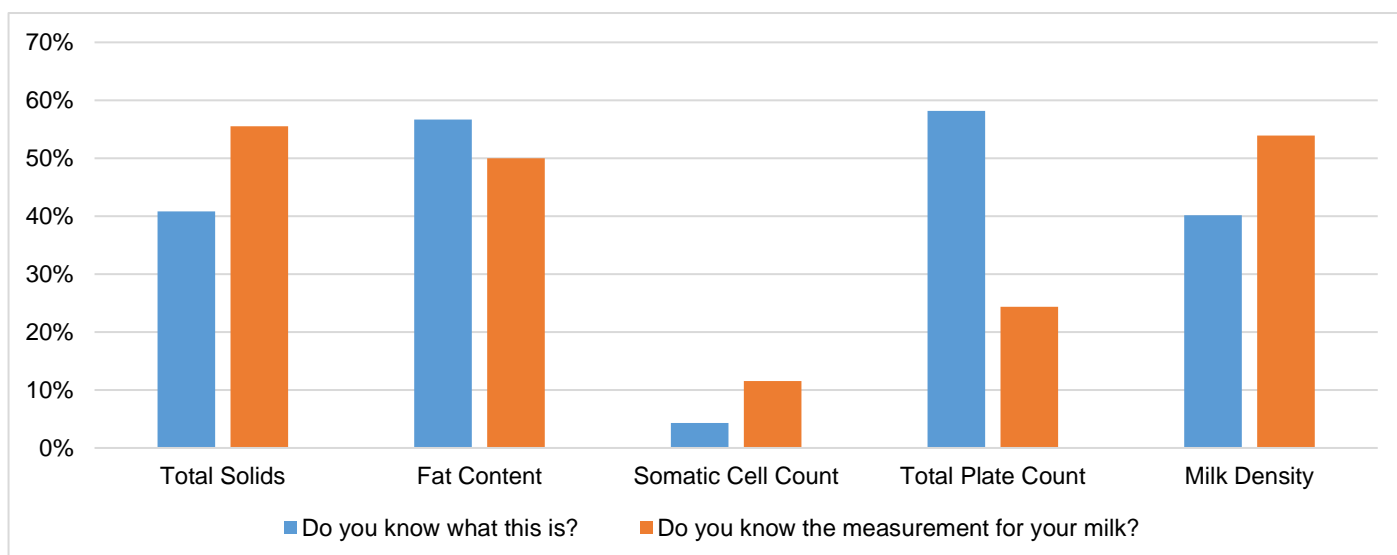


Figure 2. Farmers' knowledge of milk quality parameter.

There was no difference between farmers' knowledge of milk quality parameters across the profit quartiles. However, as described in a previous factsheet, **knowledge of milk quality factors was generally low.**

- Figure 2 summarises the proportion of farmers who knew the measurement of quality parameters for their farm based on those who understand what the concept is.
- **Less than 50% of farmers understood what total solids, milk density and somatic cell counts were conceptually.**
- Fat content and total plate counts (TPC, a measure of bacterial contamination) was understood by more farmers (57% and 58%, respectively). However, only a smaller fraction of these farmers knew the measurement for the milk they produced.

Summary

This factsheet summarises significant differences across profit quartiles regarding milk productivity, price and quality from the IndoDairy Smallholder Household Survey (ISHS).

- **The results show that farmers production per cow per day was significantly higher in Q4 and progressively decreased in the other quartiles. This translates to more than 1,000 litres difference in a cow's lactation between Q1 and Q4.**
- **Farmers in Q1 were producing the least amount of milk (7,650 litres per person per year), while farmers in Q4 were producing significantly more milk (12,000 litres per person per year), approximately 50% more milk than Q1.**
- **Farmers in Q4 were able to produce more milk while managing less land than farmers in Q1, which reflects efficient management of resources on account of Q4 farmers.**
- **Farmers in Q4 were also receiving the highest farm gate price for milk across the four profit quartiles.**

- **There was no significant difference between farmers' knowledge of milk quality parameters across the profit quartiles.**

The following factsheet, Factsheet 13.6, discusses comparison of technology adoption on dairy farms across the profit quartiles.

Appendix to Factsheet 13.5

This appendix provides summary statistics for milk productivity, price and quality by profit quartiles. Standard deviations (SD) are included where relevant.

Statistical significance between quartiles were determined using ANOVA (for binary and continuous variables) and Pearson's Chi-squared test (for categorical variables). For categorical variables with small observations ($n < 5$), Fisher's exact test was used to confirm the Chi-squared test. ANOVA and Chi-squared tests results are shown in the right-hand column, under the Total. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant ($p < 0.10$). Quartiles with the same letter are not significantly different at the 5% level ($p > 0.05$).

Table A1. Milk production statistics by profit quartile (n = 600).

Variable	Quartile 1			Quartile 2			Quartile 3			Quartile 4			Total		
	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³
Milk Production:															
<i>Total farm (L/day)</i>	37.47	39.46		37.86	33.64		41.20	40.38		39.58	25.77		39.02	35.24	
<i>Per cow (L/cow/day)</i>	13.83	4.58	a	14.14	4.38	a	15.11	4.31		17.16	4.35		14.89	4.57	***
<i>Per lactation (1000L/cow/lactation)</i>	4.14	1.37	a	4.24	1.31	a	4.53	1.29		5.14	1.30		4.46	1.37	***
<i>Per labour unit (1000L/person/year)</i>	7.65	4.45	a	9.01	5.15	ab	10.12	6.63	b	12.07	5.55		9.71	5.72	***
<i>Per land area (100,000L/ha/year) (n = 534)</i>	8.23	16.42	a	11.28	18.3	ab	12.00	23.24	ab	16.92	30.56	b	12.08	22.90	**
Difference in daily milk production between seasons? (n=596)	72.3%			78.5%			76.0%			75.8%			75.7%		
Seasonal milk production (n = 451):															
<i>Dry season (L/day)</i>	37.50	36.62		35.23	30.09		38.98	37.49		39.06	24.59		37.67	32.48	
<i>Wet season (L/day)</i>	41.61	40.17		38.82	33.68		41.59	36.45		42.14	26.29		41.02	34.35	

¹Value is either percentage or mean; ²SD = Standard Deviation; ³Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Quartiles with the same letter are not significantly different at the 5% level (p > 0.05).

Table A2. Milk prices by profit quartile (n = 600).

Variable	Quartile 1			Quartile 2			Quartile 3			Quartile 4			Total		
	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³
Milk Prices (IDR/L):															
<i>Average</i>	4,433.07	268.94	a	4,392.48	259.97	a	4,448.43	277.82	ab	4,561.66	617.67	b	4,458.74	390.44	***
<i>Highest</i>	4,551.96	273.76	a	4,506.35	280.38	a	4,577.49	297.00	ab	4,709.39	856.70	b	4,586.09	497.57	***
<i>Lowest</i>	4,302.38	322.88	ab	4,258.77	284.57	a	4,282.21	353.79	ab	4,389.09	591.23	b	4,307.98	407.77	***
Milk Prices (USD cents/L): ⁴															
<i>Average</i>	30.65	1.86	a	30.40	1.79	a	30.76	1.92	ab	31.55	4.27	b	30.83	2.70	***
<i>Highest</i>	31.50	1.89	a	31.16	1.93	a	31.65	2.05	ab	32.57	5.92	b	31.71	3.44	***
<i>Lowest</i>	29.75	2.23	ab	29.45	1.96	a	29.61	2.45	ab	30.35	4.09	b	29.79	2.82	***

¹Value is mean; ²SD = Standard Deviation; ³Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. ⁴Exchange rate 1 USD = 14,459.50 Indonesian Rupiah on 27 July 2018 Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Quartiles with the same letter are not significantly different at the 5% level (p > 0.05).

Table A3. Arrangements between farmers and milk buyers by profit quartile (n = 600).

Variable	Quartile 1		Quartile 2		Quartile 3		Quartile 4		Total	
	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²
Form of contract with buyers (n = 599)										
None	84.7%		80.0%		78.0%		78.5%		80.3%	
Written Contract	4.7%		6.0%		7.3%		5.4%		5.8%	
Verbal Contract	10.7%		14.0%		14.7%		16.1%		13.9%	
How is the milk delivered? (n = 600)										
Delivered to end-buyer location	2.0%		1.3%		3.3%		2.0%		2.2%	
Delivered to co-operative/milk collection point	93.3%		88.0%		92.0%		89.3%		90.7%	
Picked up by cooperative	4.7%		10.0%		4.7%		6.7%		6.5%	
Picked up by the buyer	0.0%		0.7%		0.0%		2.0%		0.7%	
Milk processing on-farm (n = 600)										
Filtering	99.3%		98.7%		97.3%		98.0%		98.3%	
Filtering <u>and</u> cool down	0.0%		0.0%		0.0%		0.7%		0.2%	
None	0.7%		1.3%		2.7%		1.3%		1.5%	
Milk priced determined milk quality (n=591)	79.1%	a	94.6%	c	91.8%	bc	83.0%	ab	87.1%	***
Most important quality factors for the buyer (n = 515)										
Total solids (TS)	29.1%		34.0%		28.9%		32.0%		31.1%	
Total plate count (TPC)	43.6%		41.1%		34.8%		36.9%		39.0%	
Fat content	35.9%		44.7%		36.3%		43.4%		40.2%	
Protein content	2.6%		4.3%		2.2%		0.0%		2.3%	
Milk density	17.1%		23.4%		23.7%		27.0%		22.9%	
Absence of adulterants	37.6%		27.7%		32.6%		29.5%		31.7%	
Body condition	11.1%		9.2%		11.1%		9.0%		10.1%	
Genetic quality	0.0%		0.7%		0.0%		0.0%		0.2%	
Liquid content of milk / watery	12.0%		10.6%		12.6%		14.8%		12.4%	
Other	9.4%		9.9%		12.6%		9.0%		10.3%	

¹Value is percentage. ²Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Quartiles with the same letter are not significantly different at the 5% level (p > 0.05).

Table A4. Farmer knowledge about factors that influence milk quality (n = 600).

Variable	Quartile 1			Quartile 2			Quartile 3			Quartile 4			Total		
	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³
Total solids (TS)															
Do you know what this is?	45.3%			44.7%			33.3%			40.0%			40.8%		
Do you know the measurement for you milk? (n = 245)	55.9%			56.7%			56.0%			53.3%			55.5%		
What is the measurement (%) (n = 136)	11.99	0.65	a	11.53	1.55	a	11.52	0.91	a	12.05	0.76	a	11.78	1.06	*
Why don't you know the measurement (n = 109)															
<i>I cannot measure it</i>	23.3%			34.5%			27.3%			35.7%			30.3%		
<i>I have not been told what the measurement is</i>	73.3%			62.1%			72.7%			64.3%			67.9%		
<i>Not measured by cooperative</i>	3.3%			3.5%			0.0%			0.0%			1.8%		
Fat content															
Do you know what this is?	58.7%			59.3%			50.7%			58.0%			56.7%		
Do you know the measurement for you milk? (n = 340)	56.8%		a	40.4%		a	57.9%		a	46.0%		a	50.0%		*
What is the measurement (%) (n = 170)	4.41	2.08		4.65	2.13		4.69	3.23		3.79	0.97		4.39	2.28	
Why don't you know the measurement (n = 170)															
<i>I cannot measure it</i>	31.6%			20.8%			28.1%			34.0%			28.2%		
<i>I have not been told what the measurement is</i>	65.8%			77.4%			71.9%			66.0%			70.6%		
<i>Not measured by cooperative</i>	2.6%			1.9%			0.0%			0.0%			1.2%		
Somatic Cell Count (SCC)															
Do you know what this is?	3.3%			5.3%			3.3%			5.3%			4.3%		
Do you know the measurement for you milk? (n = 26)	20.0%			0.0%			20.0%			12.5%			11.5%		
What is the measurement (cells/mL) (n = 3)	520.00	.		.	.		3.00	.		12.00	.		178.33	295.93	
Why don't you know the measurement (n = 23)															
<i>I cannot measure it</i>	0.0%			25.0%			0.0%			14.3%			13.0%		
<i>I have not been told what the measurement is</i>	100.0%			75.0%			100.0%			85.7%			87.0%		
<i>Not measured by cooperative</i>	0.0%			0.0%			0.0%			0.0%			0.0%		
Total plate count (TPC)															
Do you know what this is?	60.0%			62.7%			52.0%			58.0%			58.2%		
Do you know the measurement for you milk? (n = 349)	21.1%			28.7%			23.1%			24.1%			24.4%		
What is the measurement (million cfu/ml) (n = 85)	1.31	2.27		0.88	1.72		1.00	1.14		1.10	1.24		1.06	1.63	
Why don't you know the measurement (n = 264)															
<i>I cannot measure it</i>	19.7%			22.4%			28.3%			34.9%			26.1%		
<i>I have not been told what the measurement is</i>	77.5%			76.1%			68.3%			62.1%			71.2%		
<i>Not measured by cooperative</i>	2.8%			1.5%			3.3%			3.0%			2.7%		

Variable	Quartile 1			Quartile 2			Quartile 3			Quartile 4			Total		
	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³	Value ¹	SD ²	Sig ³
Milk density															
Do you know what this is?	42.0%			42.7%			36.7%			39.3%			40.2%		
Do you know the measurement for you milk? (n = 241)	54.0%			48.4%			65.5%			49.2%			53.9%		
What is the measurement (kg/L) (n = 130)	1.02	0.00		1.02	0.00		1.02	0.00		1.03	0.01		1.02	0.00	
Why don't you know the measurement (n = 111)															
<i>I cannot measure it</i>	20.7%			15.2%			15.8%			26.7%			19.8%		
<i>I have not been told what the measurement is</i>	75.9%			78.8%			84.2%			73.3%			77.5%		
<i>Not measured by cooperative</i>	3.5%			6.1%			0.0%			0.0%			2.7%		

Note: Farmers were asked their knowledge and awareness related to a number of factors related to milk quality, including their understanding of the concept; if they know the measurement for their farm; and either, what the average is for their farm or why they cannot find out the measurement. ¹Value is either percentage or mean. ²SD = Standard Deviation. ³Sig = Significance; * p < 0.1, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively.