END OF PROJECT REVIEW

Understanding Indonesia's smallholder dairy farmers: Facts from the household surveys

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Outline Presentation:

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Introduction

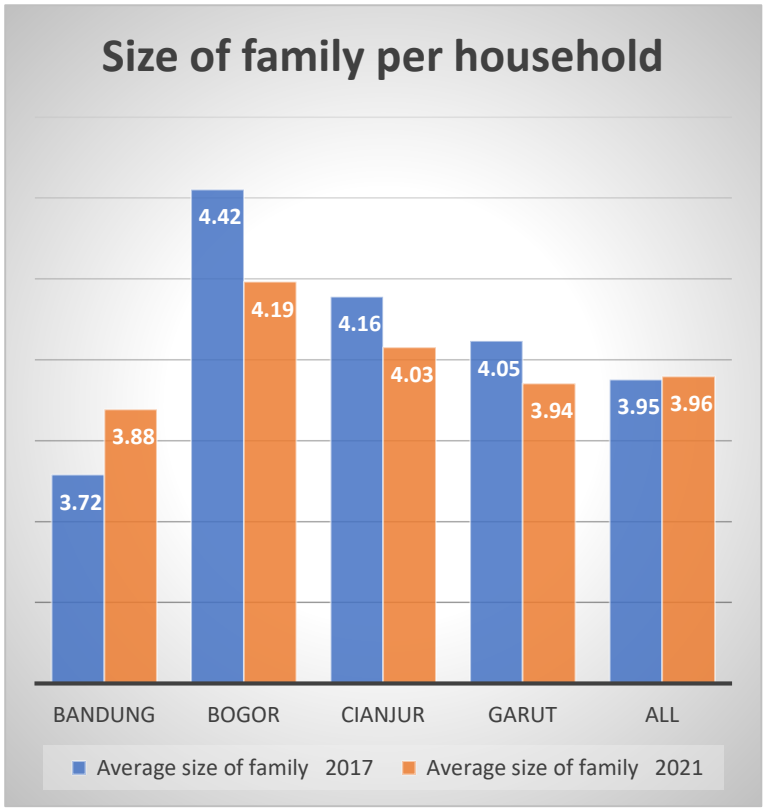
- The IndoDairy Smallholder Household Survey (ISHS) collected information from 600 dairy farming households across four districts in West Java. Data collection took place between August and September 2017
- In November–December 2021, resurvey was conducted to the same household. However, only 411 households will be compared the changes information between 2017 and 2021 data due to some of the respondents already exited from dairy farming and other reasons.
- We analyzed 411 households from the same dairy farming household as respondents of ISHS in 2017 and respondents of End Line Survey (resurvey) in 2021

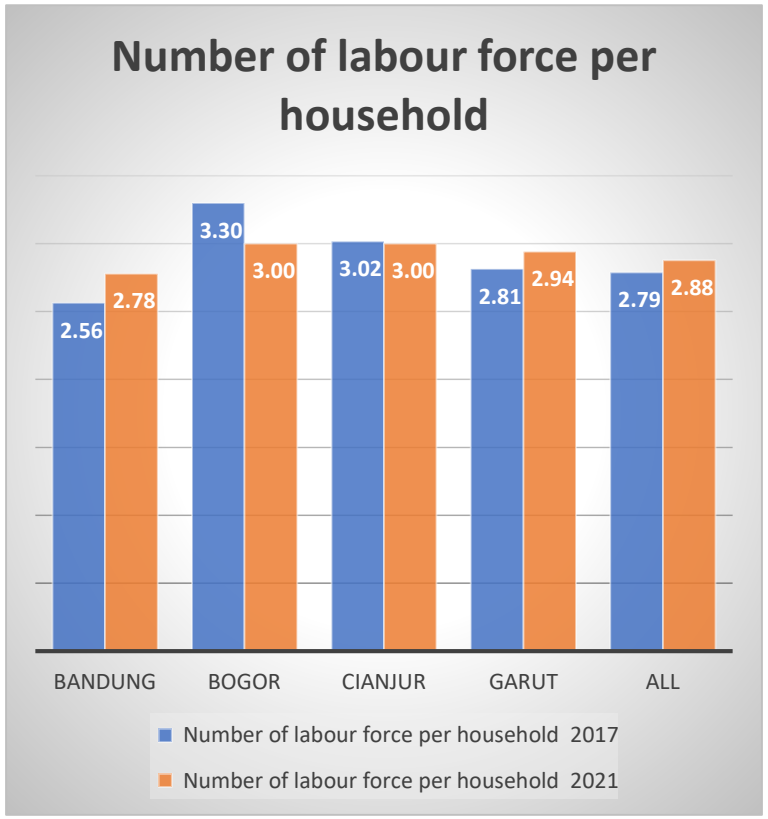
Research Objectives

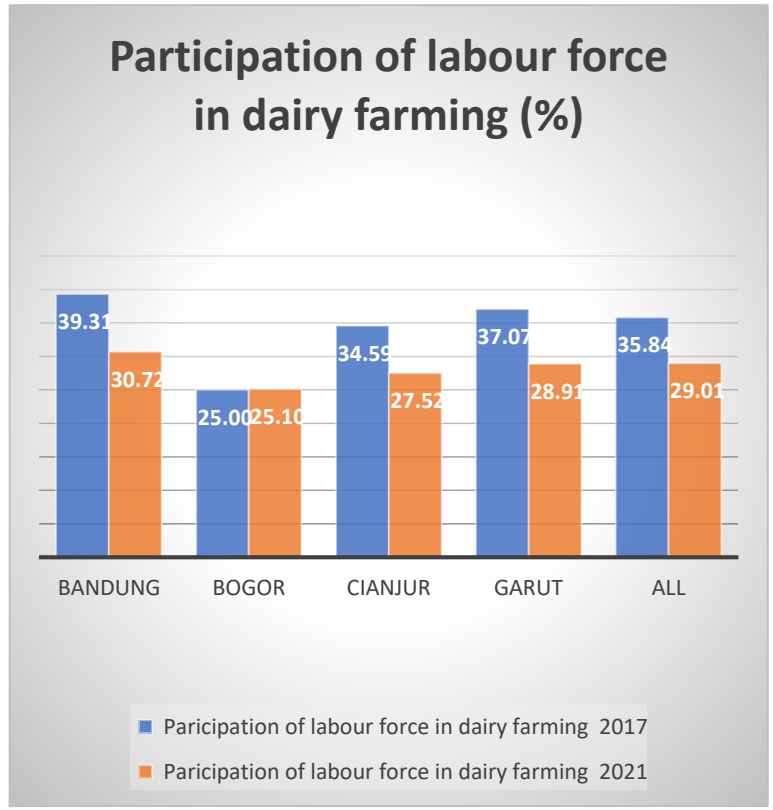
- To analyze the dynamics of smallholders dairy farming in West Java.
- To present the socio-economic changes of smallholders' dairy farming in West Java in 2017 and 2021.
- To present the key variables that have significant changes and has an impact on policy

Key results and Discussion

Characteristics of Smallholders Dairy Farmers (1)

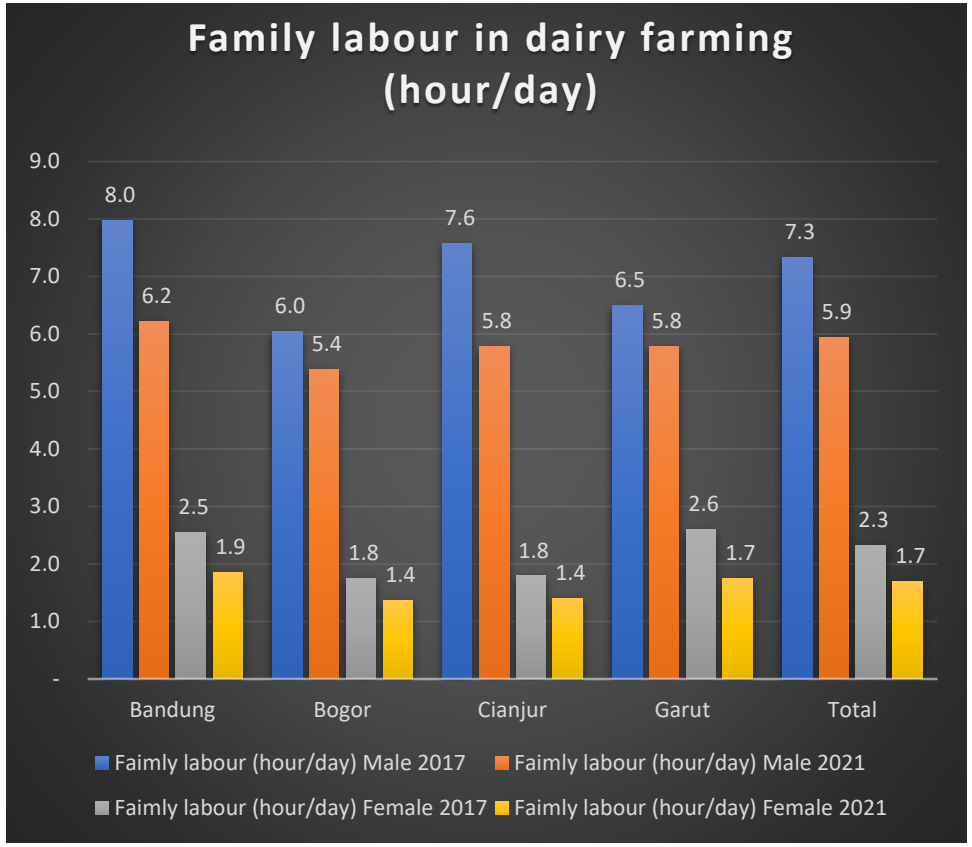


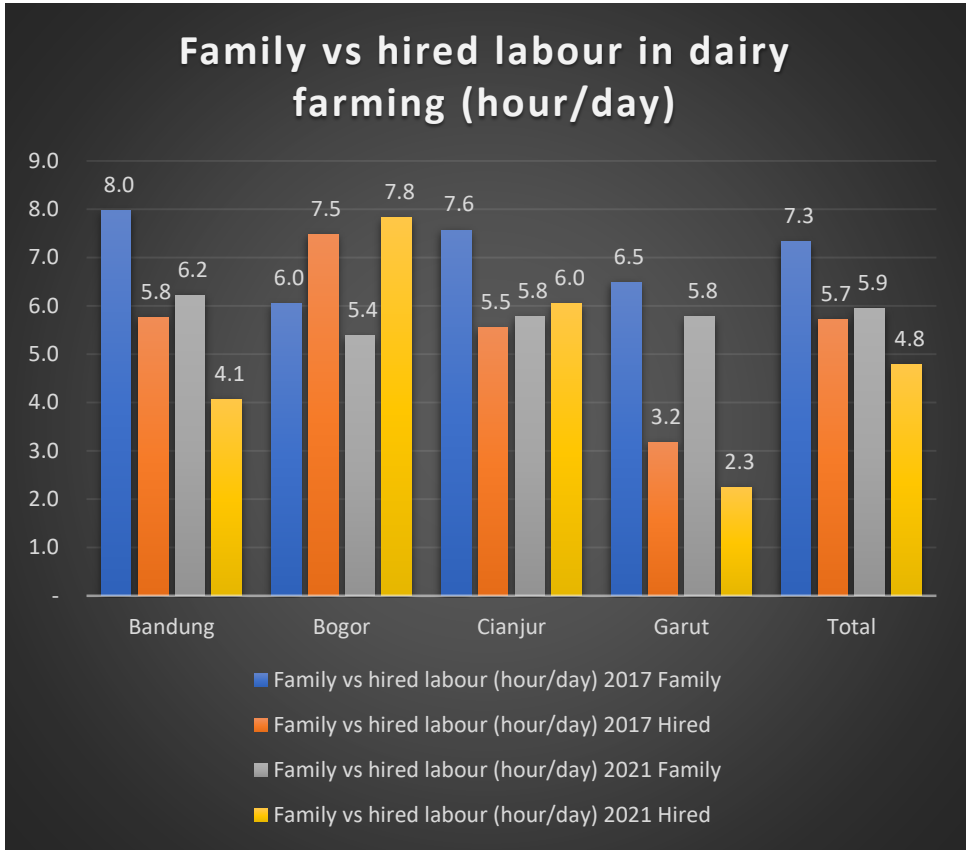




- The average number of household members is four people, with a workforce of between 2–3 people per household. During the 2017–2021 period, the labor force per household tends to increase, except in Bogor.
- Among the household labor force, 36 percent worked in dairy cattle in 2017, decreasing to 29 percent in 2021. The decline in labor force participation in dairy farming occurred in all locations, except in Bogor Regency, which was relatively constant.

Characteristics of Smallholders Dairy Farmers (2)

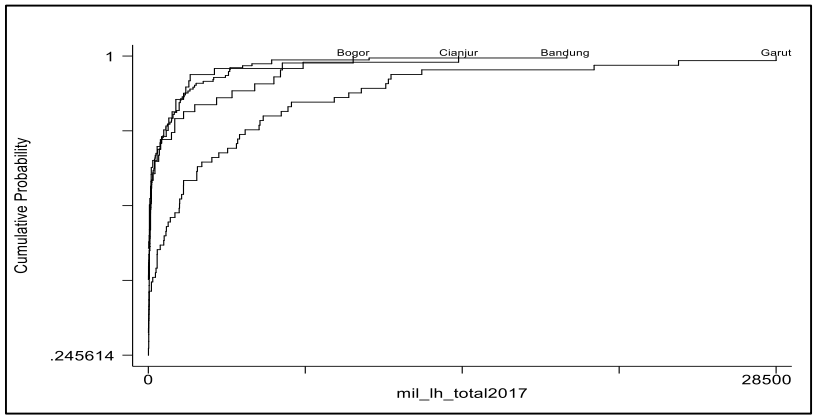


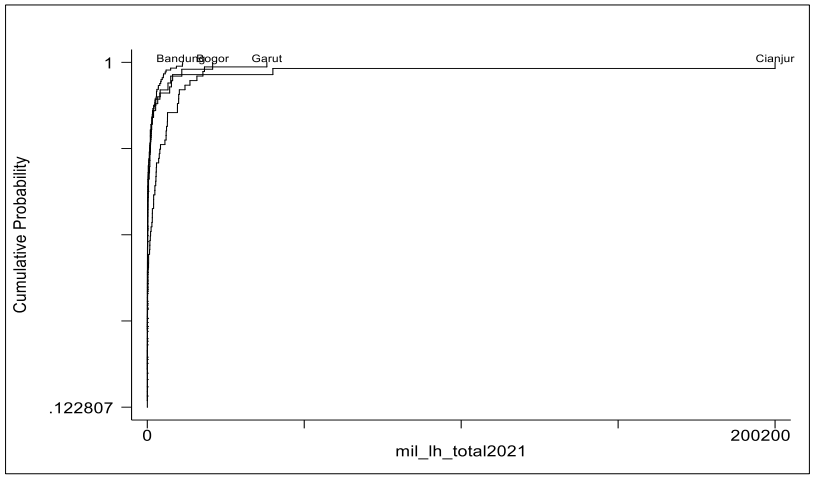


- Male family workers are more dominant than female workers (seven vs. two hours/day in 2017; and six vs. two hours/day in 2021).
- Time allocation of family labor on dairy farming in 2021 is less than in 2017, both for males and females in all research locations.
- Family labor is also more dominant than hired labor in all research locations.

Assets: Distribution of land owned by smallholders dairy farmers

	Owned Land (m2)		Gini Index	
District	2017	2021	2017	2021
Bandung	608	761	0.8421	0.8169
Garut	2,731	3,068	0.7590	0.7458
Bogor	863	1,189	0.8287	0.8511
Cianjur	640	4,475	0.8601	0.9430
Total	1,092	1,881	0.8458	0.8739

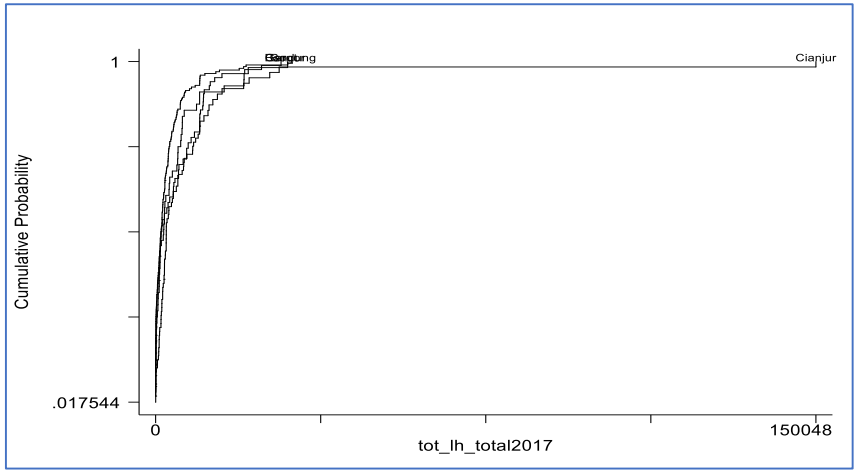


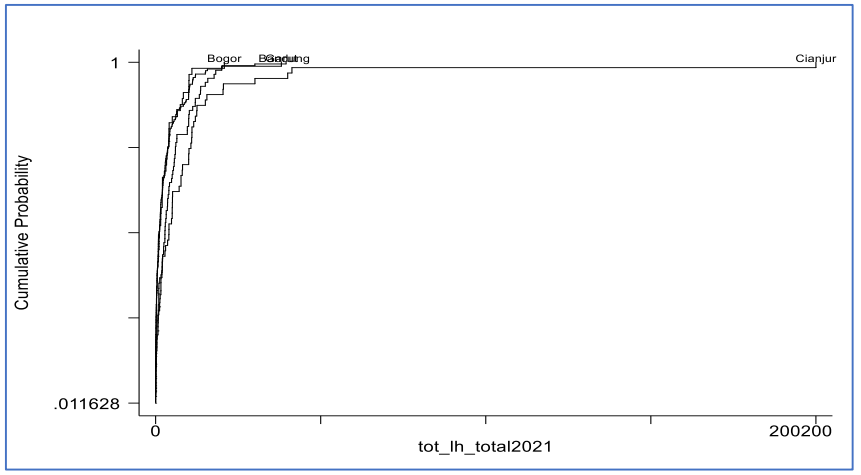


- The distribution of land ownership by smallholders' dairy farmers in 2021 was a bit more unequal than that was in 2017, as the Gini index increased from 0.8458 to 0.8739.
- This can also be seen from the CDF curves as the 2021's CDF shifted to the left. The most unequal distribution occurred in Cianjur and followed by Bogor.

Assets: Distribution of cultivated land by smallholders dairy farmers

	Managed Land (m^2)		Gini Index	
District	2017	2021	2017	2021
Bandung	2,639.5	3,024.8	0.6750	0.6874
Garut	4,865.5	4,863.1	0.5528	0.5824
Bogor	4,035.7	2,731.3	0.6719	0.6519
Cianjur	6,944.5	9,592.3	0.7580	0.7199
Total	3,969.3	4,391.4	0.6872	0.6953



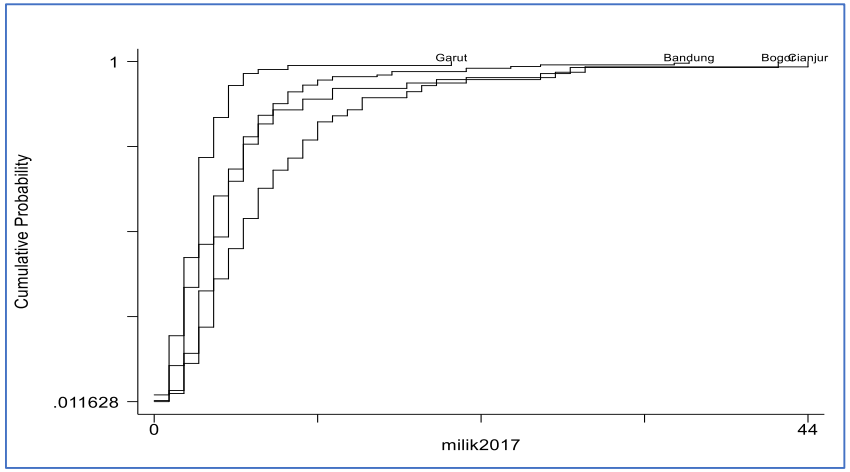


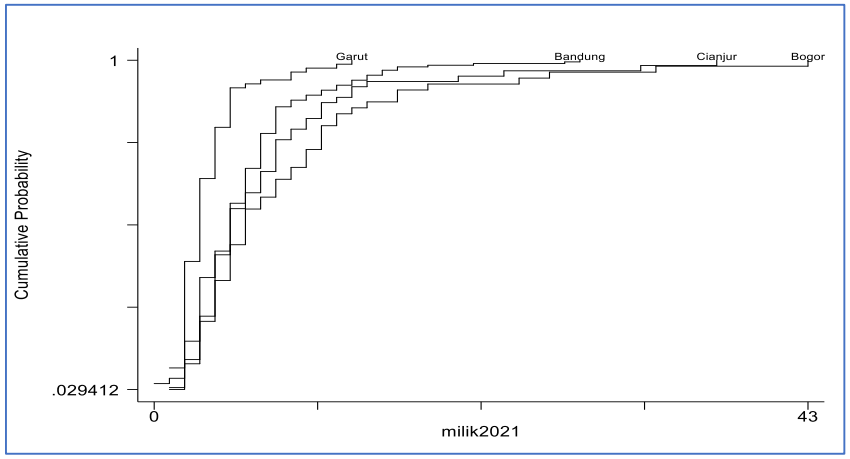
- The distribution of cultivated (managed) land by dairy farmers in 2021 was somewhat more unequal than that was in 2017.
- The most unequal distribution occurred in Cianjur and followed by Bandung.

Assets: Distribution of dairy cows owned by smallholders dairy farmers

	Owned dairy cows		Gini Index	
District	2017	2021	2017	2021
Bandung	5.56	5.95	0.3599	0.3224
Garut	8.07	8.43	0.4160	0.4265
Bogor	5.75	6.87	0.5239	0.4398
Cianjur	3.16	3.40	0.3058	0.3086
Total	5.44	5.90	0.4190	0.3891

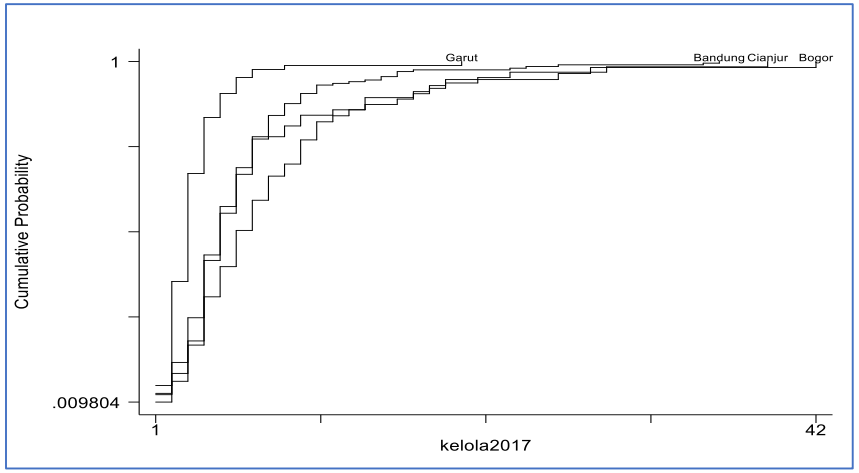
- The distribution of cows owned by dairy farmers in 2021 was more equal than in 2017, the Gini index declined from 0.4190 to 0.3891. This can also be seen from the CDF curve as the 2021's CDF shifted a bit to the right.
- The most equal distribution occurred in Cianjur, followed by Bandung.

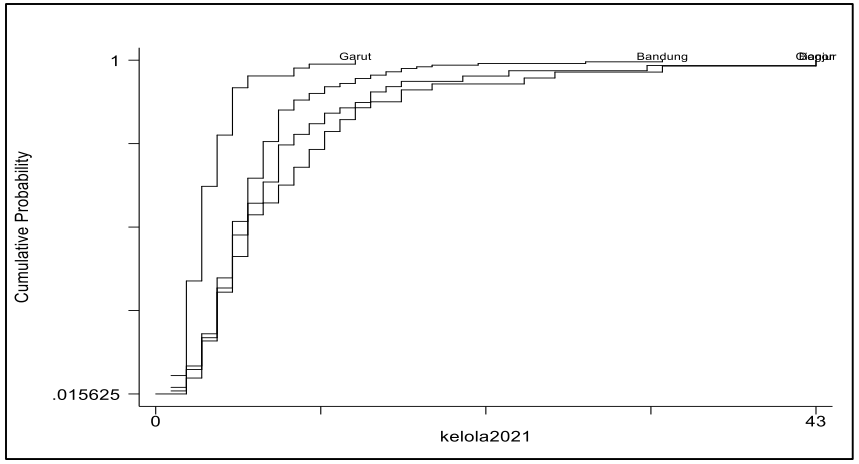




Assets: Distribution of cows managed by smallholders dairy farmers

	Owned dairy cows		Gini Index	
District	2017	2021	2017	2021
Bandung	6.17	6.22	0.3354	0.3066
Garut	8.38	8.66	0.3915	0.4121
Bogor	7.28	7.79	0.4144	0.3868
Cianjur	3.38	3.45	0.2783	0.2788
Total	6.07	6.22	0.3827	0.3692





- The distribution of cows managed by dairy farmers in 2021 was more equal than that in 2017, the Gini index declined from 0.3827 to 0.3692.
- The CDF curve for 2021 was a bit shift to the right. Cianjur experienced most equal distribution, followed by Bandung.

Technology: Dairy Farmers Response Towards the Introduction of "Milk Quality Technology"

No.	Type of Techology	Awareness			Adopt			Continue to Adopt		
		2017 %	2021 %	% changes	2017 %	2021 %	% changes	2017 %	2021 %	% changes
1.	Mastitis test	43,80	51,58	**15,09****	20,68	28,47	**27,35**	10,71	12,41	13,73
2.	Teat dipping after milking	61,31	77,62	**21,00*****	36,50	53,28	**31,51****	19,71	26,28	25,00
3.	Record keeping	48,66	51,34	5,21	22,38	17,27	**-29,58****	17,52	11,44	-53,19
4.	Using detergents for milking equipment	88,08	93,43	**5,73****	85,89	86,13	**0.28*****	85,16	85,64	0,57
5.	Improved milking hygiene to reduce TPC	86,86	80,29	***-8,18****	82,00	73,48	-11,59	81,02	72,75	-11,37
6.	Stainless steel milking equipment	83,21	79,56	-4,59	46,47	45,50	**-2.14**	43,07	42,82	-0,57
7.	Milk quality test	71,29	63,50	***-12,26****	15,82	8,76	**-80,56****	14,84	5,60	-165,22

The table indicates significant changes in milk quality-typed technology. It is a positive sign that there is an increasing awareness at the farm level to implement ”milk quality typed-technology”, in particular, for “teat-dipping after milking”, “mastitis” and “detergents-used.” Although it is not significant, overall, dairy farmers who have increased the hygiene of their milk production indicate a very good sign.

Technology: Dairy Farmers Response Towards the Introduction of "Feed and Nutrition Technology"

No.	Type of Technology	Awareness			Adopt			Continue to Adopt		
		2017 %	2021 %	% changes	2017 %	2021 %	% changes	2017 %	2021 %	% changes
1.	High protein concentrates (16% or higher)	43,07	42,34	**-1,72**	22,14	27,74	**20,18*****	9,49	19,22	**50,63*****
2.	Feed legume forages (e.g. Leucaena)	49,15	47,45	**-3,59**	32,36	29,93	- 8,13	28,71	23,60	-21,65
3.	Use of high quality grasses	84,67	63,26	**-33,85*****	76,40	54,74	-39,56	74,94	53,04	-41,28
4.	Grow animal feed crops	65,21	78,83	***17,28******	58,64	66,18	**13,40****	56,93	64,72	12,03
5.	Use of fertiliser to grow grass	89,78	80,54	**-11,48*****	77,13	63,26	***-21,92******	72,75	59,85	-21,54
6.	Conserving forages for the dry seasons (hay, silage)	59,85	67,64	**11,51****	12,65	16,30	22,39	0.2982	2,19	55,56
7.	Nutrient feed blocks	15,09	15,33	1,59	6,33	2,68	**-136,4*****	1,95	1,22	-60,00

This table indicates that the trend of feed and nutrition adoption at the farm level is decreasing. At the awareness, the percentage changes are significant for two important technology. Land scarcity for forages is the biggest constraint for dairy farmers, while conserving forages (silage) is still not popular at the farm level. This technology could be a solution.

Technology: Dairy Farmers Response towards the Introduction of "Advanced (High Cost) Technology"

No.	Type of Techology	Awareness			Adopt			Continue to Adopt		
		2017 %	2021 %	% changes	2017 %	2021 %	% changes	2017 %	2021 %	% changes
1.	Rubber/plastic floor for the barn/cage	97,08	92,70	**-4,72*****	64,23	70,80	***9,28******	61,07	67,64	9,71
2.	Improving drinking water availability 24/7	59,37	49,88	**-19,02*****	37,96	17,27	***-119,7******	36,98	14,11	***-162,07***
3.	Automatic milking machines	76,89	77,62	0,94	1,70	2,68	36,36	0,73	1,70	57,14

Technology: Dairy Farmers Response towards the Introduction of "Milk and Manure (By Product) Technology"

No.	Type of Techology	Awareness			Adopt			Continue to Adopt		
		2017 %	2021 %	% changes	2017 %	2021 %	% changes	2017 %	2021 %	t-test
1.	Biogas unit	91,00	82,24	**-10,65*****	25,06	22,14	13.19	8,27	9,25	10,53
2.	Milk pasteurisation	29,44	70,56	**58,28*****	8,27	63,26	***86,92******	6,57	59,85	***89,02*****
3.	Milk processing (make yogurt)	56,69	46,23	**-22,63*****	5,84	4,87	-20,00	2,43	1,95	-25,00
4.	UHT (Ultra High Temperature)	28,47	35,52	**19,86*****	0,73	0,49	-50,00	0,49	0,00	n.a.
5.	Manure processing / manure re-use	82,73	79,32	-4,29	23,11	24,57	5,94	13,63	17,76	***23.29******

The data indicates that the majority of respondents are less likely to adopt advanced technology. The rubber/plastic floor is considered as the most adopted technology by dairy farmers. Meanwhile, providing 24/7 drinking water or ad libitum indicates a negative trend at awareness and adoption level. In milk production and manure processing, there is a significant increase for farmers who have adopted pasteurization technology. In contrast, other technologies indicate a negative and only significant at the awareness level.

Land Size for Grass and Milk Production in Lactation Period

Average Land Size for Grass as Source for Forages (in hectares)

District	2017	2021	% changes
Bandung	0,16	0,20	22,04
Garut	0,23	0,27	14,26
Cianjur	0,16	0,30	48,08
Bogor	0,37	0,25	-45,86
All	0,20	0,24	15,42

Milk Production (liter/day/head) in "One Lactation Period"

District	2017	2021	% changes
Bandung	15,42	13,29	-16,02***
Garut	15,15	14,12	-7,31**
Cianjur	13,53	12,14	-11,49**
Bogor	14,32	13,09	-9,40
All	14,91	13,25	-12,55***

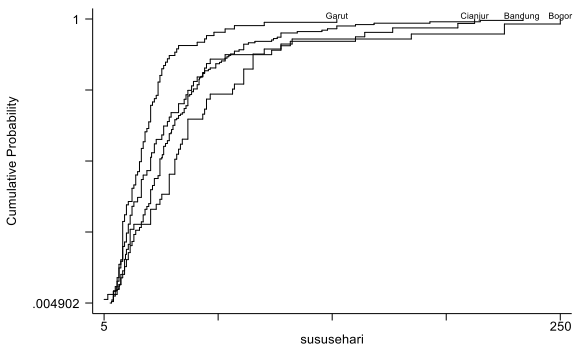
- Overall, Bogor experiences a decrease in land size for grass, while in other districts the signs are positive.
- Milk production in one lactating period decreases in all districts, and it is significant. COVID-19 pandemic contributes a significant impact to the availability of “pollard” as the main ingredients for feed
- The decreasing feed quality is also considered as an issue, and many dairy farmers have delivered this complaint.

Milk Production dan Price

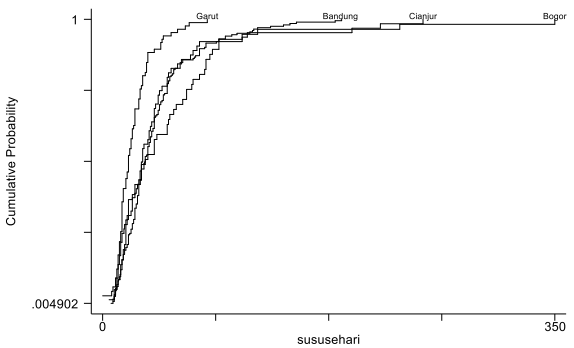
Milk production in the last six months (L/day)

District	2017	2021	Changes	Gini index 2017	Gini index 2021
Bandung	43.85	40.79	-3.06	0.360	0.366
Garut	28.26	23.88	-4.38*	0.313	0.294
Cianjur	44.09	41.90	-2.19	0.444	0.440
Bogor	56.27	50.18	-6.09	0.424	0.459
All	42.35	38.73	-3.62	0.395	0.406

2017



2021



- Milk production declined in all districts, presumably due to the COVID-19 pandemic.
- In 2021, milk production per day tended to be more unequally distributed than in 2017.

Fresh milk prices at farmer level in the last 12 months (Rp/L)

District	2017	2021	Changes
Bandung	4,427	5,293	866 ***
Garut	4,321	5,065	744 ***
Cianjur	4,180	4,982	802 ***
Bogor	4,750	5,190	440 ***
All	4,411	5,183	772 ***

- The fresh milk prices in 2021 in all districts increased significantly compare to the price in 2017
- Dairy farmers in Cianjur received the lowest fresh milk prices, both in 2017 and 2021
- The lowest price changes occurred in Bogor, while the highest was in Bandung

Input in Dairy Farming

Amount of concentrates for lactating cows (kg/head/day)

District	2017	2021	Changes
Bandung	6.89	7.79	0.90***
Garut	7.42	7.13	-0.30
Cianjur	3.28	3.41	0.14
Bogor	6.43	5.98	-0.45
All	6.36	6.72	0.36*

- Overall, despite the rising prices of concentrates, the amount of concentrates given to lactating cows increased in 2021. However, it decreased in Garut and Bogor.

Amount of grass for adult cow (kg/head/day)

District	2017	2021	Changes
Bandung	51.28	46.92	-4.36**
Garut	69.00	53.58	-15.42***
Cianjur	51.27	48.98	-2.29
Bogor	41.19	44.28	3.09
All	53.59	48.27	-5.32***

- The amount of grass given to cows decreased significantly, except in Bogor
- It is presumed that the farmers had the difficulty to obtain grass for their cows due to the COVID-19 pandemic that limited their activities, including getting grass

Households participation in using input of dairy farming

Operational costs (package from cooperative)

Inputs and items (packet)	2017	2021	% change
IB (packet)	70.07	71.53	1.46
Medicines (packet)	69.59	68.61	-0.97
Vitamins (packet)	67.88	66.91	-0.97
Veterinary fees	70.07	67.40	-2.68
Reproduction incentive	27.49	25.79	-1.70
Other	34.79	19.46	-15.33***

- There are no significant changes in household participation in operational costs in the package input items. Only other packages (including farmer health and livestock insurance) have significant changes.
- There are changes in household participation in the use of non-packaged inputs, either increasing or decreasing. However, significant changes are found in tofu waste, crop straw, and other feeds.

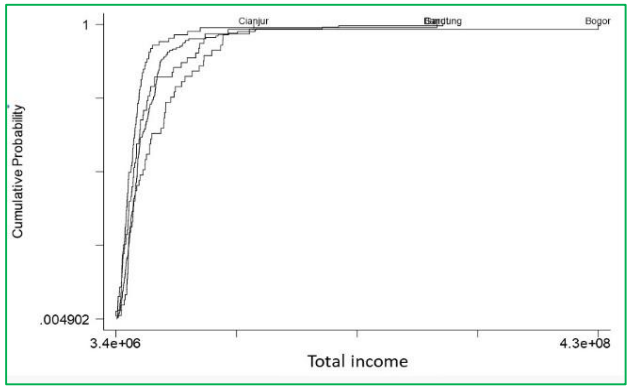
Operational costs (non-package)

Inputs and items (non-packet)	2017	2021	% change
IB (non packet)	28.47	26.03	-2.43
Medicines	22.38	26.28	3.89
Vitamins	15.82	11.92	-3.89
Concentrates	93.19	97.32	4.14
Forage/grass	97.81	99.27	1.46
Leguminosa	32.36	33.09	0.73
Mineral mix	21.65	23.11	1.46
Tofu waste	23.36	15.33	-8.03 ***
Cassava waste	0.24	0.73	0.49
Palm kernel cake	12.41	13.63	1.22
Crop straws (rice. corn. vegetable)	27.74	20.44	-7.30 **
Vegetable waste	6.81	8.52	1.70
Other feed	27.01	13.38	-13.63 ***

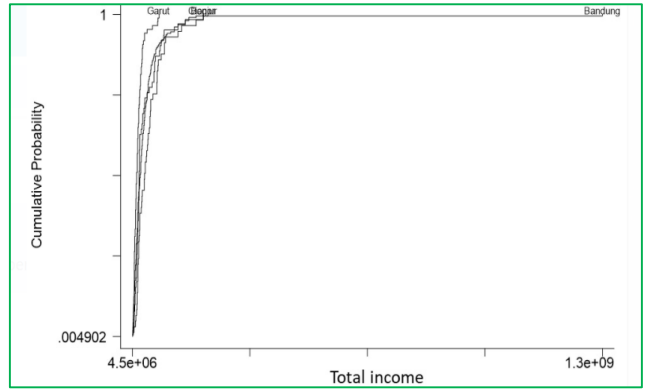
Income of smallholder dairy farmers

Household income per capita, 2017 and 2021

District	household income (million per capita/year)		
	2017	2021	% change
Bandung	30.44	42.64	40,10**
Garut	22.33	20.07	-10,12
Cianjur	28.83	36.60	26,95**
Bogor	43.82	49.28	12,47
All	30.35	37.91	24,88**



CDF Income per capita per year. 2017



CDF Income per capita per year. 2021

Change in income share by source, 2017 & 2021

Income Activities	2017	2021	% changes
Milk sales & milk processing business	62.29	59.44	-2.85***
Live dairy cattle sales	12.38	15.42	3.04***
Farming (crop. horticulture & plantation)	5.81	4.45	-1.36***
Aquaculture & Other livestock products	0.81	0.75	-0.06
Non-agricultural business	4.96	4.04	-0.93
Agricultural & Non-agricultural wage employment	8.94	10.05	1.11*
Expertise fee (veterinarian, insemination)	2.54	3.14	0.60
Pension. remittances & other non-labor sources of income	2.26	2.70	0.44

- In general, income per capita increased during 2017 – 2021, except in Garut. Nevertheless, overall, the equality of income per capita is getting worse, it indicated by shifting the CDF curve to the left.
- The shared income from dairy farming (milk sales and live dairy cattle sales) dominates household dairy farmers' income
- During 2017-2021 there was a significant change. Milk sales decreased while selling livestock increase.
- In the case of farmers in Bandung (the KPBS area), there was a significant increase in livestock sales. Some livestock were forced to be sold because they were sick, i.e., paralyzed after giving birth, and even in some cases, livestock died.

Dairy farmers participation based on information received

Dairy farmers by type of information: “animal feed”

Type of information	2017 (%)	2021 (%)	% change
Dairy cow nutrition	21.90	6.08	-15.82***
Forage and grasses	32.12	14.84	-17.27***
Concentrates	36.98	28.95	-8.03***
Feed supplements	6.08	3.16	-2.92***

Dairy farmers by type of information: "milk production, quality and marketing"

Type of information	2017 (%)	2021 (%)	% change
Milk sales (buyers, prices)	41.36	46.47	5.11
Increase milk quality	72.02	24.57	-47.45***
Increase milk yields	51.09	14.60	-36.50***
Value-adding of milk	8.27	2.43	-5.84***
Access to new markets	2.43	1.70	-0.73

Dairy farmers by type of information: "livestock reproduction and rearing"

Type of information	2017 (%)	2021 (%)	% change
Reproduction and AI	30.41	12.65	-17.76***
Cow's health	67.15	36.98	-30.17***
Applied breeding plan/progeny testing	3.89	0.73	-3.16***
Rearing heifer for replacement cow	4.87	2.68	-2.19*
Mastitis test	4.87	2.68	-2.19**

- Based on the three tables, the number of dairy farmers receiving information about animal feed, milk production, quality and marketing, and livestock reproduction and rearing **decreased significantly** during the 2017-2021 period. The rate of decline varied between 0.73% and 47.45%.
- There was a decrease of more than 30% in the percentage of dairy farmers who received information about **increasing milk quality, increasing milk yield, and cow's health.**

Dairy farmers attitude towards new technologies

Dairy farmers attitude towards new technologies, new management practices, and new production methods

Dairy farmers' attitude	2017 (%)	2021 (%)	Change (%)
Always **the first** to try new technologies, new management practices, and new production methods	9.25	9.25	0.00
One of the first to try new technologies, new management practices, and new production methods.	19.22	20.44	1.22
Wait to see others' success with new technologies new, management practices, and new production methods.	60.34	61.80	1.46
One of the last to try new technologies, new management practices, and new production methods.	6.81	5.11	-1.70
Never try new technologies, new management practices, and new production methods.	4.38	3.41	-0.97

- More than 60% of dairy farmers' attitudes towards new technologies, new management practices, and new production methods tend to **wait to see others' success** before adopting them. About 20% of dairy farmers are the **first** to try new technologies, new management practices, and new production methods. Only 9.25% have the attitude of **always** being **the first** to try new technologies, new management practices, and new production methods. There was no significant change in the attitude of dairy farmers during the 2017-2021 period.
- During the 2017-2021 period, the attitude of dairy farmers for the **wait to see others' success** category tends to increase by around 14-15% in Garut, Cianjur, and Bogor District. However, in Bandung District, it decreases by 12%. The attitude of dairy farmers for **one of the first categories increased in Bandung District**, while in other districts, it decreased.

Conclusions

During 2017–2021, the amount of labor force per household tended to increase, but the participation of the family labor force in dairy farming was declining. Time allocation of family labor on dairy farming in 2021 was less than that was in 2017, both for males and females in all districts. The distributions of land ownership and cultivated (managed) land by smallholders' dairy farmers in 2021 were a bit more unequal than that was in 2017. However, the distributions of cows owned and cows managed by dairy farmers in 2021 were somewhat more equal than in 2017.

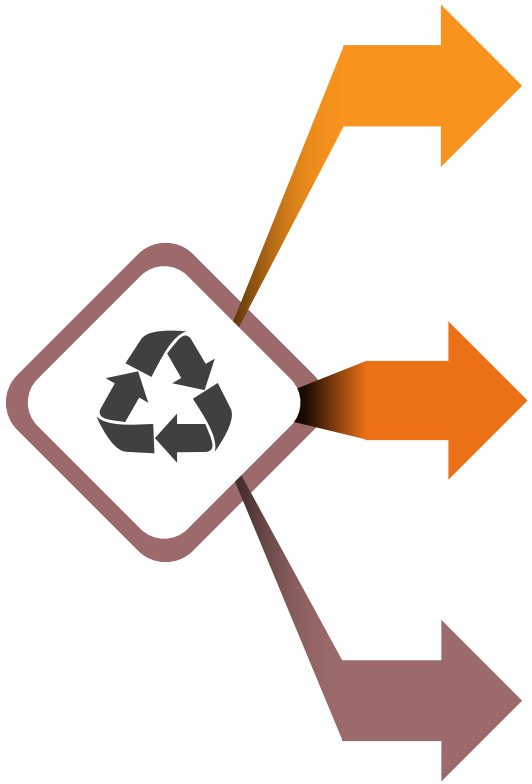
In 2017–2021, there were significant changes in dairy farmers' response to milk quality-typed technology, indicated by increasing awareness at the farm level to implement *teat-dipping after milking*, *mastitis*, and *detergents-used*. The awareness and adoption of feed and nutrition technologies at the farm level were declining. Land scarcity for forages was the biggest constraint for dairy farmers. The majority of the dairy farmers were less likely to adopt advanced technology.

Milk production in one lactating period in 2021 decreased significantly. Although not significant, average milk production in the last six months also declined in all districts (except in Garut), presumably due to the COVID-19 pandemic. Milk production per day in 2021 tended to be more unequally distributed than in 2017.

In general, income per capita of the household dairy farmers increased during 2017 – 2021, except in Garut. The shared income from dairy farming (milk and live dairy cattle sales) dominated household dairy farmers' income. Overall, smallholder dairy farmers' per capita income inequality was getting worse.

More than 60% of dairy farmers' attitudes towards new technologies, new management practices, and new production methods tend to **wait and see others' success** before adopting them. This shows the risk-averse behavior of dairy farmers towards the technology adoption process.

Policy Implications

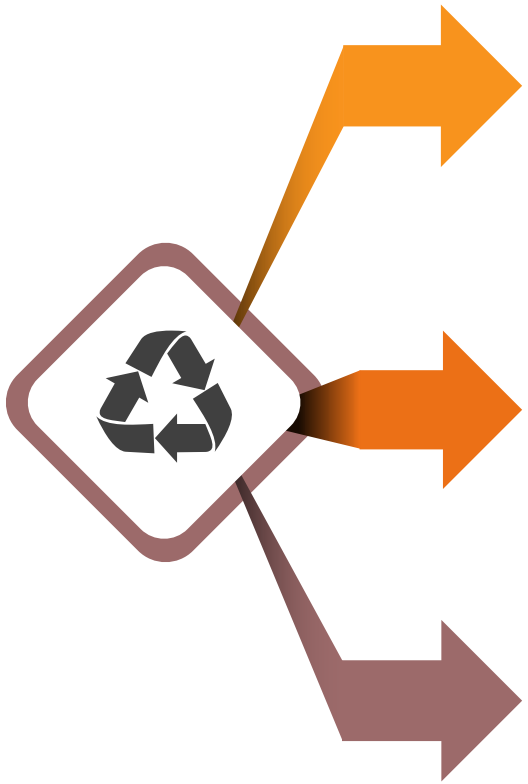


Family labor force participation and time allocation per day in dairy farming were declining, while the labor force per household tended to increase. For this reason, policies in the form of incentives are needed to attract the workforce into dairy farming. Cattle breeding assistance, cultivation technology assistance, and facilitation of price guarantees that benefit farmers are among the policy choices to be implemented.

Overall, dairy farmers who have increased the hygiene of their milk production indicate a good sign. Therefore, the government needs to intensify extension services through education and socialization of clean and healthy culture in dairy farming.

Land scarcity for forages was the most significant constraint for dairy farmers while conserving forages (silage) was still not popular at the farm level. For this reason, education and socialization of the use of silage as a source of animal feed need to be carried out.

Policy Implications



The milk production in one lactating period and average milk production in the last six months decreased significantly due to the decreasing amount of grass given to cows. It is presumed that the farmers had difficulty obtaining grass for their cows due to the Covid-19 pandemics that limited their activities, including getting grass. Once again, the technology of using silage is a solution that needs to be socialized.

The income per capita of smallholder dairy farmers increased during 2017–2021, but inequality also increased. For this reason, policies to help expand the business scale and cultivation assistance are needed to increase the productivity and income of smallholder dairy farmers.

Most smallholder dairy farmers are risk-averse to new technology adoption. Therefore, it is necessary to introduce new technology through demonstration plots and comparative studies to farmers in other areas who successfully implement the technology in the dairy cattle business.

Thank You!

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