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THE HETEROGENEITY OF SMALL, MID-SCALE, AND LARGE-SCALE CURLY RED CHILI FARMING IN MEGAMENDUNG, INDONESIA

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ABSTRACT

The change in land tenure and the shrinking size of agricultural land in Indonesia are recurring discussion topics. For farming to be sustainable, higher profit must be gained, particularly as a backup in the increasing number of small farms. This study aims to examine the farming practices of curly red chili at three farming scale levels: large-scale, mid-scale, and small farms. The observations, surveys, and interviews were conducted to obtain curly red chili production data during the wet season (December 2021 - March 2022) in Megamendung Sub-district. The farm parameters were presented descriptively; conversely, the farm's efficiency was measured using the R/C ratio of explicit cost and implicit costs. As many as 30 farmers are chosen using a purposive sampling technique. The study revealed that the profits gained by farmers depend on the farms scale with the largest share of large-scale farms, followed by mid-scale and small farms, whose R/C ratios on explicit cost were 9.50, 9.03, and 7.50, respectively. Mid-scale farms benefit from the high selling prices of the selected marketing channels; on the other hand, large-scale farms benefit from efficient production factors. Evidence shows that small farms may utilize both production factors and distribution channels less effectively. It is important for the government to consider implementing land consolidation for fragmented land like this. Land consolidation will assist farmers in the process of managing land and production systems in groups to make efficient use of farming production factors.

Keywords: Curly red chili; Farming; Land scale; R/C ratio

INTRODUCTION

Since Indonesia's land area continues to diminish, the agricultural industry is undergoing reorganization. According to the Central Bureau of Statistics (2021), agricultural land in Indonesia has dropped by 600 thousand hectares during the past five years. This drop was caused by policies promoting infrastructure development, particularly in the Java island region. In contrast, the policy of increasing land area or printing new land outside of Java must meet national productivity standards and produce crops of low quality (Saidah *et al*., 2019).

The land tenure system of agricultural households is dominated by farmer groups with a limited land area of 0.10 to 0.49 hectares. According to Central Bureau of Statistics (2021) data spanning a decade, farm households have decreased by 16.32%. In 2003, 9.3 million households held land tenures of less than 1,000 m^2; in 2013, that number decreased to 4.3 million. As small household farms proliferate, the

amount of fragmented land continues to expand. This relates to Susilowati & Maulana (2012) assertion that as land-using households increase, the number of small farms in the less than a 0.1 ha group increases due to land fragmentation.

The common definition of a small farm refers to the size of the farm and the number of animals reared (Von Braun & Mirzabaev, 2015). Small farms in The United States of America average 231 acres, mid-scale farms average 1,421 acres, and large-scale farms average 2,010 acres. However, Indonesia's standard of land scale cannot be compared to a country with a vast expanse like The United States of America. Sajogyo (1977) pioneered the grouping of land area in Indonesia by dividing farmers in Java into three categories: small farms with a farm size of less than 0.5 ha., mid-scale farms with a farm size between 0.5 to 1 ha., and large-scale farms with a farm size of more than 1.0 ha.. Later, the BPS used this category for classifying agricultural families by farm size in food and horticulture.

Most small farms in Indonesia are concentrated in the Java region, where the land characteristics tend to be arid (dry land). Relative to other commodities cultivated on dry soil, horticulture crops occupy 37.40% less land. In addition, farmers experiencing a drop in land area was the curly red chili crop. On the demand side, curly red chili holds a prominent position (Islam *et al*., 2020; Saidah *et al*., 2019). In 2021, the total consumption of curly red chili in Indonesia reached 490,83 thousand tonnes. Almost every region of Indonesia cultivates curly red chili. Megamendung Sub-district in the Bogor Regency is one of the top ten producers of curly red chili in the province of West Java, which is in the top ten worldwide. Megamendung Sub-district is a mountainous region 708 meters above sea level, with an ideal air temperature of 22 degrees Celsius and latosol soil, known as tropical red soil. Latosol soil types are abundant in the tropics, and their high amounts of iron and aluminium oxides promote the growth of curly red chilies (Wati *et al*., 2019).

According to farmers, growing curly red chilies is more profitable than growing other horticultural crops in that region. This is because red chili has a fairly high selling price and the demand this commodity from that area tends to be high. Historically, land ownership was solely held by farmers; however, a survey found a fall in land ownership. In 2013, farmers possessed 23% of the total curly red chili land; however, all land ownership has changed hands. Farmers, once landowners, are now tenants who must pay rent for the land they organized. Typically, a corporation owns the right of land use to the farmed area. The corporation allows inhabitants to cultivate on the proviso that they will leave if the area is developed. In addition to the corporation, there is uncertainty for the farmers. The corporation may use the area for any construction or business that may harm the existence of farming.

The administration of cultivated land in Megamendung Subdistrict is fragmented. The allocation of farmed and leased land is based on the farmer's ability to pay; thus, each farmer has a distinct region. The variety of land ownership influences profit differentials (Guiomar *et al*., 2018; Kryszak *et al*., 2021). Study by Latifa & Sinta (2022) and Noack & Larsen (2019), demonstrated that farming on small farms is unprofitable. However, it cannot be compared to other smallholders in an agriculture-based country, as the Noack & Larsen (2019) research focused on farming on significant tracts of land owned by a corporation.

It is fascinating to study research on farming performance in diverse land areas. Some researchers study some necessary topics relate to variations in how farmers utilize their producing factors (Guiomar *et al*., 2018; Kryszak *et al*., 2021; Ncube, 2020; Noack & Larsen, 2019). This will support earlier studies indicating that land scale generates a beneficial effect on the farmer's income (Debonne *et al.,* 2021; Kryszak *et al*., 2021). The larger land cultivated by a farmer, the greater the production and income per unit of land (Geo *et al*., 2020).

After accounting for all expenses, this study calculates the profit from growing curly red chilies. It describes the utilization of its production factors at three scales: large-scale, mid-scale, and small farms. Initial studies have analyzed chili farming on a

standardized basis (Bunyamin *et al*., 2021; Latifa & Sinta, 2022; Sembiring & Waluyati, 2021; Sobczak & Sobczak, 2021). However, it is necessary to separate the income value of the three company tiers for this investigation. Hence, the final value represents the mean value of all farmers. Similar to prior research (Latifa & Sinta, 2022; Sembiring & Waluyati, 2021), this study measures income analysis using the revenue cost ratio (R/C ratio), nevertheless, the sources of revenue and expenses are provided and quantified in cash. Farm scale categories, according to Sajogyo (1977), specifically to the large-scale farms (owning more than 1 ha. of land), mid-scale farms (owning land between 0.5 to 1 ha.), and small farms (owning land between 0.1 to 0.5 ha.) (owning less than 0.5 ha.). This research refers to those scale categories.

To ascertain if large-scale, mid-scale, and small farming discrepancies exist, this study purposively analyzes the characteristics of farmers, their farming practices, and the value of the income and costs related to producing CRC commodities. This research provides benefits for farmers to determine the level of profit and to find out whether their factors of production have been used efficiently. Land fragmentation is considered to result in losses since farmers in a small-fragmented land tend to use production inputs excessively. The implication of this research also encourages the government to reinforce the land consolidation program, which will advantage farmers in managing their input production efficiently.

METHOD

This study employed a descriptive and quantitative approach. Employing the quantitative method, the R/C ratio (Return Cost Ratio) was utilized to analyze farmer's financial feasibility. This investigation was conducted in Megamendung Sub-district of the Bogor Regency. The cost and revenue of growing curly red chilies (CRC) were also analyzed. Since it is one of the top three producers of CRC in Bogor Regency, the site was chosen on purpose (Central Bureau of Statistics, 2021). It is expected that the sample can represent the diversity of farming from three different land area scales.

The sampling technique used is non-probability sampling namely purposive sampling, which is taken through several considerations. The selection of respondents is based on the following criteria: 1) the farmer planted in December 2021 to March 2022, months of the highest productivity (Zangmo *et al*., 2020); 2) applying monoculture crop production farms; and 3) the farmer had no crop failure. The eligibility requirements have left 30 respondents out of 42 population of chili farmers. Those farmers are members of four main farmers groups: Suka Resmi Tani Mandiri, Cikatapis Maju Berkah, Tunas Tani Pangrango, and Bojong Kaso Girang.

Data Collection

The research data were cross-sectional data collected directly from through census. The data was collected from June to October 2022. Data gathering techniques were conducted using interviews with the leaders of the farmer's group. In addition, the study utilized secondary data acquired from textbooks, scientific journals, research reports, and associated institutions, such as the Central Bureau of Statistics (BPS) and the Agriculture, Food Crops, Horticulture and Plantation Agency of Bogor Regency.

As research instruments, questionnaires were utilized in survey and interview activities. There were both closed (structured) and open questions on the questionnaire. Closed-ended questions comprised structured questions for which the solutions had been provided; on the other hand, open-ended questions had questions for which the answers were descriptive. The preliminary research consisted of collecting the initial three samples to determine the variety of production parameters, such as the type of fertilizer and pesticides. During the research phase, the questionnaire specified the general conditions of CRC production variables at the research location.

Data Analysis

Descriptive Analysis

Descriptive analysis is a method that employs interviews and observations. This method determines farmer age, education, farming experience, land size, and land ownership status rent. Data is analyzed in the form of narration or text. In addition to quantitative analysis, descriptive analysis was used to explain the results of quantitative analysis.

Quantitative Analysis

The quantitative analysis discusses company costs, including operational and implicit costs. In the quantitative method, we re-examine company cost, revenue, and productivity by converting the actual measurement of land (in kilograms per meter squares or similar units) to the number per ha. of cropland. To parallel the input and output generated in an average meter square of cropland to hectares, it is multiplied by the cropland equivalence factor. Using Microsoft Excel as a data calculating tool, quantitative data is processed manually, and the results are presented in tabular format. The quantitative analysis examines revenue, costs, and the R/C ratio, adopting the theory developed by Soekartawi (2016).

The total revenue is the sum of explicit revenue and implicit revenue. Explicit revenue is the worth of the products sold by farmers; on the other hand, implicit revenue is the value of unsold crops for household consumption or donation. It can be expressed systematically as follows (1):

$$TR = ETR + ITR \quad (1)$$

As revenue derives from multiplying production by the product's selling price, the formula for explicit revenue and implicit revenue is written in formulas (2) and (3) respectively.

$$ETR = (Y_i \,.\, Py_i) \quad (2)$$
$$ITR = (Y_i \,.\, Ps_i) \quad (3)$$

Description :
ETR = Explicit revenue (IDR)
ITR = Implicit revenue (IDR)
Y_i = Curly red chili production (kg.)
Py = Explicit price of Y_i (IDR/kg.)
Ps = Implicit price of Y_i (IDR/kg.)

Generally, costs are classified as explicit costs and implicit costs. Farmers made a direct payment to others in cash, classified by explicit cost. Implicit costs are known as tangible expenses that do not involve a payment of money; however, they must still be calculated since it reflects the potential cost in CRC farming. Equation (4) is used to determine the formula for calculating the agricultural profit.

$$\pi = (\Sigma ETR_i + \Sigma ITR_i) - (\Sigma Ec_i + \Sigma Ic_i) \quad (4)$$

Description :
Ec_i = Explicit cost (IDR/ha.)
Ic_i = Implicit cost (IDR/ha.)

The Return and Cost Ratio (R/C ratio) reveals a farm's profitability. This ratio is used to determine the profitability of farming based on the revenue farmers receive per rupiah invested in cultivation. Two forms of R/C ratios exist the R/C ratio on explicit cost (α_1) and the R/C ratio on total cost (α_2). The mathematical formula for calculating the R/C ratio value is shown in equations (5) and (6).

$$\text{R/C on explicit cost } (\alpha_1) = {}^{TR}/_{(\Sigma Ec_i\ Ic_i)} \quad (5)$$

$$\text{R/C over total cost } (\alpha_2) = {}^{TR}/_{(\Sigma Ec_i + \Sigma Ic_i)} \quad (6)$$

The R/C ratio determines the gain of the investment value which may result in some possibilities. Justification of any possible conditions is 1) If the ratio $\alpha_{1,2} = 1$, then the farm is at the break-even point which refers to the market price of an asset that is the same as its original cost; 2) if the ratio $\alpha_{1,2} > 1$, then the farm is considered profitable, 3) if the ratio $\alpha_{1,2} < 1$, then the farm is considered a loss, and 4) if $\alpha_1 > 1$ but $\alpha_2 < 1$, then the farm in the research location is still profitable; however, operational gains may be lost when implicit costs are considered.

RESULTS AND DISCUSSION

Farmer Characteristics

The characteristics of farmers were categorized based on their age, level of education, agricultural experience, land size, and land ownership status. Table 1 displays the agricultural classifications.

Table 1. Features of Curly Red Chili Farms in the Region of Megamendung

No	Farmer Personalities	Category	Interval	Large-Scale Farms (%)	Mid-scale Farms (%)	Small Farms (%)
1.	Farmer Age	Unproductive	<15 years	0	0	0
		Productive	15 – 64 years	89	100	100
		Unproductive	> 70 years	11	0	0
2.	Education (last graduation)	Low	Primary School	33	56	75
		Middle	Junior High School	44	11	25
		High	Senior High School	22	33	0
3.	Farming Experience	Less experienced	1-10 years	67	67	75
		Experienced	11-58 years	33	33	25
4.	Land size	Narrow	< 0,5 ha	0	0	100
		Mid-scale	0,5 - 1,0 ha	0	100	0
		Large-scale	> 1,0 ha	100	0	0
5.	Land Ownership Status Rent	Tenant		0	0	0
		Peasant		89	78	75
		Tenant & peasant		11	22	25

Source: Primary data processed, 2022

Table 1 displays the characteristics of CRC farmers in the study area. The land is a production element whose annual costs are paid in cash. There are as many as nine farmers (30%) categorized as large-scale farms, nine farmers (30%) classed as mid-scale farms, and twelve farmers (40%) classified as small farms. All mid-scale and small farms are in the productive age group, although there are still farmers in the non-productive age group at the large-scale farms. Age affects agricultural production, with farmers of productive age possessing strong physical capacities and being receptive to new ideas. Large-scale farms that pass their productive years typically hire additional laborers for land cultivation and harvesting (Bahtera *et al*., 2020; Mariyono, 2019). Some research reveals that elderly farmers may have less comprehension but have the advantage of being able to assess the farm's status (Debonne *et al*., 2021; Mariyono, 2019).

Education level indicates a farmer's capacity to accept new technologies. Farmers with a greater level of education are more innovative and dynamic than farmers with a lower level of education. The education levels of farmers are categorized as small, mid-scale, and large-scale. Table 1 indicates that no farmers at a small scale have a high school education. At the same time, the mid and large-scale

farmers are better in having higher education. Small farms have limited expertise; therefore, production parameters depend solely on experience instead of the incorporation of new data. This is similar to research indicating that small farms typically require assistance to adopt technology developments (Debonne *et al*., 2021; Ncube, 2020).

The level of education has a significant effect on the profits of CRC farming (Saidah *et al*., 2019). Farmer's experience has a positive impact on farmers' ability to manage farmland. The length of time in farming has enabled them to make more effective decisions (Minten *et al*., 2020). Farmers are categorized as less experienced since they have been farming for a maximum of ten years. The decision-making process of experienced farmers will be more deliberative due to their accumulated farming experience. Above their level of education, small, mid-scale, and large-scale farms typically need more experience.

The land is a component that can affect farmer's income and profit (Geo *et al*., 2020; Kryszak *et al*., 2021; Saidah *et al*., 2019). Correspond to Sajogyo (1977), this study divides the size of farmers' businesses according to the area of their land, notably large-scale farms, mid-scale farms, and small farms. According to Table 1, the CRC farming in Megamendung Subdistrict is dominated by small farms (40%). Based on the land ownership, for those three scales, no farmers act as landowners, which means farmers work as tenants or peasant. Peasant is a person who normally does not have sufficient land and cultivates other's land to earn his livelihood, while tenant refers to a person who farms the land of another and pays rent, in this study, with cash. It may be more reasonable to utilize the land rented more efficiently so that the rental charge can be paid (Han *et al*., 2021; Kryszak *et al*., 2021). This describes a phenomenon that tenant farmers dominate land ownership among Indonesian farmers. Due to the rental responsibilities, the rental land would decrease farmers' profits.

Analysis of Farm Income

The income analysis of CRC farming in the subdistrict of Megamendung is based on revenue and expense components. Farm revenue is a sum between explicit revenue and implicit revenue. Explicit revenue is tangible expenses with the exchange of cash. In contrast, implicit revenue refers to non-cash receipts obtained from the CRC leftover that aren't sold, but are used for household consumption or handout to neighbors. Similar to revenue, farming expenses are categorized as explicit costs and implicit costs. Table 2 analyses large-scale, mid-scale, and small CRC farms.

Table 2 reveals that the total revenue of CRC farming on large-scale, mid-scale, and small farms throughout one growing season is IDR 300,229,340 per ha.; IDR 322,059,512 per ha. and IDR 264,318,182 per ha.. The production and selling price governs the revenue earned by farmers. Considering that the scale of this study is 1 hectare, the term productivity is more applicable (Kryszak *et al*., 2021; Sembiring & Waluyati, 2021). The productivity of CRC in the studied area differs between large-scale, mid-scale, and small enterprises. At 10,197 kg per ha., the highest CRC yield is produced by large-scale farms, attaining national productivity. In contrast, the productivity of CRC for mid-scale and small farms is relatively low at 7,949 kg per ha. and 7,079 kg per ha. respectively, below the minimum chili production value in Indonesia, which ranges between 8,000 kg per ha. and 10,000 kg per ha.. This supports a preliminary study by (Kryszak *et al*., 2021; Minten *et al*., 2020) that medium-scale tenant farmers can produce more output than small farms' do.

Depending on the purchaser, the selling price of CRC ranges from IDR 25,000 to 50,000 per kg at each farm scale. Farmers' selling prices tend to be higher in non-metropolitan areas such as Jambi (Latifa & Sinta, 2022) and Yogyakarta (Sembiring & Waluyati, 2021) which gained a profit of IDR 20,400 per kg and IDR 12,863 per kg respectively. For farmers with large-scale, mid-scale, and small, the average price of CRC is IDR 29,444 per kg, IDR 40,000 per kg, and IDR 37,500 per kg, respectively. A case study in Africa (Ncube, 2020) found that large-scale farms get into arrangements

with intermediaries before harvest. Large-scale farmers must sell their yield at low prices due to the subjection to the middlemen, however, their end-customer is classified as a traditional market user. Large-scale farms may experience a price disadvantage; however, they get a warranty for an adequate harvest to completely sell out (Mariyono, 2019).

Table 2. Analysis of Curly Red Chili Farming at Three Scales per Hectare per Growing Season

Components	Large-scale Farms IDR/ha.		Mid-scale Farms IDR/ha.		Small Farms IDR/ha.	
	Total	%	Total	%	Total	%
Revenue						
Explicit Revenue	299,965,278		321,836,735		263,636,364	
Implicit Revenue	264,063		222,778		681,818	
Total Revenue	300,229,340		322,059,512		264,318,182	
Explicit Cost						
Seeds	1,405,625	3.49	1,481,633	3.18	2,451,515	4.76
Manure	9,437,500	23.44	5,454,810	11.69	10,250,000	19.89
Inorganic Fertilizer	2,372,500	5.89	1,969,388	4.22	2,712,121	5.26
Pesticides	1,873,438	4.65	2,183,673	4.68	3,372,727	6.54
External laborers	10,351,250	25.71	16,210,102	34.75	10,466,721	20.31
Land Rent	4,687,500	11.64	7,040,816	15.09	6,515,152	12.64
Truck Rent	1,437,500	3.57	1,306,122	2.80	181,818	0.35
Total Explicit Cost	31,565,313	78.41	35,646,545	76.42	35,950,054	69.75
Implicit Cost						
Family Laborers	2,438,250	6.06	3,484,898	7.47	8,218,901	15.95
Motorbike Rent	0	0.00	673,469	1.44	909,091	1.76
Depreciation	6,251,880	15.53	6,840,224	2.39	6,462,111	2.84
Total Implicit Cost	8,690,130	21.59	10,998,592	23.58	15,590,102	30.25
Total Cost	40,255,442	100.00	46,645,137	100.00	51,540,156	100.00
Income on Explicit Cost	268,399,965		286,190,190		227,686,309	
Income on Total Cost	259,709,836		275,191,598		212,096,207	
R/C Ratio on Explicit Cost	**9.50**		**9.03**		**7.33**	
R/C Ratio on Total Cost	**7.45**		**6.90**		**5.12**	

Source: Primary data processed, 2022

Mid-scale farms sell their crops to other middlemen with specialized distribution channels to modern markets, resulting in better prices for the farmers than large-scale farms earn. The finding is similar to Debonne *et al*. (2021) claims that medium and large-scale farms are active in highly specialized markets. Moreover, small farms utilize short distribution networks by selling directly to consumers, benefiting from short marketing channels. This research is confined to farmers' income; therefore, additional research may be required to determine the efficacy of the marketing channel for CRC in that region. Choosing a short marketing channel should be the right method for farmers because it reduces marketing margins and increases farmer share (Murry & Tsopoe, 2019). The research by Jorwar *et al*. (2018) underlying that reducing the number of intermediaries is necessary to minimise marketing costs and losses. This analysis will aid farmers in comprehending the most effective method for marketing their production, resulting in increased profit margins.

This study indicated that even though the productivity rate of mid-scale farms was lower than that of large-scale farms, their revenue was the highest compared to other farmers. This is since the selling price received by mid-scale farms is often high. The selling price has a positive effect on farm income (Debonne *et al*., 2021; Mariyono, 2019; Saidah *et al*., 2019). Small farms have the highest value in terms of non-cash income. This indicates that small farms typically consume CRC for personal

consumption before selling the remainder. According to Bahtera *et al*. (2020) and Mariyono (2019), this trait is innate to a smallholder farm.

The revenue of CRC in this study tends to provide a greater average revenue than that other studies have found. Astutik *et al*. (2019) researched the cayenne pepper income in Lumajang Regency and reveals a difference in the profits gained between small scale and big scale land. This study shares similarities with sub-studies by Bunyamin *et al*. (2021), Latifa & Sinta (2022), and Sembiring & Waluyati (2021) showing that large-scale farms can earn up to IDR 300 million per ha. per growing season while small farms can only earn as much as IDR 96.4 million per ha. and IDR 88.6 million per ha. per growing season.

Analysis of Farm Input Use

Inputs are the resources used to make outputs, in this case, CRC yield. Agricultural production will only yield ideal results if it is supported by agricultural inputs, such as materials derived from natural resources, labor, and modal. Their use of agricultural inputs will determine the number of costs farmers incurs. There are two categories of farming cost, explicit and implicit cost, which all are included in this calculation. The size or quantity of the products produced affects cash costs. The implicit considerations are not incurred directly by farmers but must be calculated for determining the number of resources employed. Explicit costs include ongoing cash for land, car rentals, and variable cash costs for seeds, manure and inorganic fertilizers, pesticides, and external laborers. The implicit cost consists of assumed fixed expenditures, such as the depreciation of equipment and motorbike rentals, and imputed variable costs, such as family laborers.

Figure 1 shows the distribution frequency of the area cultivated. The average land area cultivated by large-scale farms is 1.77 ha. In comparison, the average land area cultivated by mid-scale and small farms is 0.54 ha. and 0.275 ha., respectively, and the total land area is 24.2 ha.. Most farmland in the study area consists of peasant works (80%); on the other hand, the remaining 20% comprises rented and peasant works. The annual land rental costs for large-scale, mid-scale, and small farms are IDR4.6 million per ha., IDR7.0 million per ha., and IDR6.5 million per ha.. Mid-scale farms face the drawback of using land highly prized by tenants; thus, they must pay higher.

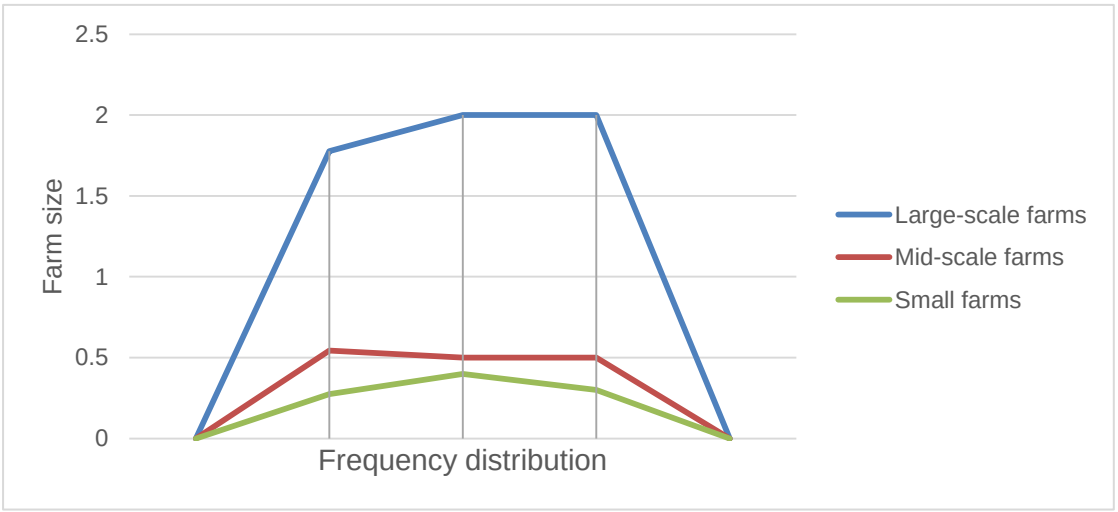

Figure 1. Farm size distribution
Source: Primary data processed, 2022

Large-scale farms incurred an explicit cost of IDR 31,565,313 per ha., although mid-scale and small farms faced higher explicit costs on average. A similar conclusion was reached by Debonne *et al*. (2021) and Noack & Larsen (2019) where there is a

cost savings over higher output per unit of labor in larger farms. At overall firm sizes, the most significant percentage of explicit cost outlays is devoted to labor costs, particularly non-family labor (Minten *et al*., 2020; Sembiring & Waluyati, 2021). This is comparable to Geo *et al*. (2020), and Sobczak & Sobczak (2021) that the use of labor has a significant effect on production costs which holds the highest proportion. In Megamendung Sub-district, labor is used for land preparation, planting, weeding, fertilizing, weeding, spraying, and harvesting. Man-day work (HOK) is a unit of measurement for labor utilization. The labor output varies by gender; female labor is valued at 0.80 and male labor is valued at 1.

External laborers and family laborers are responsible for all aspects of cultivation, including processing, planting, maintenance, and harvesting. A similar pattern of results was obtained by Islam *et al*. (2020) stated that the difference lies in the amount of labor expended, with external laborers requiring more labor than family laborers. The proportion of family laborers and external laborers is depicted in Figure 2.

Figure 2. Comparison of external laborers and family laborers use in CRC farming in large-scale, mid-scale and small farms
Source: Primary data processed, 2022

Figure 2 demonstrates that the ratio of external laborers to family laborers varies throughout the three scales. This study supports the finding of Debonne *et al*. (2021) stated that small farms typically employ more family members than other laborers. This is because little time is required on a small scale of land, and daily wage labor will boost farming costs (Daramola *et al*., 2021; Kryszak *et al*., 2021). In the case of large-scale farms, family laborers are allocated mainly for farming activities; however, small farms rely on family laborers for nearly all activities. This result ties well with previous studies wherein mid-scale farms typically delegate 90% of their labor to other workers (Minten *et al*., 2020). The average number of man-day work (HOK) spent on family laborers by large-scale, small, and mid-scale farms is 40.64, 59.55, and 185.75 man-day, respectively; on the other hand, the average number of man-days spent on external laborers is 185.7, 332.65, and 206.36 HOK.

In line with Saidah *et al*. (2019), most labor is assigned to harvesting activities; on the other hand, very little labor is used for upkeep. Maintenance includes the application of fertilizer, weeding, pesticide treatment, and staking. Large-scale farms spent 17,36 HOK, 42.03 HOK, 19.44 HOK, and 5.65 HOK on these activities; on the other hand, mid-scale farms devoted 25,55 HOK, 26,90 HOK, 18.37 HOK, and 25,18 HOK, and small farms devoted 42.00 HOK, 23.76 HOK, 46.24 HOK, and 6.24 HOK, respectively. Based on these data, the maintenance workforce is often small, resulting in lower maintenance expenses.

Mid-scale farms perform minor plant upkeep relative to the other two business scales. This is also evident in using minimal quantities and doses of chemical fertilizers

and pesticides. Observations in the field indicate that the incidence of pest assaults on the fields of mid-scale farms is low. Mid-scale farmers practice crop rotation in a single growing season and invest substantial money in land cleanliness. Unfortunately, large-scale and small farms do not practice crop rotation, despite its usefulness in preventing pests and plant diseases (Islam *et al*., 2020).

Pesticides are required to control plant-disrupting organisms (pests) such as diseases, weeds, and insects. *Anthracnose, bacterial wilt,* and *leaf spot* often occur at the research site. *Anthracnose* is the leading source of economic loss for CRC farmers at the research location (Islam *et al*., 2020). This disease is caused by fungi that grow in relatively humid environments (Zangmo *et al*., 2020; Zanwar *et al*., 2022). Farmers face this danger since they choose to plant during the wet season, specifically in December (for large-scale farms) and January (for mid-scale and small farms). In addition to water availability, farms time their harvest to coincide with Islamic holy holidays (April-May). The peak season for CRC demand is during the year.

Aphids, mites, fruit flies, and *armyworms* frequently attack CRC plants in the research location. Large-scale farms are the most susceptible to pest infestations. It is likely to tend that expansive terrain has a higher probability of disease transmission. Consistent with what has been found in previous studies (Islam *et al*., 2020; Latifa & Sinta, 2022), farmers at all scales employ chemical pesticides and do not use vegetable pesticides at all. Pesticides are used only when plants are already afflicted with pests and diseases. There are two types of pesticides, i.e. insecticides and fungicides. Chemical pesticides containing the active ingredients *Profenofos* 500 g/l or *Abamectin* 18 g/l are used to remove *armyworms* and *aphid*s. The active ingredients of fungicides used to remove *aphids, mites,* and *fungi* are *Propineb* 70%*, Asibenzolar-s-methyl* 1%, or *Mankozeb* 80%. Without enough expertise, small farms utilize a variety of pesticide brands based on trial and error. The use of excessive pesticides has the potential to harm the soil (Geo *et al*., 2020) hence decreasing the yield of CRC (Zanwar *et al*., 2022).

Unlike pest and disease management, farmers do not use chemicals to kill weeds. *Amaranthus spinosus* and *Cyperus rotundus* are common weeds that harm CRC. Farmers do not use herbicides but remove weeds manually by hands or with sickles. When comparing our results to those of older studies, it must be pointed out that hand weed eradication was seen as ineffective and increased production costs (Daramola *et al*., 2021). In addition, that research suggests for the application of integrated weed management with pesticides containing *propaben*® plus hand weeding, or *butachlor* plus hand weeding could provide higher chili fruit yield.

For the plants to bear fruit densely, farmers utilize chemical fertilizers. The Agricultural Extension Service has established a standard fertilizer application rate of 100 kg./ha. for NPK, 150 kg./ha. for KCL, 100 kg./ha. for TSP, and 100 kg./ha. for urea. The mid-scale farms' use of manure is often the lowest of the three scales. Small farms, on the other hand, apply too much fertilizer. Large-scale and small farms slightly surpassed the prescribed dose of NPK fertilizer, applying 125 kg./ha. and 151.52 kg./ha., respectively, whilst mid-scale farms applied less than the recommended quantity of 63.27 kg./ha..

Farmers of mid-scale utilized more KCL fertilizer. Large-scale farms use the most KCL fertilizer, with an average of 194 kg./ha., followed by mid-scale farms, with an average of 142.86 kg./ha.. Small farms significantly surpassed the allowed dose of 393.94 kg./ha. for KCL application. Large-scale farms (216 kg./ha.) and small farms (333.33 kg./ha.) put in way more than the authorized amount of TSP fertilizer. In comparison, mid-scale farms applied the recommended dose of TSP fertilizer at 112,24 kg./ha.. Around 60 kg./ha. is the minimum urea used as a fertilizer by mid-scale and small farms. Large-scale farms do not utilize urea fertilizer since the other three types of fertilizer are sufficient for enhancing crop yields. The usage of urea fertilizer by CRC producers at all three scales remains below the required minimum.

Farmers utilize a negligible quantity of manure (organic fertilizer). The price per bag of manure is between IDR 18,000 and IDR 25,000. Large-scale farms utilize an average of 2,9 tonnes/ha. of manure, compared to 1,4 tonnes/ha. for mid-scale farms and 1.2 tonnes/ha. for small farms. Compared to the Department of Farming's recommendation, which ranges from 10 to 30 tonnes/ha., the application of manure is typically relatively low. Farmers have to be convinced that the nutritional content of manure needs to be increased, and they must be aware that manure has long-term benefits in enhancing land productivity and reducing soil degradation (Saidah *et al*., 2019).

Seeds have a major influence on the production costs of chili farming (Geo *et al*., 2020; Sobczak & Sobczak, 2021). Mainly small farms bear the expense of seed usage. Large-scale, mid-scale, and small farms utilize 106 g./ha., 110 g./ha., and 185 g./ha. of seed, respectively. The low number of seeds used by large-scale farmers is related to the wide spacing of plants. The relation between spacing and production has been observed by Daramola *et al*. (2021) where wider spacing resulted in the highest chili fruit yield per plant. Other researchers attributed this due to less competition for nutrients, water, and light in spacing level (Singh *et al*., 2019).

In addition to explicit costs, the total cost of this study included implicit costs. In line with Sembiring & Waluyati (2021), the proportion of implicit cost was often lower than explicit cost, ranging between 22 and 30% of the total cost. Depreciation of equipment is the most expensive compared to other implicit costs such as family laborers and motorbike rent. Mulch accounts for 78% of the overall cost of depreciation. Consistent with research by Debonne *et al*. (2021) and Latifa & Sinta (2022) large-scale and small farms receive the majority of family laborers, whilst mid-scale farms tend to maximize external laborers' utilization. The assessment of motorbike rent as an implicit cost is only performed for mid-scale and small farms. Car rental is carried out by large farmers, who typically have more capital at their disposal than small farms to invest in required equipment (Minten *et al*., 2020).

Revenue Cost Ratio (R/C Ratio) of Farm scale

The R/C ratio gauges the profit farmers earn by comparing the value of their revenue to their farming expenses. The R/C ratio on explicit cost indicates the relationship between explicit revenue and explicit cost. This analysis depicts farming's profitability under actual conditions. This analysis considers cash flow without factoring in the implicit cost that farmers should pay. Figure 3 illustrates the R/C ratio of explicit cost.

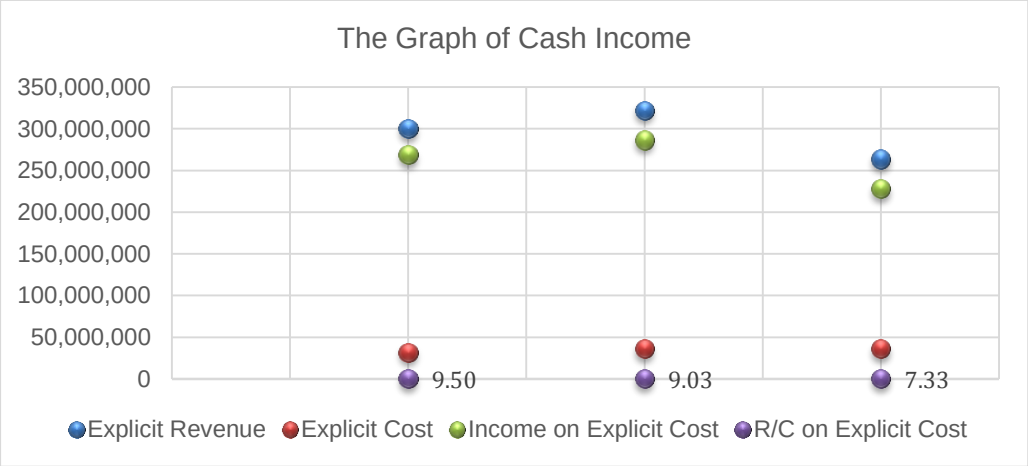

Figure 3. Comparison of cash profit values for large-scale, mid-scale and small farms
Notes: left=large-scale farms, mid=mid-scale farms, right=small farms
Source: Primary data processed, 2022

The R/C ratio for explicit cost for large-scale, mid-scale, and small farms is 9.50, 9.03, and 7.33, respectively, as depicted in Figure 3. This indicates that for every rupiah (IDR) invested in farming, large-scale farms would get IDR 9.50, while mid-scale farms will earn IDR 9.03, and small farms will earn IDR 7.33. Small farms tend to have a low calculation ratio due to low productivity. This aligns with findings in Uganda (Noack & Larsen, 2019) and implies that smaller farms have a higher proportion of farming overhead in their cost structures.

When considering the cost of all resources, the R/C ratio serves as the total cost. The R/C ratio of the implicit cost for large-scale, mid-scale, and small farms is 7.45, 6.90, and 5.12, respectively, indicating that every rupiah spent on cultivation will generate 7.45, 6.90, and 5.12 rupiah for large-scale, mid-scale, and small farms, respectively. The results of this study are comparable to Saidah *et al*. (2019) and Debonne *et al*. (2021) who examine that land area affects farming profitability, where the larger the land area, the higher the profit generated.

According to the results of the two R/C ratio calculations, developing CRC farming on large-scale, mid-scale, and minor scales in Megamendung Sub-district is profitable and practicable. This study demonstrates that there are disparities between business sizes. Since they can produce in huge quantities, large-scale farms profit from using land more intensively (Minten *et al*., 2020), using fewer inputs per unit of land (Kryszak *et al*., 2021; Noack & Larsen, 2019), and acquiring market certainty (Noack & Larsen, 2019). Large-scale farms have a comparative advantage due to their higher output values than mid-scale and small- farms. A network of specialized marketing channels benefits mid-scale farmers, resulting in higher selling prices. Compared to large-scale and mid-scale farms, small farms tend to have the lowest productivity and incorrect use of production elements, such as excessive fertilizers and pesticides. Overall, this strengthens the ideas of other researchers where the effectiveness of plant production is better done on a larger scale (Debonne *et al*., 2021; Kryszak *et al*., 2021; Noack & Larsen, 2019).

CONCLUSION

This study examines the characteristics of farmers, their farming practices, and an analysis of the revenue and cost associated with cultivating CRC commodities to determine whether large-scale, mid-scale, and small-scale disparities exist. The study demonstrates that farmers are still considered productive at all company scales. Large-scale farms are descendants of farmers with secondary education; on the other hand, other farmers have low levels of education and lack experience. The land tenure status of CRC farmers is tenancy or leasehold.

The agricultural demonstration comprises land preparation, sowing, planting, maintenance, and harvesting. There are variances in the utilization of resources; however, all farmers perform these steps. Small farms use production inputs irresponsibly, use insufficient tillage, exceed permissible KCL and NPK, and use numerous soil-degrading pesticides. This contributes to the low CRC production of small farms.

Cultivating CRC yields the most profit for large-scale farms, whose value is comparable to that of mid-scale farms. The R/C ratio analysis of explicit cost indicates that the benefits obtained by large-scale, mid-scale, and farms are 9.50, 9.03, and 7.33, respectively. This study concluded that cultivating CRC would be more profitable to implement on a large-scale farms. Large-scale farms benefit from efficient use of production components, high productivity bolstered by good cultivation management, and market security resulting from guaranteed cooperation with intermediaries. Mid-scale farmers profit from shorter distribution channels, which results in better selling prices than large-scale farms.

This study suggests that cultivating chilies on large-scale land is highly recommended over fragmented land. Due to the inefficient use of labor and the

excessive use of seeds, fertilizers, and pesticides, farming on narrow land would increase production costs. It is essential for the government to consider implementing land consolidation for fragmented land like this. Land consolidation will assist farmers in the process of managing land and production systems in groups to make efficient use of farming production factors. The group-based created in land consolidation will increase the land area cumulatively, which will reduce the cost of production usage including the cost of labor and capital. The efficient use of inputs strengthens the bargaining position of farmers, which will ultimately increase the welfare of farmers.

This study has limitations since it focuses solely on the breadth of agricultural expenditures. Researchers have yet to identify the price gap as the basis for assessing marketing efficiency or the price gap in measuring technical efficiency utilizing production parameters. There is a need for additional research to determine whether production factors have been utilized effectively at the three scales. Further research will demonstrate that large-scale, non-fragmented cultivation of curly red chilies is more profitable for farmers.

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