THE UNIVERSITY of ADELAIDE
The Centre for Global Food and Resources

The IndoDairy Smallholder Household Survey
From Farm-to-Fact

Factsheet 13.6: Profitability Comparison - Technology Adoption

Background

In the previous factsheet, milk production, price and quality were considered. In this factsheet, the characteristics of the IndoDairy Smallholder Household Survey (ISHS) based on profit quartiles will be further studied, focusing on what technologies are used by dairy farmers in West Java.

The dairy farmers were asked a series of questions to understand the level of adoption of dairy farming technologies on farm. Dairy farmers were first asked if they had ever heard or were aware of certain technologies. If they answered yes to this, they were then asked if they had ever used that technology. If they answered yes, they were further asked when they first used it and if they are still currently using it on farm.

The overall results of the ISHS data for these questions based on the districts is shown in Factsheet 9. The results provide an overall comprehensive overview of the technology adoption aspects of dairy farmers in West Java. Moreover, they give insights into technologies with low awareness, technologies with low adoption, technologies with disadoption and technologies with continued adoption.

Technologies with low awareness

Overall, the level of awareness of technologies across the profit quartiles was consistent with little significant differences. The detailed results are shown in Table A1 in the Appendix

Figure 1 shows the level of awareness about different technologies across the profit quartiles.

Significant difference

There were significant differences across profit quartiles in the awareness of the following technologies ($p < 0.05$):

Conserving forages for the dry season (hay, silage):

- More farmers in Quartile 1 (Q1) (63%) were aware about conserving forages for the dry season than Quartile 3 (Q3) (51%) and Quartile 4 (Q4) (53%) farmers.

Cooling milk in water tanks:

There was little difference between Q1 (62%) and Q4 (63%) in the awareness of cooling milk in water tanks; however, there was significantly low awareness amongst farmers in Q2 (52%) and Q3 (50%).

Australian Government Australian Centre for International Agricultural Research
Dairy Australia
Ministry of Agriculture Indonesia
IPB University Bogor Indonesia
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Milk pasteurization:

- Fewer farmers in Q4 (29%) were aware about milk pasteurisation compared to farmers in Q1 (35%).

Slight difference

There were slight differences across profit quartiles in the awareness of the following technologies ($p < 0.10$):

Nutrient feed blocks:

- The overall awareness of nutrient feed blocks was low with only 14% of farmers aware of what nutrient feed blocks are.
- Only 8% of farmers in Q4 (most profitable) were aware about nutrient feed blocks compared to 15.3% in Q1 (least profitable).

Breeding plan applied:

- There was little difference between Q1 (49%) and Q4 (51%) when it came to awareness of breeding plans; however, there was significantly low awareness amongst farmers in Q2 (38%) and Q3 (43%).

No difference

Awareness of following technologies showed no significant difference between profit quartiles ($p > 0.10$):

- Mastitis test
- High protein concentrates (16% or higher)
- Feed legume forages
- Use of high-quality grasses
- Growing animal feed crops
- Use of fertilisers
- Rubber/plastic floor for barn cage
- Teat dipping after milking
- Improving drinking water availability
- Record keeping
- Using detergents for milking equipment
- Improving milk hygiene to reduce TPC
- Automatic milking machines
- Stainless steel milking equipment
- Biogas units
- Milk processing
- Milk quality test – TPC/SCC
- UHT (Ultra High temperature)
- Synchronization oestrus
- Manure processing/manure re-use

Technologies with low adoption

The dairy farmers were asked, of the technologies that they were aware of, had they ever adopted any of them on the farm.

The results are shown in Table A2 in the Appendix and Figure 2.

Significant difference

There were significant differences across profit quartiles in the adoption of following technologies ($p < 0.05$):

Mastitis test:

- Overall, only half of the farmers (50%) surveyed had ever used a mastitis test.
- Only 34% of farmers in Q4 had done the mastitis test on their cattle compared to 58% in Q1.
- 60% of farmers in Q3 had used the mastitis test.

Biogas units:

- Overall, 28% of farmers had used biogas units on their farms.
- The number of farmers in Q1 (36%) that had used biogas units was more than the number of farmers in Q3 (19%) and Q4 (27%).

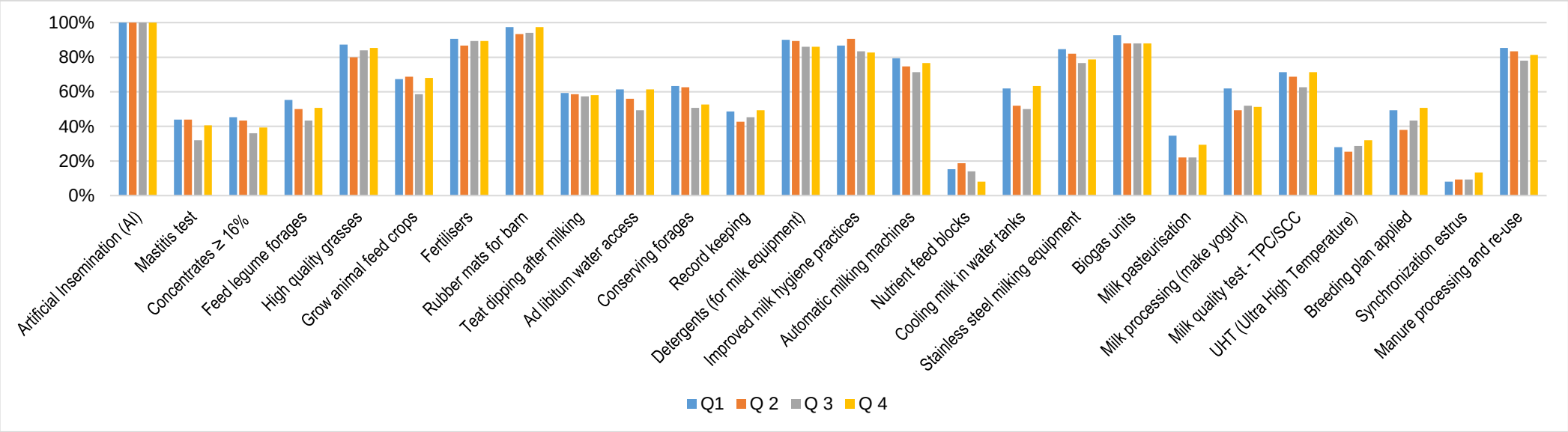

Figure 1. Comparison of technology awareness by profit quartiles.

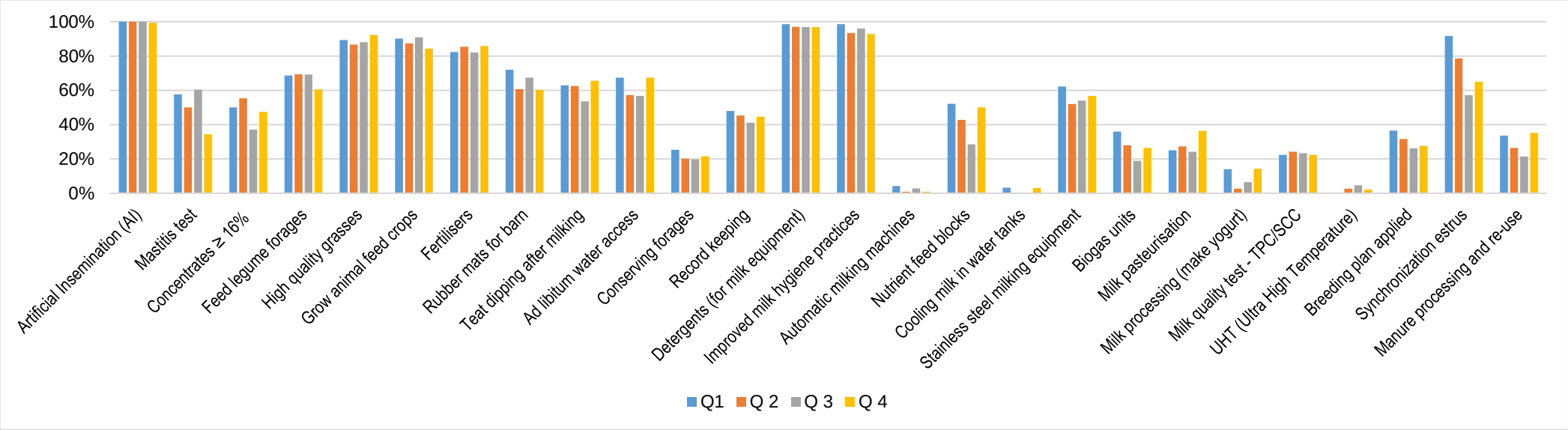

Figure 2. Comparison of technologies that have ever been used by dairy farmers by profit quartiles.

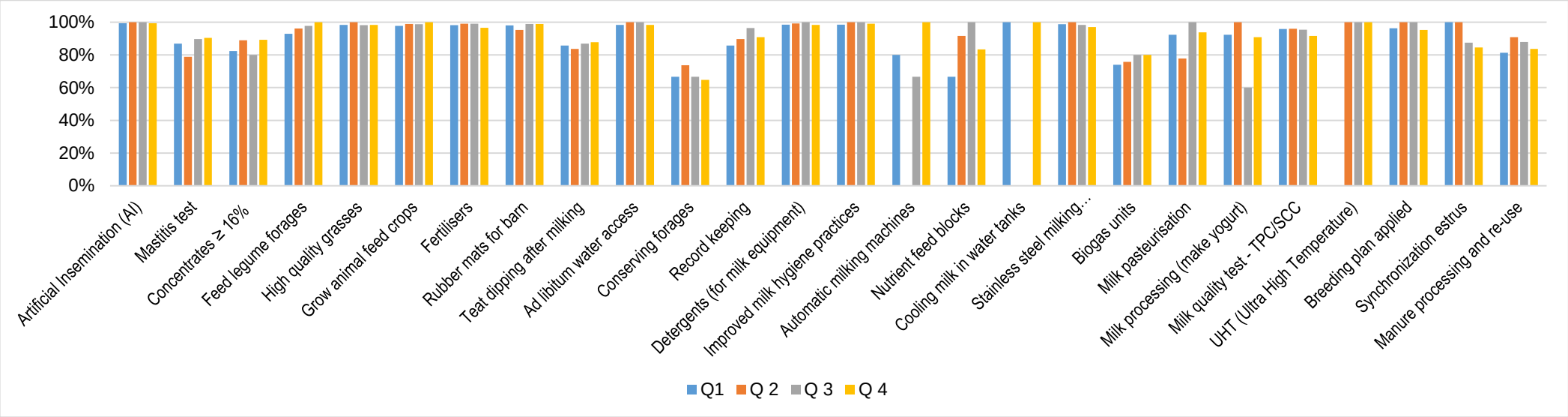

Figure 3. Comparison of technologies used since 2014 by profit quartiles.

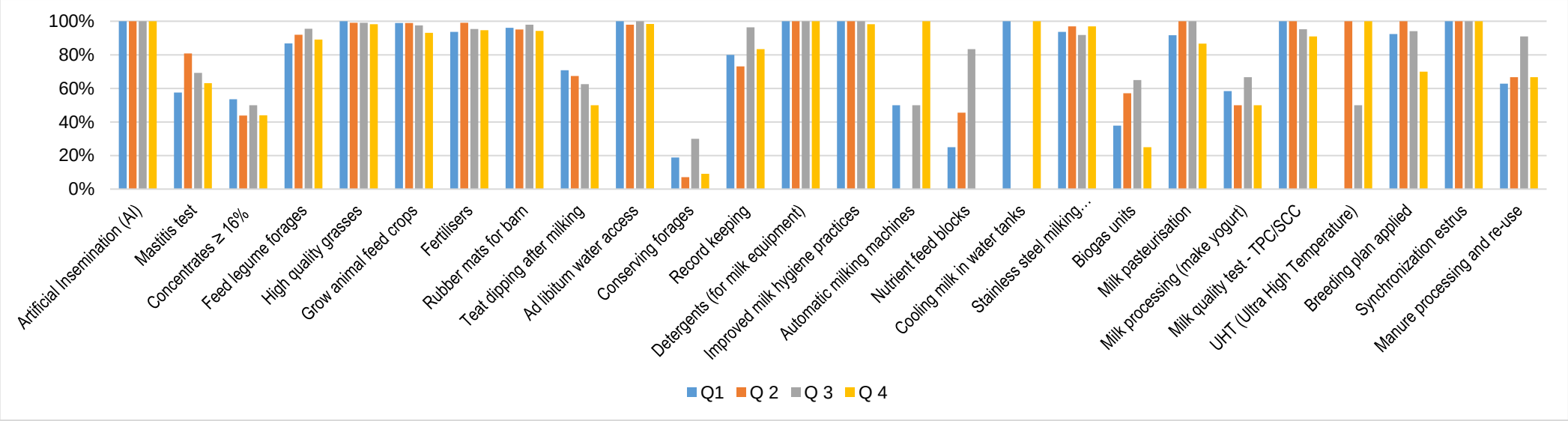

Figure 4. Comparison of technologies currently used on farm by profit quartiles.

Milk processing:

- Only a few farmers (10%) had been involved in milk processing across the four quartiles.
- Out of these, the number of farmers involved in milk processing was similar in Q1 and Q4 (14%), while considerably lower in Q3 (6%) and Q2 (3%).

Slight difference

There were slight differences across profit quartiles in the adoption of the following technology ($p < 0.10$):

Manure processing

- Number of farmers that had ever used manure processing was lower in Q2 (26%) and Q3 (21%) compared to Q1 (34%) and Q4 (35%).

No difference

Adoption of following technologies showed no significant difference between profit quartiles ($p > 0.10$):

- Mastitis test
- High protein concentrates (16% or higher)
- Feed legume forages
- Use of high-quality grasses
- Growing animal feed crops
- Use of fertilisers
- Rubber/plastic floor for barn cage
- Teat dipping after milking
- Improving drinking water availability
- Conserving forages for the dry season
- Record keeping
- Using detergents for milking equipment
- Improving milk hygiene to reduce TPC
- Automatic milking machines
- Nutrient feed blocks
- Cooling milk in water tanks
- Stainless steel milking equipment
- Biogas units
- Milk processing
- Milk quality test – TPC/SCC
- UHT (Ultra High temperature)
- Breeding plan applied
- Synchronization estrus

Technologies with disadoption

For the farmers who answered that they were aware of certain technologies and had adopted them on their farm in the past, they were asked if they had ever used these technologies since 2014 in order to identify technologies that farmers had stopped adopting or had disadopted. The results are shown in Table A3 in the Appendix.

The different technologies farmers have used since 2014 across the four profit quartiles are shown in Figure 3.

There were no significant differences across the four profit quartiles in terms of technologies with disadoption since 2014.

Technologies with continued adoption

Lastly, farmers were asked if they were still continuing to use or adopt the technologies at the time of the survey. This question was asked to the farmers only if they reported to be aware of these technologies, had ever used them and had not disadopted them since 2014.

The results are shown in Table A4 in the Appendix and Figure 4.

Significant difference

There were significant differences across profit quartiles in the continued adoption of following technologies ($p < 0.05$):

Nutrient feed blocks

- It is interesting to note that from 50% of farmers in Q4 who had ever used nutrient feed blocks, not a single farmer had reported to having this technology currently in use at the time of the survey.

Biogas units

- The number of farmers using biogas units currently in Q4 (25%) was the lowest amongst the quartiles, while farmers in Q3 (65%) and Q2 (57%) had significantly more farmers who reported that they are currently using this technology.

Breeding plan applied

- 70% of farmers in Q4 were currently using breeding plans while significantly a greater number of farmers in Q1 (92%), Q2 (100%) and Q3 (94%) were currently using this technology.

Slight difference

There were slight differences across profit quartiles in the continued adoption of following technologies ($p < 0.10$):

Growing animal feed crops

- Slightly fewer farmers in Q4 (93%) were growing animal feed crops at the time of the survey compared to farmers in Q1 (99%), Q2 (99%) and Q3 (98%).

Improved milking hygiene to reduce TPC

- While 100% of farmers in Q1, Q2 and Q3 agreed to improving milking hygiene to reduce TPC, 98% of farmers in Q4 agreed to the same at the time of the survey.

No difference

Use of following technologies at the time of the survey, showed no significant difference between profit quartiles ($p > 0.10$):

- Mastitis test
- High protein concentrates (16% or higher)
- Feed legume forages
- Use of high-quality grasses
- Growing animal feed crops
- Use of fertilisers
- Rubber/plastic floor for barn cage
- Teat dipping after milking
- Improving drinking water availability
- Conserving forages for the dry season
- Record keeping
- Using detergents for milking equipment
- Automatic milking machines
- Cooling milk in water tanks
- Stainless steel milking equipment
- Milk processing
- Milk quality test – TPC/SCC
- UHT (Ultra High temperature)
- Synchronization oestrus
- Manure processing/manure re-use

Summary

- **Majority of the farmers were aware of technologies like artificial insemination, rubber/plastic floor for barn cage, biogas units, and use of detergents for milking equipment.**
- **On the other hand, a fewer number of farmers had heard about or were aware of technologies like synchronization of estrus, nutrient feed blocks, milk pasteurisation and UHT (Ultra High Temperature).**
- **More farmers in Q1 were aware about practices like conserving forages for the dry season and nutrient feed blocks compared to farmers in Q4.**
- **With regards to awareness of majority of technologies or practices, there was no significant difference across profit quartiles.**
- **Only half of the overall surveyed farmers had used Mastitis test. Of these, the share of farmers who had used it was higher in Q1 than in Q4.**
- **Results showed no significant differences across the profit quartiles on disadoption of technologies since 2014.**
- **For technologies and practices with continued adoption at the time of the survey, there were not many significant**

differences, except the share of farmers using biogas units was lowest in Q4 compared to farmers in Q3 and Q2, and more farmers from Q1, Q2 and Q3 were using breeding plans than farmers in Q4.

The following factsheet, Factsheet 13.7, discusses farmers' attitudes, perceptions, expectations and future aspirations across the four profit quartiles.

Appendix to Factsheet 13.6

This appendix provides summary statistics related to technology adoption by profit quartile. 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. Comparison of technologies by level of awareness in dairy farmers by profit quartiles (n=600).

Variables	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]
Have you heard about the technology? (n=600)										
Artificial Insemination (AI)	100.0%		100.0%		100.0%		100.0%		100.0%	
Mastitis test	44.0%		44.0%		32.0%		40.7%		40.2%	
High protein concentrates (16% or higher)	45.3%		43.3%		36.0%		39.3%		41.0%	
Feed legume forages (e.g. Leucaena)	55.3%		50.0%		43.3%		50.7%		49.8%	
Use of high-quality grasses	87.3%		80.0%		84.0%		85.3%		84.2%	
Grow animal feed crops	67.3%		68.7%		58.7%		68.0%		65.7%	
Use of any fertilisers for the grass	90.7%		86.7%		89.3%		89.3%		89.0%	
Rubber/Plastic floor for the barn/cage	97.3%		93.3%		94.0%		97.3%		95.5%	
Teat dipping after milking	59.3%		58.7%		57.3%		58.0%		58.3%	
Improving drinking water availability 24/7	61.3%		56.0%		49.3%		61.3%		57.0%	
Conserving forages for the dry seasons (hay, silage)	63.3%	a	62.7%	a	50.7%	a	52.7%	a	57.3%	**
Record keeping	48.7%		42.7%		45.3%		49.3%		46.5%	
Using detergents for milking equipment	90.0%		89.3%		86.0%		86.0%		87.8%	
Improved milking hygiene to reduce TPC	86.7%		90.7%		83.3%		82.7%		85.8%	
Automatic milking machines	79.3%		74.7%		71.3%		76.7%		75.5%	
Nutrient feed blocks	15.3%	ab	18.7%	b	14.0%	ab	8.0%	a	14.0%	*
Cooling milk in water tanks	62.0%	a	52.0%	a	50.0%	a	63.3%	a	56.8%	**
Stainless steel milking equipment	84.7%		82.0%		76.7%		78.7%		80.5%	
Biogas units	92.7%		88.0%		88.0%		88.0%		89.2%	
Milk pasteurisation	34.7%	a	22.0%	a	22.0%	a	29.3%	a	27.0%	**
Milk processing (make yogurt)	62.0%		49.3%		52.0%		51.3%		53.7%	
Milk quality test - TPC/SCC	71.3%		68.7%		62.7%		71.3%		68.5%	
UHT (Ultra High Temperature)	28.0%		25.3%		28.7%		32.0%		28.5%	
Breeding plan applied	49.3%	a	38.0%	a	43.3%	a	50.7%	a	45.3%	*
Synchronization Oestrus	8.0%		9.3%		9.3%		13.3%		10.0%	
Manure processing / manure re-use	85.3%		83.3%		78.0%		81.3%		82.0%	

[1]Value is a percentage; [2]Sig = 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. Comparison of technologies have been adopted by dairy farmers by profit quartiles.

Variables	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]
Have you ever used the technology?										
Artificial Insemination (AI) (n=600)	100.0%		100.0%		100.0%		99.3%		99.8%	
Mastitis test (n=241)	57.6%	b	50.0%	ab	60.4%	b	34.4%	a	50.2%	**
High protein concentrates (16% or higher) (n=246)	50.0%		55.4%		37.0%		47.5%		48.0%	
Feed legume forages (e.g. Leucaena) (n=299)	68.7%		69.3%		69.2%		60.5%		66.9%	
Use of high-quality grasses (n=505)	89.3%		86.7%		88.1%		92.2%		89.1%	
Grow animal feed crops (n=394)	90.1%		87.4%		90.9%		84.3%		88.1%	
Use of any fertilisers for the grass (n=534)	82.4%		85.4%		82.1%		85.8%		83.9%	
Rubber/Plastic floor for the barn/cage (n=573)	71.9%		60.7%		67.4%		60.3%		65.1%	
Teat dipping after milking (n=350)	62.9%		62.5%		53.5%		65.5%		61.1%	
Improving drinking water availability 24/7 (n=342)	67.4%		57.1%		56.8%		67.4%		62.6%	
Conserving forages for the dry seasons (hay, silage) (n=344)	25.3%		20.2%		19.7%		21.5%		21.8%	
Record keeping (n=279)	47.9%		45.3%		41.2%		44.6%		44.8%	
Using detergents for milking equipment (n=527)	98.5%		97.0%		96.9%		96.9%		97.3%	
Improved milking hygiene to reduce TPC (n=515)	98.5%		93.4%		96.0%		92.7%		95.1%	
Automatic milking machines (n=453)	4.2%		0.9%		2.8%		0.9%		2.2%	
Nutrient feed blocks (n=84)	52.2%		42.9%		28.6%		50.0%		42.9%	
Cooling milk in water tanks (n=341)	3.2%		0.0%		0.0%		3.2%		1.8%	
Stainless steel milking equipment (n=483)	62.2%		52.0%		53.9%		56.8%		56.3%	
Biogas units (n=535)	36.0%	b	28.0%	ab	18.9%	a	26.5%	ab	27.5%	**
Milk pasteurisation (n=162)	25.0%		27.3%		24.2%		36.4%		28.4%	
Milk processing (make yogurt) (n=322)	14.0%	a	2.7%	a	6.4%	a	14.3%	a	9.6%	**
Milk quality test - TPC/SCC (n=411)	22.4%		24.3%		23.4%		22.4%		23.1%	
UHT (Ultra High Temperature) (n=171)	0.0%		2.6%		4.7%		2.1%		2.3%	
Breeding plan applied (n=272)	36.5%		31.6%		26.2%		27.6%		30.5%	
Synchronization oestrus (n=60)	91.7%		78.6%		57.1%		65.0%		71.7%	
Manure processing / manure re-use (n=492)	33.6%	a	26.4%	a	21.4%	a	35.2%	a	29.3%	*

[1]Value is a percentage; [2]Sig = 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 A3. Comparison of technology disadoption since 2014 by dairy farmers by profit quartiles.

Variables	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]
Have you used this technology since 2014?										
Artificial Insemination (AI) (n=599)	99.3%		100.0%		100.0%		99.3%		99.7%	
Mastitis test (n=121)	86.8%		78.8%		89.7%		90.5%		86.0%	
High protein concentrates (16% or higher) (n=118)	82.4%		88.9%		80.0%		89.3%		85.6%	
Feed legume forages (e.g. Leucaena) (n=200)	93.0%		96.2%		97.8%		100.0%		96.5%	
Use of high-quality grasses (n=450)	98.3%		100.0%		98.2%		98.3%		98.7%	
Grow animal feed crops (n=347)	97.8%		98.9%		98.8%		100.0%		98.8%	
Use of any fertilisers for the grass (n=448)	98.2%		99.1%		99.1%		96.5%		98.2%	
Rubber/Plastic floor for the barn/cage (n=373)	98.1%		95.3%		98.9%		98.9%		97.9%	
Teat dipping after milking (n=214)	85.7%		83.6%		87.0%		87.7%		86.0%	
Improving drinking water availability 24/7 (n=214)	98.4%		100.0%		100.0%		98.4%		99.1%	
Conserving forages for the dry seasons (hay, silage)(n=75)	66.7%		73.7%		66.7%		64.7%		68.0%	
Record keeping (n=125)	85.7%		89.7%		96.4%		90.9%		90.4%	
Using detergents for milking equipment (n=513)	98.5%		99.2%		100.0%		98.4%		99.0%	
Improved milking hygiene to reduce TPC (n=490)	98.4%		100.0%		100.0%		99.1%		99.4%	
Automatic milking machines (n=10)	80.0%		0.0%		66.7%		100.0%		70.0%	
Nutrient feed blocks (n=36)	66.7%		91.7%		100.0%		83.3%		83.3%	
Cooling milk in water tanks (n=6)	100.0%		.		.		100.0%		100.0%	
Stainless steel milking equipment (n=272)	98.7%		100.0%		98.4%		97.0%		98.5%	
Biogas units (n=147)	74.0%		75.7%		80.0%		80.0%		76.9%	
Milk pasteurisation (n=46)	92.3%		77.8%		100.0%		93.8%		91.3%	
Milk processing (make yogurt) (n=31)	92.3%		100.0%		60.0%		90.9%		87.1%	
Milk quality test - TPC/SCC (n=95)	95.8%		96.0%		95.5%		91.7%		94.7%	
UHT (Ultra High Temperature) (n=4)	.		100.0%		100.0%		100.0%		100.0%	
Breeding plan applied (n=83)	96.3%		100.0%		100.0%		95.2%		97.6%	
Synchronization oestrus (n=43)	100.0%		100.0%		87.5%		84.6%		93.0%	
Manure processing / manure re-use (n=144)	81.4%		90.9%		88.0%		83.7%		85.4%	

[1]Value is a percentage; [2]Sig = 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. Comparison of technologies currently being used by dairy farmers by profit quartiles.

Variables	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]
Are you currently using the technology?										
Artificial Insemination (AI) (n=597)	100.0%		100.0%		100.0%		100.0%		100.0%	
Mastitis test (n=104)	57.6%		80.8%		69.2%		63.2%		67.3%	
High protein concentrates (16% or higher) (n=101)	53.6%		43.8%		50.0%		44.0%		47.5%	
Feed legume forages (e.g. Leucaena) (n=193)	86.8%		92.0%		95.5%		89.1%		90.7%	
Use of high-quality grasses (n=444)	100.0%		99.0%		99.1%		98.3%		99.1%	
Grow animal feed crops (n=343)	98.9%	a	98.9%	a	97.5%	a	93.0%	a	97.1%	*
Use of any fertilisers for the grass (n=440)	93.6%		99.1%		95.4%		94.6%		95.7%	
Rubber/Plastic floor for the barn/cage (n=365)	96.1%		95.1%		97.9%		94.3%		95.9%	
Teat dipping after milking (n=184)	70.8%		67.4%		62.5%		50.0%		62.5%	
Improving drinking water availability 24/7 (n=212)	100.0%		97.9%		100.0%		98.4%		99.1%	
Conserving forages for the dry seasons (hay, silage) (n=51)	18.8%		7.1%		30.0%		9.1%		15.7%	
Record keeping (n=113)	80.0%		73.1%		96.3%		83.3%		83.2%	
Using detergents for milking equipment (n=508)	100.0%		100.0%		100.0%		100.0%		100.0%	
Improved milking hygiene to reduce TPC (n=487)	100.0%	a	100.0%	a	100.0%	a	98.2%	a	99.6%	*
Automatic milking machines (n=7)	50.0%		.		50.0%		100.0%		57.1%	
Nutrient feed blocks (n=30)	25.0%	ab	45.5%	ab	83.3%	b	0.0%	a	40.0%	**
Cooling milk in water tanks (n=6)	100.0%		.		.		100.0%		100.0%	
Stainless steel milking equipment (n=268)	93.6%		96.9%		91.8%		96.9%		94.8%	
Biogas units (n=113)	37.8%	ab	57.1%	ab	65.0%	b	25.0%	a	44.2%	**
Milk pasteurisation (n=42)	91.7%		100.0%		100.0%		86.7%		92.9%	
Milk processing (make yogurt) (n=27)	58.3%		50.0%		66.7%		50.0%		55.6%	
Milk quality test - TPC/SCC (n=90)	100.0%		100.0%		95.2%		90.9%		96.7%	
UHT (Ultra High Temperature) (n=4)	.		100.0%		50.0%		100.0%		75.0%	
Breeding plan applied (n=81)	92.3%	ab	100.0%	b	94.1%	ab	70.0%	a	88.9%	**
Synchronization Oestrus (n=40)	100.0%		100.0%		100.0%		100.0%		100.0%	
Manure processing / manure re-use (n=123)	62.9%		66.7%		90.9%		66.7%		69.9%	

[1]Value is a percentage; [2]Sig = 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 ($p > 0.05$).