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Comparative challenges, cost, and profitability of cooperative versus non-cooperative farmers: case of arabica coffee in Indonesia

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Abstract

Coffee plays an important role as an Indonesian agricultural plantation commodity. Although Arabica coffee, which has a higher selling price on the international market than other coffee types, is a crucial source of income for small farmers, the production and quality of Indonesian coffee are very low, which affects the farmers' income. Agricultural cooperatives can boost the welfare of members and society in general. However, despite the potential benefits of such cooperatives, many small farmers remain sceptical and are reluctant to become members. Within this context, our study aimed to quantitatively examine and compare the challenges, costs, and profitability of agricultural cooperatives using the Kerinci Regency in Indonesia as a case study. We used data obtained through a direct economic survey of 102 randomly selected farmers. Our results indicated that net profit differed significantly between cooperative and non-cooperative farmers and that hired labor represented the most variable costs for all farmers. Our novel findings highlight the financial benefits of agricultural cooperatives for small farmers.

1. Introduction

Agriculture in Indonesia has long served as the backbone of the country's economy. Indonesia has produced both Arabica and Robusta coffee (1696–1699) since Dutch colonization when it was introduced by the Dutch Royal East India Company (*Verenigde Oostindische Compagnie* or VOC) for research purposes (Pratiwi and Ita, 2015). The Indonesian climate and altitude support the production of coffee, with the coffee industry continuing to grow in all provinces across Indonesia, from Aceh to Papua Island, with different qualities and quantities (Martauli, 2018). Although the contribution of the agricultural sector to the country's GDP has declined, agriculture remains the nation's leading employer. Within this context, coffee plays an important role in the livelihoods of smallholder farmers. The cultivation of coffee supports farmers and provides substantial employment opportunities as it requires extensive labor, especially in the production and harvesting processes (Sarirahayu and Aprianingsih, 2018). Thus, the production and harvesting of coffee are major drivers of development in rural areas (Pratiwi and Ita, 2015). Nearly half the Indonesian population is employed, directly or indirectly, in the agricultural sector either as smallholder grassroots farmers or as labor in industrial plantations (Barichello and Patunru, 2009). The Indonesian grassroots farming system is predominantly family-based with subsistence crops farmed under traditional (non-mechanized) management styles on smallholdings, with low capital requirements (Syuaib, 2016). Thus, coffee is a vital agricultural commodity for small farmers in Indonesia and plays an important role in the national economy. Globally, Indonesian coffee has increased in popularity owing to its rich taste and strong aroma (Faradillah *et al*., 2019).

Robusta and Arabica are the two most widely grown coffee species in Indonesia (Iqbal dan Muslim, 2011). Robusta coffee comprises approximately 83% of the total Indonesian coffee production and Arabica coffee comprises the remaining 17% (Suryanendra and Suryani, 2021). Comparing the production of Robusta coffee with that of Arabica coffee is expected to increase Arabica coffee production by 30% by 2025 (Indonesia Coffee Exporters Association (ICEA), 2017). Coffee, specifically Arabica, has high economic value and is an important source of income for farmers. Approximately 96.19% of Indonesian coffee plantations are smallholder plantations, which are distinguished by limited cultivation and postharvest technologies (Wahyudi *et al*., 2020). However, coffee production in Indonesia in the

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period 1984–2017 fluctuated and then subsequently stagnated. In 2017, only 761.55 kg of coffee beans/ha/year of Robusta coffee and 813.89 kg of coffee beans/ha/year of Arabica were produced (Directorate General of Plantation (Dirjenbun), 2019). Thus, the production of Indonesian coffee can be classified as low, especially compared to competing countries such as Vietnam, with a crop production of approximately 2,300 kg/ha (International Coffee Organization (ICO), 2019).

Agricultural cooperatives are a type of democratically owned business controlled by its members who utilize services intended to increase profits in the agricultural sector, thus improving the welfare of its members and society at large (Agbo, 2010). Cooperatives reduce costs for farmers by enabling the pooling of resources and encouraging mutual support, increased visibility, and an increased capacity to negotiate prices and markets (Bolton, 2019). Cooperatives can be important catalysts for adopting innovation and upgrading production systems by promoting efficient information flow (Fischer and Qaim, 2012). However, although cooperative businesses provide opportunities for small farmers and local labor, the current coronavirus pandemic has changed the circumstances. The existence of COVID-19 has simultaneously had a systematic impact on the Asset and Business volume of Agricultural Cooperatives in Indonesia and has resulted in losses to cooperatives and their members (Darma *et al.*, 2020). Small farmers lack knowledge about improved farm practices, do not have access to modern tools, lack capital and income, as well as have poor access to markets, and lack improved planting materials and production inputs (Ibezim *et al.*, 2010). One of the ways of solving these problems, which has achieved great success and gained favor worldwide, is through the development of agricultural cooperatives (Arua, 1991). Examples of various agricultural cooperatives can be found in the Kerinci Regency, which forms part of Jambi Province in Indonesia (Table 1).

Despite the essential benefits of cooperatives, many small farmers remain sceptical and are reluctant to subscribe as members. Notably, only a limited number of studies have analyzed the challenges Arabica coffee cooperatives face (Kaido *et al.*, 2021) and the cost requirements of coffee producer cooperatives in Indonesia (Karyani *et al.*, 2018) Arabica. Within the absence of research on the cost and profitability of both cooperative and non-cooperative small farmers, our study quantitatively investigates comparative cost and profitability using data obtained through a direct economic survey of farms in a rural Indonesian study area. Our study further addresses the challenges of cooperative and non-cooperative small farming members based on the survey results.

2. Materials and methods

Our study was conducted using the Kerinci Regency in Jambi Province, Indonesia as a case study. Interviews were conducted with 102 randomly selected farmers (51 belonging to agricultural cooperatives and 51 not part of agricultural cooperatives) using semi-structured questionnaires, in January 2020. Costs were calculated based on the distribution of each type of cost item, namely variable, fixed, and total costs. Variable costs included tools, production and material costs, hired labor, marketing, and transport, while fixed costs included repairs, maintenance, and depreciation, calculated using the straight-line method. Profitability indicators were calculated as the gross profit generated from the yield multiplied by the sales price. From this, the generated net profit was calculated as gross profit minus total cost. The two-sample t-test with a significance of 5% was used to determine the difference between variable, fixed, and total costs, as well as profitability, using Stata version 16. The selected study area, Kerinci Regency, is located on the western tip of

Table 1. Development of agricultural cooperatives (Ag) in Kerinci Regency, Jambi Province, Indonesia from 2010–2018.

Area	Cooperative type					
	Village	Agriculture	Plantation	Livestock	Fishing	Forestry
Kerinci	167	243	3	0	1	1
Merangin	459	20	4	2	2	0
Sarolangun	357	262	79	0	1	0
Batang Hari	225	68	198	47	1	50
Muaro Jambi	283	169	458	10	357	15
East Tanjab	296	381	43	30	279	0
West Tanjab	447	37	733	8	0	0
Tebo	293	153	360	0	2	1
Bungo	294	10	108	2	7	2
Sungai Penuh	27	68	0	3	6	9
Jambi city	25	8	0	0	0	0

Source: Department of Cooperatives and Small and Medium Enterprises (Diskopumkm) (2018)

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Jambi Province with an approximate area of 4,200 km^2 and unique bio-geophysical characteristics including abundant and varied natural resources (Figure 1).

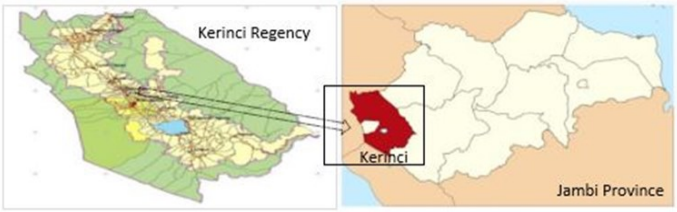

Figure 1. Map of Kerinci Regency in Jambi Province. Source: Dispupr (2007)

The region has a total population of 236,762 (Central Bureau Statistics (BPS), 2014). Notably, agriculture has become the primary livelihood strategy of the population (Department of Public Works and the People (Dispupr), 2007). Jambi Province has a number of Arabica coffee-producing regions (Table 2), with Kerinci Regency being the largest producer, accounting for approximately 67% of Arabica coffee production. Coffee is primarily produced in two large Arabica coffee production centers in Jambi Province, one in Kerinci Regency (809 ha, 144 t) and one near Sungai Penuh City (601 ha, 70 t) (Central Bureau Statistic (BPS), 2018).

Table 2. Total production, land size, and market destinations of Arabica coffee in Jambi Province.

Arabica coffee cultivation area	Land size (ha)	Production (t)
Kerinci Regency	809	144
Merangin Regency	0	0
Sarolangun Regency	0	0
Batanghari Regency	0	0
Muaro Jambi Regency	0	0
East Tanjung Jabung Regency	0	0
West Tanjung Jabung Regency	0	0
Tebo Regency	0	0
Bungo Regency	0	0
Jambi City	0	0
Sungai Penuh City	601	70
Indonesia total	228,709	119,378

Source: BPS (2018)

3. Results and discussion

3.1 Socio-demographics of respondents

From the surveys, we obtained descriptive statistics of the socio-demographics of the interviewed farmers, including both members and non-members of agricultural cooperatives (Table 3). Of the respondents, 94% were men and 6% women, with the average age of respondents being 41.8 for non-cooperative farmers and 45.7 for cooperative farmers. Furthermore, 96.1% of the cooperative and 80.4% of non-cooperative farmers were descendants of a Javanese tribe, followed by 13.8% of non-cooperative and 2% of cooperative farmers from a Batak tribe. Cooperative farmers were selected based on their residence within the cooperative's cover area. The majority of cooperative farmers are Javanese, who formerly descended from Java Island to work in tea plantations during the Dutch colonial era in Kerinci Regency.

Table 3. Socio-demographic statistics of interviewed Arabica coffee farmers.

Socio-demographic	Cooperative		Non-cooperative	
	Number	Mean	Number	Mean
Sex ratio (%)				
Male	96.1	-	94.1	
Female	3.9	-	5.9	
Age (years)	-	45.7		41.8
Ethnicity (%)				
Javanese	96.1	-	80.4	
Bataknese	2	-	13.8	
Indigenous	2	-	5.9	
Education (%)				
Elementary school	54.9	-	3.9	
Junior high school	29.4	-	39.2	
High school	15.7	-	51	
Bachelor			5.9	
Land ownership (%)				
Own land	98	-	100	
Lease	2	-		
Secondary job (%)				
No	15.7	-	35.3	
Yes	84.3	-	64.7	
Farming experience (years)	-	7.0		5.5
Number of observations (People)	51		51	

In terms of education, 29.4% of cooperative farmers and 39.2% of non-cooperative farmers had received junior high school education. Notably, 5.9% of non-cooperative farmers had received a bachelor's level of education and by intending to trade directly with end consumers, specifically in the local market, hoped to obtain a better price than that offered by the cooperative. These farmers have the capacity (ability and higher education) to sell coffee to the market. However, most of them work on an individual basis (not as a group or farmers' association), and their products are of inferior quality because they lack advanced refining equipment and machinery comparable to that of cooperatives, which are businesses. This indicates that farmers who are members of cooperatives have the benefit of being able to adopt new policies, technologies, and advanced tools. These results were confirmed (Alassaf *et al*., 2011) who observed that a farmer's level of education is an important factor in determining the ability to understand

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farming-related policies, technologies, or programs, as well as the decision to continue farming activities.

Over 90% of the study area is owned by farmers (both cooperative and non-cooperative), with only 2% being leased by farmers. Regarding employment, 84.3% of cooperative farmers and 64.7% of non-cooperative farmers have secondary jobs. The proportion of secondary jobs held by cooperative farmers is higher because these farmers are novices, often from immigrant families. Cooperative farmers often have increased livelihood burdens, and secondary jobs assist in meeting their daily needs. In contrast to non-cooperative farmers, farmers that are non-members of agricultural cooperatives often have access to more diverse farmland, with 5.9% being descendants of indigenous tribes with other livelihoods such as cinnamon farming. Thus, they can focus on farming and lease a portion of their land out to other farmers. From our survey, cooperative and non-cooperative farmers were recorded to have approximately 7 and 5.5 years of farming experience, respectively. Farming experience is a key driver in improving agricultural production and efficiency (Bozoglu *et al*., 2020). With over 3 years of farming experience, cooperative and non-cooperative farmers are said to be capable of farming Arabica coffee. This result seems to be consistent with another study that found that a farming experience of over 2 years affects the productivity of farmers (Sugiantara and Utama, 2019). In addition, the farming experience will stimulate farmers to manage agricultural businesses. The longer the experience in farming, the more advanced the farmers' skills (Dewi *et al.*, 2017).

3.2 Characteristics of Arabica coffee farming

Results from our survey were used to investigate and analyze the characteristics of Arabica farming (Table 4). Crop failure is a severe problem with 80.4% of cooperative farmers and 66.4% of non-cooperative farmers experiencing this problem. Notably, 90.2% of cooperative farmers and 72.5% of non-cooperative farmers follow intercrop planting, primarily consisting of vegetables that can be harvested rapidly and are frequently planted between coffee plants not yet in fruit. Farmers were able to gain some income through this while waiting for coffee plants to produce fruit. The intercropping system significantly contributes to higher productivity and income on coffee farms (Saragih, 2013). In our study area, the average Arabica coffee farm size was recorded as 1.1 ha for cooperative farmers and 1.3 ha for non-cooperative farmers. Sigarar Utang was the most commonly cultivated Arabica coffee variety; 60% of cooperative farmers and 40% of non-cooperative farmers cultivated this variety. The average Arabica coffee production in cooperative coffee farms was 212 kg and 272.2 kg in non-cooperative coffee farms. Notably, 94.1% of non-cooperative farmers were members of local farmer associations. Conversely, only 54.9% of cooperative farmers had joined farmer associations. These local associations are formed by groups of farmers with a relationship based on familiarity and trust. Additionally, they have shared interests in utilizing agricultural resources. In comparison, cooperatives are businesses that emphasize economic activities by providing agricultural resources and services to ensure member welfare. Marketing is a key driver in raising the income of Arabica coffee farmers, with findings from our survey indicating that 5.9% of cooperative farmers sold to the local powder coffee mill (rather than to the cooperative), while all non -cooperative farmers sold their yield to the powder coffee mill. Although price information is crucial for farmers, 96.1% of non-cooperative farmers gained price information only from the powder coffee mill. This highlights their vulnerability to pricing decisions of the powder coffee mill compared with farmers who obtain price information from official institutions. Cooperative farmers have increased confidence in anticipating the price because 94% of cooperative farmers gained price information from the cooperative.

3.3 Challenges of Arabica coffee farming

Both cooperative and non-cooperative Arabica coffee farmers in Kerinci Regency face a number of challenges, including the sensitive issue of price instability (Table 5). These results reflect those of Sambuoa and Mbwagab (2017) who reported that price fluctuations have resulted in a decline in coffee productivity and reduced income level in Tanzania. In our study, all non-cooperative farmers indicated that price instability contributed to their financial problems, while only 72.6% of cooperative farmers stated that price was a crucial problem because they are confident about stable prices provided by cooperatives.

Problematic government support was also perceived as a challenge with over 90% of cooperative farmers not receiving government support, as most are not members of farmer associations, while only 68.6% of non-cooperative farmers mentioned not receiving government support. This is due to government support coming through farmer associations and not to individual farmers, cooperatives, or business institutions. Thus, farmer associations are necessary to obtain support from the government. The availability of bank loans was also mentioned as a crucial challenge in Arabica farming; none of the respondents had received soft loans from the bank to extend the size of farming land or to support cultivation, post-harvest facilities, or infrastructure. Notably, over 65% of the respondents had little

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Table 4. Characteristics of Arabica coffee farming in Kerinci Regency, Indonesia obtained from a survey of 102 farmers.

Characteristic	Cooperative farmers			Non-cooperative farmers		
	Number	Mean	Std. dev.	Number	Mean	Std. dev.
Crop failure (%)						
Yes	80.4	-	-	66.7	-	-
No	19.6	-	-	33.3	-	-
Sold plant part (%)						
Red cherry	86.3	-	-		-	-
Green and red cherry logs	13.4	-	-	100	-	-
Price information (%)						
Cooperative	94.1			1.9	-	-
Powder coffee mill	5.9			96.1	-	-
Government				1.9		
Sales destination (%)						
Cooperative	94.1				-	-
Powder coffee mill	5.9			100		
Farmer association (%)						
Joined	54.9			94.1	-	-
Not joined	45.1			5.9		
Price determination (%)						
Powder coffee mill				98		
Government				1.9	-	-
Cooperative	94.1					
Others	5.9					
Reason for sale to mill and cooperative (%)						
No quality requirements				100	-	-
Reliable	27.5					
Higher price	72.6					
Coffee variety (%)						
Sigarar utang	60			40		
Andung sari	20			30		
P-88	20			30		
Farming size (ha)		1.1	1.1		1.3	0.8
Employees (no.)		3	1.34		2.6	0.9
Production (kg/ha)		212	195.5		272.2	160
Yield (per year)		22	3.4		23	4.9
Use of certified seed (%)	3.9			62.7		
Use of intercropping (%)	90.2			72.5		
Number of observations (People)	51			51		

awareness of the certification process (such as certification of good agricultural practice and organic farming). In addition, there is a need for the maintenance of infrastructure (production pathways) to support production and improve productivity. Among the non-cooperative farmers, 62.7% perceived the current production pathway as poor. This finding is consistent with that of (Ajah, 2015) who indicated that cooperative farmers' access to farm inputs was significantly higher than that of non-cooperative farmers (15.7%). Notably, 51% of cooperative farmers and 76.5% of non-cooperative farmers are familiar with using the internet to source information and support their coffee-related cultivation processes. The internet has also given farmers access to information from different sources regarding prices and modern coffee cultivation techniques.

3.4 Comparative analysis cost and profitability

The results of our study indicate that the average cost of Arabica coffee production by cooperative farmers was 2680 kg/month, while that by non-cooperative farmers was 1899 kg/month (Table 6). The average total variable cost incurred by Arabica coffee cooperative farmers and non-cooperative farmers was IDR 971273 and IDR 48287, respectively. The share of variable costs for cooperative farmers was 93.16%, similar to that of non-cooperative farmers (93.41%). The primary component of the total variable cost of respondents was the cost of hired labor, equating to 48.07% (IDR 501176) of the total cost for cooperative farmers and 50.34% (IDR

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Table 5. Respondents' perceptions of the challenges related to Arabica coffee farming in the Kerinci Regency, Indonesia.

Challenge	Cooperative farmers		Non-cooperative farmers	
	Number	%	Number	%
Difficulty in selling and cultivation				
None	46	90.2	51	100
Accumulated yields	1	2		
Payment delay	3	5.9		
Price-related argument	1	2		
Government support				
None	49	96.2	16	31.4
Seed and fertilizer	1	2	26	51
Shade plants	1	2	9	17.6
Bank loan				
No	51	100	51	100
Yes	0	0		
Financial hurdles				
Price	37	72.6	51	100
Capital	10	19.6		
Administration	4	7.8		
Certification				
Low awareness	32	69	37	72.5
No opportunity for certification	14	27.5	10	19.6
Never heard	5	9.8	4	7.8
Production pathway				
Good	31	60.8	14	27.1
Adequate	12	23.5	5	9.8
Poor	8	15.7	32	62.7
Internet usage				
Applied	26	51	39	76.5
Not applied	12	23.5	6	11.8
Unable to use	13	25.5	6	11.8
Welfare, basic facilities				
Good	30	58.8	50	98
Adequate	7	13.7		
Poor	14	27.5	1	1.96
Number of observations (People)	51		51	

260000) for non-cooperative farmers. Our findings indicated a significant difference between cooperative and non-cooperative farmers in terms of total variable costs (p = 0.0000). The second largest variable cost was that of production material, amounting to a total of IDR 349608. This equates to 33.53% of respondents' total costs for non-cooperative farmers and 22.36% for cooperative farmers. These results indicate that production and material costs are slightly higher than hired labor cost, thus representing the main variable cost. This was also reported by Audrey and Djuwendah (2018) who found total variable costs to be greater than total fixed costs, which amounted to 54.48%. Marketing and transportation contributed to the lowest share of variable cost components, which correlates to our findings that farmers rarely need marketing and transport-related support as buyers (cooperative and powder coffee mill) are in close proximity to their farms. In addition to farmers' variable costs, our survey also focused on fixed costs. Fixed costs included depreciation, repair, and maintenance, and were calculated to be 3.97 and 2.34% for cooperative farmers and non-cooperative farmers, respectively. Maintenance amounted to 2.88 and 4.25% for cooperative and non-cooperative farmers, respectively, while the total fixed costs for cooperative farmers amounted to IDR 71353 (6.84%) and IDR 34044 (6.59%) for non-cooperative farmers. Statistical test results indicated a significant difference in terms of the total fixed cost between cooperative and non-cooperative farmers (p = 0.0016). These results indicate that the total cost for cooperative farmers (IDR 1042626) was greater than the total cost for non-cooperative farmers (IDR 516531), as confirmed by a t-test (p = 0.0000). With successive increases in production intensity and required materials, further improvements were observed owing to cooperative farmers wanting to increase yields of Arabica coffee.

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Table 6. Average cost and profitability of Arabica farming in the Kerinci Regency, Indonesia.

Cost item	Cooperative Farmers (51)			Non-Cooperative Farmers (51)			Pooled Data (102)			*P*- Value
	Quantity	Cost (IDR)	Share (%)	Quantity	Cost (IDR)	Share (%)	Quantity	Cost (IDR)	Share (%)	
Variable Cost										
Tools		20000	1.92		69000	13.36		89000	5.71	0.275
Production and material		349608	33.53		115487	22.36		465095	29.83	0.0000*
Hired Labor (People/Month)	3.18	501176	48.07	2.58	260000	50.34	5.76	761176	48.82	0.0002*
Marketing and Transportation		100489	9.64		38000	7.36		138489	8.88	0.0005*
A. Total variable cost		971273	93.16		482487	93.41		1453760	93.24	0.0000*
Fixed Cost										
Depreciation		41353	3.97		12083	2.34		53436	3.43	0.0058*
Repair and Maintenance (Per month)		30000	2.88		21961	4.25		51961	3.33	0.1437
B. Total fixed cost		71353	6.84		34044	6.59		105397	6.76	0.0016*
C. Cost production (D/E)		2680	0.26		1899	0.37		4579	0.29	0.0000*
D. Total Cost (A+B)		1042626			516531			1559157		0.0000*
E. Yield (Kg/Month)		389			272					0.0915
F. Sales Price		8500			7088					0.0000*
G. Gross Profit (E x F)		3306500			1927936					0.668
H. Net Profit (G-D)		2263874			1411405					0.0080*
I. Cost-Benefit Ratio (G/D)		3.17			3.73					0.0000*

*Statistically significant, $p < 0.05$.

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The average yield per month for cooperative farmers and non-cooperative farmers was 389 and 272 kg, respectively. This corresponds to the findings reported by Francesconi and Ruben (2012), who investigated the effects of being in a cooperative and found that members produced higher volumes per unit input compared to farmers who were not cooperative members. Although the average yield of coffee farmed in Jambi Province is reported as 977 kg/month (Central Bureau of Statistics (BPS), 2019), in our study a number of respondents mentioned that pests such as weasels and ants had decreased their yields. The sale price of Arabica coffee by cooperative farmers of IDR 8500/kg differed significantly from that of non-cooperative farmers (IDR 7088/kg) (p = 0.0000). Furthermore, the gross profit value for cooperative farmers was IDR 3306500, and IDR 1927936 for non-cooperative farmers. The most significant outcome of our survey was the difference in net profit gained between cooperative (IDR 2263874) and non-cooperative farmers (IDR 1411405). These results correspond to those observed in previous studies. For example, a study of maize and horticultural cooperatives in Rwanda found significant differences in income levels between members and non-members (Verhofstadt and Maertens, 2014).

In our study, a 3.17 and 3.73 rate of return was reported for cooperative and non-cooperative farmers, respectively. This finding has important implications for developing Arabica coffee farmers in the Kerinci Regency, as it highlights the benefits of becoming a cooperative member. Cooperatives play a crucial role in increasing the income of farmers, giving them a higher price than that received by non-cooperative farmers. As cooperatives have strict quality regulations, farmers are encouraged to maintain high-quality cultivation and post-harvest production management practices. However, because of the higher quality demanded from cooperatives and the longer harvesting season of Arabica coffee, farmers prefer to pick and sell immediately without meeting the required quality. These conditions affect the reluctance of farmers to join the cooperative. Cooperatives also provide detailed technical guidance for pre- and post-cultivation related to good Arabica coffee farming management. This was found to have significantly improved the farming practices of cooperative farmers for producing good quality red cherries of Arabica coffee by 117 kg/month (Table 7). Distinct sales can affect the prices set by cooperative and non-cooperative farmers. Our findings revealed that cooperative farmers sell red cherries for IDR 8500, while non-cooperative farmers sell a mix of poor-quality green logs for IDR 7088 (Table 7).

Furthermore, sale destinations are crucial for determining revenue and differences between the two types of farmers. Despite increased profit, cultivation and production costs of farmers' cooperatives were 49.5% higher than those of non-cooperative farmers. This is because the cultivation and production of high-quality red cherries require more tools, materials, and a longer post-harvesting process than the production of Arabica coffee green logs (shorter cultivation period and production process) primarily sold by non-cooperative farmers. Notably, a net profit of IDR 852469 for cooperative farmers (60.40% more than non-cooperative farmers) allows a number of reliable conclusions to be drawn from our findings. However, our results indicate that 5.9% of cooperative farmers still sell to coffee mills for immediate cash flow purposes, including daily needs and children's education fees. Furthermore, results from the two-sample t-test revealed a significant difference between the net profit obtained by cooperative and non-cooperative farmers (p = 0.0080). These results correspond to the findings of several studies conducted on cooperatives in southern Ethiopia, where the farming income of rural households within cooperatives was higher than that of farmers not in cooperatives (Getnet and Anullo, 2012).

Despite promising results, we acknowledge the limitations of our study. We did not clarify the factors affecting the net income of Arabica coffee farmers owing to data constraints and thus, we suggest that further research focus on the factors affecting the cost and profitability of Arabica coffee farming. We suggest that local government in Indonesian rural areas adopt our novel finding that increasing net profit is a key benefit for small farmers who join cooperatives to encourage farmers to join agricultural cooperatives.

4. Conclusion

The present study was designed to investigate the cost, profitability, and challenges of Arabica coffee farming for cooperative and non-cooperative farmers in the Kerinci Regency, Indonesia, based on a direct survey of 102 Arabica coffee farmers. The study identified that the biggest element of variable costs for both cooperative

Table 7. Quality, suppliers, price-cost, and sales destination related to the cultivation and production of Arabica coffee in the Kerinci Regency, Indonesia.

Quality Form	Suppliers (farmers)	Price (IDR)	Cost (IDR)	Sales destination
High	Cooperative	8500	1942626	Cooperative
Low	Non-Cooperative	7088	516531	Powder coffee mill

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and non-cooperative farmers is hired labor. Within this context, we suggest that farmers use local labor to decrease this cost. As farming land is small, respondents also suggested cultivating Arabica coffee together with family members to reduce the need for daily wages. Our findings from this novel study reveal the difference in the sale price and net profit between cooperative and non -cooperative farmers. These findings emphasize the benefits of joining cooperatives, as cooperatives are able to provide higher prices as well as guidance for more efficient cultivation techniques that improve the yields of Arabica coffee. Moreover, cooperatives can be instrumental in increasing farmers' income from Arabica coffee farming in the future.

Conflict of interest

The authors declare no conflict of interest.

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