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ARTICLE

The competitive and comparative advantages of *aglaonema* farming in Depok City, Indonesia

As vantagens competitivas e comparativas do cultivo de aglaonemas na cidade de Depok, Indonésia

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Abstract: As the COVID-19 pandemic decreases, the demand trend for ornamental plants begins to decline. To maintain its competitiveness, it is necessary to study the government policies and the performance of *aglaonema* farming. The objectives of this study were: 1) to analyze the profitability and competitiveness of *aglaonema* in Indonesia along with the policy impact, and 2) to simulate fluctuations in *aglaonema's* competitiveness after the changes in its indicators. The Policy Analysis Matrix (PAM) was employed in supporting the descriptive and quantitative methods. The research object was the variety fiery red 'Suksom Jaipong', the most popular *aglaonema* in the 2000s. The data was collected from farmers in July 2022 - November 2022 in Depok City, one of Indonesia's centers for ornamental plants. The results of the study explained that *aglaonema* farming in Depok City was profitable and gained both competitive and comparative advantages, indicated by PCR and DRCR valued at 0.146 and 0.107. The evaluation of policy using Output Transfer, NPCO, Input Transfer, Factor Transfer, NPCI, EPC, and SRP indicators, showed that trade policies such as free trade did not harm farmers' competitiveness and on the contrary, positively stimulated *aglaonema's* competitiveness. The simulations of a decrease in production or a weakening of the Indonesian rupiah exchange rate have proven to not significantly affect competitiveness. This study concludes that the competitiveness of *aglaonema* in Depok City is relatively high, supported by the optimization of local resources.
Keywords: *Aglaonema,* competitiveness, ornamental plant, *policy analysis matrix*.

Resumo: À medida que a pandemia do COVID-19 diminui, a tendência de demanda por plantas ornamentais começa a diminuir. Para manter sua competitividade, é necessário estudar as políticas governamentais e o desempenho do cultivo de aglaonemas. Os objetivos deste estudo foram: 1) analisar a lucratividade e a competitividade de *aglaonema* na Indonésia, juntamente com o impacto político, e 2) simular flutuações na competitividade da *aglaonema* após as mudanças em seus indicadores. A Matriz de Análise de Políticas (MAP) foi empregada para subsidiar os métodos descritivos e quantitativos. O objeto de pesquisa foi a variedade Suksom Jaipong, de cor vermelho-fogo, a *aglaonema* mais popular da década de 2000. Os dados foram coletados de agricultores de julho de 2022 a novembro de 2022 na cidade de Depok, um dos centros de plantas ornamentais da Indonésia. Os resultados do estudo explicaram que o cultivo de *aglaonema* na cidade de Depok foi lucrativo e obteve vantagens competitivas e comparativas, indicadas pelos valores de PCR e DRCR de 0,146 e 0,107. A avaliação das políticas utilizando indicadores de Transferência de Produtos, NPCO, Transferência de Entradas, Transferência de Fatores, NPCI, EPC e SRP, mostrou que políticas comerciais como o livre comércio não prejudicaram a competitividade dos agricultores e, pelo contrário, estimularam positivamente a competitividade do *aglaonema*. As simulações de uma diminuição da produção ou de um enfraquecimento da taxa de câmbio da rupia Indonésia provaram não afectar significativamente a competitividade. Este estudo conclui que a competitividade de *aglaonema* na cidade de Depok é relativamente elevada, apoiada pela otimização dos recursos locais.
Palavras-chave: *Aglaonema,* competitividade, *matriz de análise de políticas*, planta ornamental.

Introduction

Horticulture is a business with growth potential within the agriculture industry. In the current era of globalization trade, Indonesian horticultural products must compete with similar products from other nations on the global market. Fruits, vegetables, ornamental plants, and biopharmaceutical plants are examples of horticultural products. Of the four horticulture commodities, ornamental plant commodities have the most business development potential (Çelik and Arisoy, 2013).

This business has tremendous growth potential in Indonesia's ornamental plant industry. Domestic and international buyers favor the variety of sorts and unusual shapes of Indonesian ornamental plants. On average, markets in the Americas and Europe prefer ornamental plants imported from Southeast Asia because they are seen as having relatively lower prices and producing a wide variety of forms and colors, particularly hybrids (Asciuto et al., 2008).

According to Central Bureau of Statistics data, *Orchids, Anthuriums, Carnations, Gerberas, Gladiolus, Heliconia, Chrysanthemums, Roses, Tuberose, Dracena, Jasmine,* and *Palm* are the principal export ornamental plant commodities. Despite fewer global statistics for *aglaonema* plants, the national production of this plant reached a relatively high level in the 2020s. *Aglaonema* is an ornamental potted plant that can grow in any environment and is simple to cultivate (Yeo, 2021; Zahara and Win, 2020; Zarliani et al., 2021). These plants demand just a modest amount of land or capital (Dominguez et al., 2017; Zarliani et al., 2021).

Presently, the strength of the *aglaonema* market for the most part comes from Thailand, China, and Indonesia, while the principal market of *aglaonema* is Japan. The purchasers come from the upper working class both locally and abroad. In Indonesia, *aglaonema* showcasing is as yet overwhelmed by national consumption. Given measurable information in 2022, the production of *aglaonema* in Indonesia was 1,396,552 trees, of which 41% of the total was cultivated in the West Java Region. There are more than 22 species and hundreds of varieties, but the *Suksom Jaipong*, a fiery red *aglaonema*, became the most popular in this era.

The growth of *aglaonema* in the era of global trade does not only rely on tariff barriers but also technical barriers such as quality, sanitary, and phytosanitary regulations. Since ornamental plants hardly compete with Thailand and Malaysia, the competitiveness of the *aglaonema* variety

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still requires to be enhanced (Santosa et al., 2018). The government implemented several policies to boost competitiveness. Government policies and protections are realized, among other strategies, through the imposition of import tariffs amounting to 10% based on Indonesia Minister of Finance Regulation Number 6/PMK.010/2017 concerning Stipulation of Import Duty Tariffs on Imported Goods (Ministerial Regulation Concerning Importation and Exportation of Horticultural Seeds, 2017), regulation of subsidized fertilizers through the Regulation of the Minister of Agriculture Number 59/2016 (Ministerial Regulation Regarding Procurement and Distribution of Subsidized Fertilizers for the Agricultural Sector, 2013), as well as setting the retail price of subsidized fuel through the Decree of the Minister of Energy and Mineral Resources Number 3448 K/12/ MEM/2017 (Ministerial Regulation concerning Retail Prices for Types Specific Fuel Oils and Types of Special Fuel Oils Assignments, 2017). Government policies may affect *aglaonema* farming positively or negatively. Government policies are deemed acceptable if they provide profits for agriculture; however, if the opposite occurs, it indicates that agriculture in the region is no longer competitive (Simamora and Nadapdap, 2021).

Principally, competitive and comparative advantage approaches are used to evaluate the competitiveness of agricultural products in different nations (Lambrecht et al., 2015; Moradnezhadi et al., 2017; Nacka et al., 2019). Competitive advantage is a product's ability to produce effectively to be competitive in both local and global markets. Comparative advantage, in contrast, refers to the ability of a region or country to produce a commodity at a lower cost than other places. Methods frequently employed to measure the competitiveness of an agricultural product include Revealed Comparative Advantage (RCA), Export Product Dynamics (EPD), and Policy Analysis Matrix (PAM).

Apart from those analysis methods, the Policy Analysis Matrix (PAM) is a suitable analytical instrument for measuring various measures of competitiveness. PAM summarises the answers to three issues that other assessment techniques cannot yet quantify: agricultural profit, competitiveness, and the effect of government policy (Monke and Pearson, 1989). Although particular studies have examined PAM (Simamora and Nadapdap, 2021) and the competitiveness of ornamental plants (Anacleto et al., 2020; Nedanov and Žutinić, 2015) there is no study conserving on PAM analysis for *aglaonema*, either in Indonesia or other regions. In this work, the analysis of *aglaonema* farming is given 1) to examine the profitability and competitiveness of *aglaonema* farming in Depok City and 2) to simulate fluctuations in *aglaonema's* competitiveness using sensitivity analysis of production unit and exchange rate.

Material and Methods

To obtain information about *aglaonema* farming, a survey was carried out with a purposive sampling technique. The study was conducted in Depok City, one of Indonesia's ornamental plant centers. Suksom Jaipong, the most favorable variety according to Haryanto et al., (2023), was selected as the locus of the research. Most of the *aglaonema* farmers in this city are members of exclusive *aglaonema* cultivators which currently reach 52 people, all of them were visited and 32 farmers agreed to participate in the research.

The competitiveness of *aglaonema* farming was analyzed using the Policy Analysis Matrix (PAM) presented by Monke and Pearson (1989). PAM initiated two identities, one defining profitability and the other measuring the effects of divergences. The steps to use this method consist of (1) identifying the input and output of *aglaonema* farming; (2) dividing cost components into tradable (foreign) and non-tradable (domestic) expenses; (3) calculating shadow pricing; and (4) tabulating in the PAM matrix (Tab. 1).

Tab. 1. Policy Analysis Matrix (PAM)

		Input Cost		
Description	**Revenue**	***Tradable***	***Non-tradable***	**Profit**
Private Price	A	B	C	D
Social Prices	E	F	G	H
Divergence Effect	I	J	K	L

Source: (Monke and Pearson, 1989)

As mentioned by Monke and Pearson (1989), the term private refers to actual market prices received or paid by farmers, thus it is incorporated into the effects of all policies and market failures. On the other hand, the term social reflects scarcity values or social opportunity costs. Policy indicators obtained from the Matrix are resumed below:

- *Private Profit* (D) = A – (B + C) ; D > 0 then farming is financially profitable.
- *Social Profit* (H) = E – (F + G); H > 0 then it is economically profitable.
- *Private Cost Ratio* (PCR) = C / (A – B); PCR < 1 means that farming is financially efficient or has a competitive advantage
- *Domestic Resource Cost Ratio* (DRCR) = G / (E – F); DRCR < 1 means that a comparative advantage exists.
- *Output Transfer* (I) = A – E; I > indicates government policies have incentivized farmers.
- *Nominal Output Protection Coefficient* (NPCO) = A/E; NPCO > 1 there is a favorable ratio of domestic producer prices to equivalent world prices
- *Tradable Input Transfer* (J) = B – F; J>0; tradable input transfers from the farmer to the input producers or government
- *Factor Transfer* (K) = C – G ; K>0; non-tradable input transfers from the farmer to the input producers or government
- *Nominal Input Protection Coefficient* (NPCI) = B/F; NPCI <1 level of government protection is high; farmers pay lower for tradable inputs.
- *Net Transfers* (L) = D – H; L> 0 means that there is a surplus as a result of government policies on input and output
- *Effective Protection Coefficient* (EPC) = (A–B)/(E–F) ; EPC > 1 indicates protection of output and tradable input markets
- *Producer Subsidy Ratio* (SRP) = L/E; SRP > 0 means that farmers incur fewer production costs than opportunity costs
- *Profitability Coefficient* (PC) = D/H; PC > 1 shows the positive impact of all transfers on producers profitability

The data and data sources in this study used for PAM analysis are summarized in Tab. 2.

Tab. 2. Data and Data Sources for PAM Analysis

		Data source	
Data	**Unit**	**Private cost**	**Social cost**
Aglaonema production	pot/farm	farmer	farmer
Aglaonema selling price	US$/pot	farmer	trader
Rupiah exchange rate	Rp/US$	Central Bank of Indonesia	Central Bank of Indonesia
Labor wages	US$/man-day	farmer	farmer
Seeds	US$/pot	farmer	e-commerce+freight+ insurances
Pesticides	US$/l	farmer	e-commerce+freight+ insurances
Fertilizer	US$/gr, US$/l	farmer	e-commerce+freight+ insurances

Sensitivity analysis is applied to two sides: profit sensitivity and competitiveness indicator sensitivity. The sensitivity or elasticity of change is measured using the following formula.

$$Ep,c = \frac{P_1}{Q_1} \times \frac{Q_1 - Q_0}{P_1 - P_0}$$

Ep,c is the profit elasticity or competitiveness indicator, Q_0 is the initial value of the factor, Q_1 is the final value of the factor (post-simulation), P_0 is the initial value of the profit or the competitiveness indicator, P_1 is the final value of the profit or the competitiveness indicator (post-simulation).

Justification for input-output barriers

Investigation of input and output barriers is needed to measure price accuracy. In Indonesia, market inputs such as seeds, certain fertilizers, and certain pesticides lack barriers to entry or exit. Regulation of the Ministry of Finance of the Republic of Indonesia No. 45/PMK.010/2022 on the Stipulation of Import Duty Tariffs in the Context of the Framework Agreement Concerning Comprehensive Economic Cooperation between Government Member Countries of the Association of Southeast Asian Nations and the Republic of Korea governs the procurement of seeds (ASEAN -Korea Free Trade Area). The underlying reason is that the seeds are sourced from Southeast Asian countries such as Thailand, the Philippines, and Malaysia. The regulation stipulates that the entrance duty for imported seeds in the category of pot plants (HS code 06029090) is 0%.

The fertilizer procurement policy refers to the Regulation of the Minister of Finance of the Republic of Indonesia Number 152/PMK.010/2021 concerning the Stipulation of Import Duty Tariffs in the Comprehensive Economic Partnership Agreement between the Republic of Indonesia and EFTA Countries. *Decastar* and *Osmocot* are fertilizers imported from the Netherlands. In HS code 3105.10.10.00, the two inputs are declared free of import fees (0%).

The pesticide policy refers to the Regulation of the Minister of Finance of the Republic of Indonesia Number 49/PMK.010/2022 concerning the Stipulation of Import Duty Tariffs in the Context of the Asean-Hong Kong Free Trade Agreement, Republic of China (ASEAN-Hong Kong, China Free Trade Agreement). Most of the pesticides are imported from China. Production inputs that fall into this category are *antracol* fungicide (HS code 38085929), *curacron* insecticide (HS code 38085910), and husks (HS code 2302.40.10). All inputs imported from China are set free of import duty (0%).

This study's output is the *aglaonema* pot plant. According to the Regulation of the Minister of Finance of the Republic of Indonesia Number 45/PMK.010/2022 Concerning Stipulation of Import Duty Tariffs in the Context of the Framework Agreement Concerning Comprehensive Economic Cooperation between Governments of Member Countries of the Association of Asian Nations Southeast and the Republic of Korea (Asean-Korea Free Trade Area), there are no barriers in the output market, meaning that *aglaonema* products are free entry and exit in the Indonesian market.

The HS code for *aglaonema* is 0602109000. Trade data accessed on the International Trade Center's website (2023) shows that Indonesia's exports for this product category reached 662,961 units or a value of 6,592 USD in 2020, while imports were valued at 343 USD. Although no information is available on the global consumption of *aglaonema* specifically, general data for ornamental plants stated that there was an increase of 3.91% annually (Gabellini and Scaramuzzi, 2022). However, in Japan's market consumer, the import value of this plant reached 261,204,035 units in 2020. This demonstrates that Indonesian farmers can still increase *aglaonema's* export potential by increasing their competitiveness.

Results and Discussion

Profit gain from *aglaonema* farming

The farmer community in Depok distributes their plants through direct channels in Bogor, Jakarta, and Bekasi. Marketing strategies are most frequently conducted through exhibitions and domestic booths, while few farmers utilize *e-marketing* channels through social media. A small portion of farmers have likewise performed a life-selling activity on *e-commerce*. Distribution through online shops is typically sent through freight forwarding companies.

The quality standard of *aglaonema* is determined by its specialties and characteristics. As stated by a researcher, the quality of *aglaonema* can be evaluated with capacity tolerance to biotic and abiotic stresses, the measurement of dimensions, and aesthetics quality (Santagostini et al., 2014). However, rather than setting prices based on assessments, Depok farmers use market trends to guide their pricing strategies. The farmers exchanged information about the demanding varieties at that time which were valued a high prices. *Aglaonema Suksom Jaipong* is sold in pot sizes at various prices. The average pot size for standard-size aglaonema is 10 - 12 cm at 25.00 - 35.00 US$/ unit and 15 - 17 cm for premium *aglaonema* costs 40.00 – 60.00 US$/ unit. Final products are packed with paperboard paper and newspaper to keep plants alive longer.

Profits from farming are split between private profits and social profits. Private profits are the difference between revenues and total costs based on the actual prices farmers receive, whereas social profits are computed using shadow pricing. The analysis shown in Tab. 3 assessed both implicit and explicit costs.

Tab. 3. Farming analysis for private prices and social prices per hectare in a month.

Description	Unit	Amount	Private Price (US$/ unit)	Private Value (US$)	Social Price (US$ /unit)	Social Value (US$)
A. Outputs						
Revenue	pot	5,279	44.00	232,284.26	60.00	316,751.27
B. Input						
Seeds (purchasing)	pot	3,959	5.00	19,796.95	5.00	19,796.95
Seeds (nursing)	pot	1,320	3.39	4,477.13	3.39	4,477.13
Growing media	kg	1,174	2.29	2,687.89	2.29	2,687.89
Husk	kg	255	1.59	406.82	2.19	559.59
Fern	kg	354	0.75	264.22	0.75	264.22
Cocopeat	kg	170	0.74	125.95	0.51	86.31
Decastar Fertilizer	kg	17	7.46	130.22	6.695	116.83
Osmocot Fertilizer	kg	17	6.45	106.84	6.296	104.36
Antracol fungicide	kg	16	7.16	112.47	9.57	150.35
Curacron Insecticide	l	10	8.67	88.25	10.88	110.78
External Labor	m-d	147	8.14	1,194.90	8.14	1,194.90
Internal Labor	m-d	74	53.85	3,981.49	53.85	3,981.49
Tax	month		2,104.06	2,104.06	2,104.06	2,104.06
Depreciation	month		522.55	522.55	522.55	522.55
Total Expenses				36,000		36,157

Source: Primary Data (processed), 2022.

Additionally, selling various types of *aglaonema* yielded higher returns for farmers. The price of *aglaonema* is computed as US$ 60.00 per unit based on FOB at Tanjung Priok port, including distribution charges to sub-districts in Depok City. This price is different than the locally treated *aglaonema,* which is US$ 44.00 per unit. Prices at farmers can still be competitive for premium types of aglaonema which have certain qualities that customers need (Anacleto et al., 2021; Tiasmalomo et al., 2021). Locally treated plants have more resistance and adaptation than imported plants. Consumers also favor *aglaonema* which is robust, unusual, and distinctive, despite its high price (Anacleto et al., 2020; Gabellini and Scaramuzzi, 2022; Khofifah et al., 2022; Paiva et al., 2020).

The ratio of domestic to imported seeds purchased is 96.14 : 3.86 percent, indicating that few farmers use imported seeds. In line with Van Huylenbroeck and Bhattarai (2022), the quantity utilization for fertilizers, insecticides, and growing media is typically low in floriculture farming. Pots, fertilizers, and insecticides account for no more than 1.69 percent of the cost. The social costs for both fertilizers imported from the Netherlands are included in the tradable category. Some components of fungicides and insecticides are imported, but most are manufactured domestically. The composition of domestic to local inputs is 61.97 percent to 38.03 percent.

The labor component is categorized as 100 percent non-tradable, which means the need for labor can be fulfilled by domestic human resources. Workers outside the family (external labor) and workers within the family comprise the labor force (internal labor). Labor in the family (internal labor) contributes a small amount to the total cost (4.56%) but is considered significant to the total cost of labor. This is because internal labor accounts for more than half of the labor costs (77.36%). In addition, internal laborers were quite competent in plant care, besides the planting hobby they grow instantly (Haryanto et al., 2023). Because internal labor is free of charge, the profitability of farming income remains mutual.

It can be concluded that *aglaonema* farming in Depok City generates a surplus. The implicit and explicit costs are less than farming revenue. At US$ 232,284 per ha each month, the profit value of *aglaonema* farming is relatively high, assuming this estimation does not account for implicit expenses. Based on policy analysis, the government only treats some globally traded components. Seeds, fertilizers, insecticides, and planting mediums are exempt from import quotas and tariffs (0%). Farmers who rely on imports for their production elements generate a reduction in profit. The demanded profit is triggered by the high selling value of ornamental plants (Olewnicki et al., 2019), rapid stock turnover, and minimal labor costs (Gabellini and Scaramuzzi, 2022).

Policy Analysis Matrix of *aglaonema* farming

Tab. 4 presents the result of the PAM calculation, which reflects the government policy intervention for *aglaonema* farming in Depok City.

Tab. 4. Policy Analysis Matrix (PAM) of *aglaonema* farming.

Description	Revenue (US$)	Input Cost (US$)		Profit (US$)
		Tradable	*Non-tradable*	
On private price	232,284	2,458	33,541	196,285
On social prices	316,751	2,477	33,681	280,594
Divergence effect	-84,467	-18	-139	-84,309
PCR				0.146
DRCR				0.107

The value of revenue and the costs of tradable and non-tradable inputs are related to a farming's competitiveness. Tab. 4 shows that the farming system has an excess profit of US$ 196,285 per ha, which is achieved by holding down tradable and non-tradable input costs, while social profits gained by farmers are higher by as much as US$ 280,594 per ha. Higher value is reflected by the higher world price, thus it is suggested that the farmer develop a strategy to increase its quality and promotion worldwide (Olewnicki et al., 2019).

Divergence effects are shown in the third row of PAM results in Tab. 4. The value of output transfer, input transfer, and factor transfer respectively is -84,467; -18; -139. The negative value of output transfer indicates that the free trade policy allows consumers to purchase imported *aglaonema* at a higher world price than the market rate price. Since there is an opportunity for global trade, farmers are suggested to expand their sales worldwide to achieve a higher price. These basic findings are consistent with other studies stating that ornamental floriculture as a luxury item (Gabellini and Scaramuzzi, 2022) with elastic demand (Olewnicki et al., 2019), allows customers to pay exceptional prices for its invincibility and uniqueness (Anacleto et al., 2020; Gabellini and Scaramuzzi, 2022).

The input transfer is negative, indicating that farmers are subsidized in tradable input usage as much as its value. The factor transfer is also negative, however, there is no specific policy for labor that incentivizes farmers. A study encourages that even if farming receives limited protection from the government, it does not inevitably result in a loss of competitiveness in that country. The competitive advantage of the commodity will protect farmers and preserve competitiveness (Anacleto et al., 2020).

Farming competitiveness is measured by PCR and DRCR values. In accordance with Simamora and Nadapdap (2021), since the cost of tradable and non-tradable inputs is less than the value of revenue, the PCR and DRCR are affected to be less than one. The results of the PAM analysis indicate that *aglaonema* farming in the city of Depok gains both competitive and comparative advantages. The PCR value of 0.146 indicates that to obtain an added value of output for each IDR 1, an additional domestic cost of IDR 0.146 is required; hence, utilizing the domestic resources for cultivating *aglaonema* is more efficient than importing them.

A DRCR value of 0.107 indicates that *aglaonema* farming in Depok City has a comparative advantage. The DRCR indicates that every US$ 1 afforded to import *aglaonema* is equal to just only spent US$ 0.107 in domestic resources when the plant is produced domestically. Equal to PCR, it is suggested that using domestic resources for *aglaonema* farming gains its efficiency. To achieve more customer satisfaction, farmers are expected to be able to breed hybrid varieties of plants (Van Huylenbroeck and Bhattarai, 2022) and perform a differentiation strategy (Anacleto et al., 2020). In addition, increasing the skills of farmers in its community will be necessary for farming development (Nedanov and Žutinić, 2015; Orozco et al., 2021).

The effect of government policies on *aglaonema*'s competitiveness

Government policies affect three ways on *aglaonema* farming, i.e. output, input, and input-output simultaneously. As mentioned before, government initiatives do not directly be the reason for farming competitiveness. The formation of the ratio in Tab. 5 may help to describe the policy effects further.

Tab. 5. Indicators of *aglaonema* farming policy.

Indicator	Value	Default value	Mark
1. NPCO	0.73	<1	*low protection on output*
2. NPCI	0.99	nearly 1	*slight protection on input*
3. EPC	-18	<1	*government policies on inputs and outputs have not effectively supported farmers*
4. SRP	0.99	>0	*farmers spend fewer production costs than opportunity costs*
5. PC	0.70	< 1	*consumers benefit from competitive product price*

NPCI of 0.99 in Tab. 5 shows that policies are slightly reducing input costs at the average market prices of as much as 99 percent of world prices. However, the government's strategy of exempting marketable inputs like seeds and planting mediums from tariffs and import quotas tends to disadvantage farmers. In the planting media component, the proportion of non-tradable inputs is more significant than that of tradable inputs, indicating that farmers might minimize production costs by utilizing local resources. This finding shows a specialty in *aglaonema*, compared to other ornamental plants such as jasmine (Simamora and Nadapdap, 2021) which highly depend on government policy.

The NPCO value of 0.73 shows that policies are decreasing the market price to a level of 23 percent lower than the world price. EPC, another indicator of incentives, indicates the ratio of value added in private prices to value added in world prices. Since EPC along with NPCO and NPCI ignores the transfer effects of non-tradable policies, it is essential to measure the transfer with PC. The value of PC (0.70) is nearly 1, indicating that the competitive advantage obtained by individual farmers is close to the comparative advantage obtained by consumers (Simamora and Nadapdap, 2021), that is, the profit earned by farmers is almost equal to the profit earned by consumers.

A final incentive indicator is the subsidy ratio to producers (SRP). The SRP value in this study is positive, which is 0.99, there is limited protection on input tradable and the impact may be insignificant. However, no government intervention is in line with price reduction; hence government action has no direct effect on *aglaonema*'s farmer welfare. Trade on input factors of production and output is unrestricted, implying that the government imposes neither quotas nor tariffs. The entry price indicates the extent of its competitive edge over rival nations. However, the favorable values of *aglaonema* producers are competitive in the ornamental plant market. Competition between domestic and imported production variables has forced farmers to maximize the use of local resources (Haryanto et al., 2023; Pradas et al., 2023).

Sensitivity analysis on total output changes

The simulation for sensitivity analysis is conducted on the changes in total output and the currency exchange rate. Change in sales volume is the first scenario in the sensitivity analysis. This commodity is susceptible to fluctuations in sales volume because it is elastic to price variations. Fluctuations in demand make it difficult for farmers to manage stocks, making simulations of changes to these components become crucial (Anacleto et al., 2021; Khofifah et al., 2022). Changes in production during the height and the post of the COVID-19 outbreak have been investigated. Farmers were having a hard time selling 2.78 less than that during the phase of the ornamental trend, though the costs could be saved by 2 times less (Haryanto et al., 2023). Tab. 6 shows the scenario of the decrease in production by 2.78 times lower to 1,899 pots per month, and was compromised by a half less cost of production. This results in decreasing the competitive and comparative advantages of *aglaonema* farming.

Tab. 6. Changes in the competitiveness indicators of *aglaonema* farming due to the decrease in product sold and total cost.

Indicator	Initial	Post Simulation	Implication
PCR	0.146	0.189	Slightly decreasing the competitive advantage
DRCR	0.107	0.139	Slightly decreasing the comparative advantage

Sensitivity analysis on exchange rate changes

The Indonesian currency exchange rate affects shadow prices of input or output, derived from CIF or FOB border prices. Fertilizers, seeds, and media are typically imported inputs, while *aglaonema* is an exported product. A forecast study conducted by Ardesfira et al. (2022) showed that the Rupiah exchange rate (IDR) weakened more significantly with the highest forecast limit reaching IDR 17,781.8 per US$ at the end of 2023. Since there is a tendency to import input factors and an opportunity to export outputs, the weakening of the exchange rate may result in a farmer's income and competitiveness. This scenario result is shown in Tab. 7.

Tab. 7. Changes in the competitiveness indicators of *aglaonema* farming due to the weakening of the Indonesian Rupiah Exchange Rate.

Indicator	Initial	Post Simulation	Implication
PCR	0.146	0.137	Slightly increasing the competitive advantage
DRCR	0.107	0.100	Slightly increasing the comparative advantage

Changes in the exchange rate solely impact social expenses. Since the unit of currency for factors of production is US$-the currency of the United States, the cost of imported factors of production is controlled mainly by fluctuations in the US$ exchange rate against the IDR. The farmers will benefit from the higher selling price of exported *aglaonema*. The use of local resources has proven to strengthen the farmers' competitiveness, despite the flooding of imported products. This concept ties in well with previous studies (Darras, 2020; Pradas et al., 2023). The difference in earnings obtained is negligible (-6.3% to -6.5%), as it is marginally smaller than this threshold. This demonstrates that the competitiveness of *aglaonema* products in this city is relatively strong, followed by a high level of farmers' independence in regulating local production variables.

Conclusions

The findings of the research conclude that *aglaonema* cultivation in Depok City was productive and acquired both competitive and comparative advantages, shown by PCR and DRCR which were less than one, i.e. 0.146 and 0.107. The assessment of policy utilizing Output Transfer, NPCO, Input Transfer, Factor Transfer, NPCI, EPC, and SRP indicators, decided that the strategy of eliminating trade duties for *aglaonema* plants has positive impacts on *aglaonema* farming in Depok City. The simulation of a 2.78-fold decrease in the product sold combined with a half decrease in costs, and a depreciation of the Indonesian exchange rate to IDR 17,781.8 per US$ does not necessarily diminish farmers' revenue. The simulations of a decrease in production or a weakening of the Indonesian rupiah exchange rate have demonstrated to not essentially influence competitiveness. This study concludes that the competitiveness of *aglaonema* in Depok City is relatively high upheld by the utilization of domestic resources.

Those conclusions lead to further recommendations. First, the PAM analysis may not optimally describe the relationship between government policies and *aglaonema* farmers' income. This study provides a more accurate depiction of the competitiveness established by farmers but is less effective in showing the quantitative percentage of policy impact. Second, this research indicated that farmers of ornamental plants have the edge over farmers from other commodities due to their higher levels of human and natural resources, but not by the existence of government subsidies. While this study focuses on the competitiveness of farm profitability, future research is anticipated to examine the impact of institutional mechanisms on *aglaonema* farming with a larger market structure.

Author Contribution

LIH: developing the idea, interpreting data results, writing and editing the manuscript.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

Data will be made available on request.

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