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Does Soybean in Indonesia Still Competitive?: A Policy Analysis Matrix Approach

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Abstract

The low productivity of soybeans in Indonesia is one of the reasons why domestic production cannot meet market demand. In addition to suboptimal and contradictory government policies, they contribute to the domestic soybean competitiveness against imported soybeans. The purpose of this study is to analyze the economic and financial profitability of farming, analyze the competitiveness status of soybeans, analyze the impact of government policies on soybean competitiveness, and analyze the sensitivity of domestic soybean competitiveness. This study applies the Policy Analysis Matrix (PAM). The results of this analysis are used to observe two basic indicators to measure competitiveness and assess the role of government policies. This research uses a case study of soybean farmers in the Jember Regency area. The analysis results show that the soybean farming business in Jember Regency is capable of generating economic profits. Soybean farming in Jember is capable of producing comparative and competitive advantages. Furthermore, the policy analysis reveals that the impact of soybean policy on farming in the region is not yet optimal. Therefore, new governance policies are needed. Parameter analysis in the PAM analysis indicates that price and productivity variables have a potential role in increasing production and domestic soybean competitiveness.

Keywords: *Competitiveness, Soybean Farming, Policy Implications, Policy Analysis Matrix*
JEL Classification: Q11; Q12; Q18

INTRODUCTION

Drawing from various empirical studies based on data and facts gathered from various sources, the complexity of soybean issues in Indonesia can be shown. This is particularly related to the availability of soybean supply and domestic soybean price fluctuations (Dossou et al., 2017; Ministry of Trade, 2022; Setyawan & Huda, 2022; Zainuri et al., 2015). Essentially, Indonesia is a country with the second-largest soybean consumption rate in the world, after China and also increase annually (Harsono et al., 2022). Most of the domestic soybean demand is used as raw material for production. However, in its development, domestic soybean production can only meet 20 percent of the domestic soybean needs. The remaining

80 percent is fulfilled by soybean imports. Based on data collected from the Central Statistics Agency, as much as 90 percent of domestic soybean needs are imported from the United States (BPS, 2021b; Kusnandar, 2022). Looking at Indonesia's trade balance data during 2021, it can be shown that the soybean trade balance always experiences a deficit with an average soybean import of 2 to 2.5 million tons in each consecutive year. Looking back, Indonesia actually achieved self-sufficiency in soybean production in 1992, where the production reached 1.8 million tons. However, the development of soybean production in Indonesia subsequently declined, making it unable to meet the increasing demand for soybeans (Ministry of Trade, 2022).

According to consumption data collected by Ministry of Agriculture, it is shown that Indonesia has only been able to meet 19.15 percent of its total soybean needs through local production over the past five years. This situation is a serious warning for Indonesia due to its high dependence on imported soybeans. The inability to achieve self-sufficiency is mainly due to several factors, such as the difficulty in finding suitable land for soybean cultivation, slow productivity growth, the lack of competitiveness of soybeans compared to other crops (such as corn and sugarcane), the lack of price incentives for farmers, and import tariff policies that weaken the competitiveness of domestic soybean production (Budiharti & Wardana, 2021; Nasir et al., 2021; Setyawan & Huda, 2022; Tossou et al., 2023; Wardhono et al., 2021).

Essentially, several policy scenarios have been implemented to encourage the increase of local soybean production. However, the results of these policies have not been able to solve the problems of soybean production in Indonesia (Yunitasari & Prihtanti, 2019). The three most frequently applied policies are policies to increase soybean production, policies to restrict soybean imports, and price stability policies (Kardiyono et al., 2018; Zakiah, 2011). However, in its development, the existing policy cycle has still failed to address the fundamental issues of national soybean governance.

Substantially, meeting the domestic soybean demand cannot be separated from the local farmers' cultivation activities (Aimon & Satrianto, 2014; Buana & Rusdarti, 2018; Sahaya, 2013). Soybean farming business is done locally and profitably, with comparative and competitive advantages that are better than relying solely on imports (Sari & Prajanti, 2016). The profit received by farmers is determined by the production price (output) and the input production price (input) received by farmers. This research is conducted with the aim of determining whether soybean cultivation in Indonesia is profitable and competitive.

The empirical space in which the understanding of soybean commodities develops has interesting aspects that arise in different spatial areas. Permadi (2015) states that the private profitability and social profitability of soybean farming in Indonesia have efficiency and competitive and comparative advantages, which can be interpreted as soybean farming having competitiveness (Fertiwi, 2018; Nur Mahdi & Suharno, 2019). On the other hand, it is also presented in research conducted by Handayani (2019) who examined the simulation of local soybean competitiveness policies in the domestic market, stating that the strategy used to increase competitiveness and domestic soybean production is through increasing productivity by applying agricultural technology. In contrast to Rante (2013) study that analyzed the development strategy of soybean cultivation for rural community economic empowerment in Keerom Regency, which concluded that local soybean farming is financially feasible. The strategy used to increase local soybean production and develop soybean-based processing industries is through the assistance of funding from both banking and non-banking financial institutions.

The main focus of this research is directed towards the province of East Java as one of the largest soybean production centers in Indonesia (BPS, 2021a). In the long term, it is expected that this province will be able to become one of the soybean production centers in meeting the consumption needs in Indonesia. The next case study in this research is taken in Jember Regency. Jember Regency is the fifth largest soybean producer in East Java (BPS, 2021a). Soybean farming in Jember is expected to demonstrate comparative and competitive advantages. Additionally, Jember Regency has soybean farming characteristics that can represent national soybean farming. Several elements such as land type, input usage in production, productivity level, and government policy absorption in soybean farming in Jember Regency are similar to national characteristics. The location determination for the research is selected at the district level, with three districts chosen as production centers with continuous soybean cultivation and high productivity rates, namely Bangsalsari, Jombang, and Umbulsari. This shows that these three areas are the centers of soybean plantations in Jember. The sustainability and scale of soybean production in Jember is largely determined by the sustainability and production of soybeans in these three regions. Therefore, these three regions can be a representation of soybean production in Jember.

METHOD

Sampling

The research was conducted from January to April 2022. The method used in this study was a survey, which collected information through several samples from the population. Data was obtained through interviews with respondents using questionnaires. The sampling of active soybean farmers was carried out using a simple random sampling technique, where each soybean farmer had an equal chance of being selected as a sample. The respondents used in this study were soybean farmers from 3 districts in Jember Regency, namely Bangsalsari, Jombang, and Umbulsari districts. The selection criteria were based on the highest level of soybean production in Jember Regency and the performance of farmer institutions such as Gapoktan (Farmers' Group Association), as well as the continuity of soybean cultivation in Jember. The respondents in this study were soybean farmers who had been cultivating soybeans for at least 10 years. The respondents in this study were 16 farmers who planted soybeans with a harvest period of 3-4 months. The characteristics of the respondent farmers were differentiated based on criteria such as gender, age, level of education, number of dependents, land area, business status, land status, and length of soybean cultivation. The characteristics of the respondent farmers can be viewed in Table 1.

Table 1. The Characteristics of The Respondent Farmers in Jember Regency

Characteristics	Respondents	Numbers (people)	Percentage (%)
Sex		Male	16
Total Workforce	1 - 5 people	13	81.25
	6 - 10 people	2	12.5
	≥ 11 people	1	6.25
Age (Year)	30-40	4	25
	41-50	2	12.5
	50-60	7	43.75
	61-70	3	18.75
Educational level	Elementary graduate	7	43.75
	Junior graduate	2	12.5
	Senior graduate	6	37.5
	University graduate	1	6.25
Land area (Ha)	0.05-0,1	3	18.75
	0,2-1.00	10	62.5
	1.01-1.50	3	18.75
Land status	Private	13	81.25
	Lease	3	18.75
The status of farming business	Primary	7	43.75
	Side hustle	9	56.25
Length of soybean cultivation (Year)	5 to 10	9	56.25
	11 to 20	4	31.25
	≥ 21	2	12.5

Source: The data collected by the author

The Determination Of Cost Allocation

The inputs for soybean production that are assumed to be 100% tradable goods include Urea, KCL, NPK, pesticides, and handling equipment. Inputs that are assumed to be 100% domestic factors include soybean seeds, land lease value, and labor. The composition of domestic and foreign cost allocation for transportation activities is based on a study of agribusiness actors, where labor costs in the transportation process are considered domestic components and transportation costs, which represent equipment rental fees, are considered foreign components (tradable) (Suminartika, 2020). Furthermore, handling costs for soybean commodities consist of material costs and labor costs (domestic factor) (Niadii et al., 2020). A detailed breakdown of domestic and foreign cost allocation components is presented in Table 2.

Table 2. Domestic and Foreign Cost Allocation Components in Soybean Farming

Type of Costs	Domestic (%)	Foreign (%)
Seed	100	0
Urea fertilizer	0	100
SP-36 fertilizer	0	100
NPK fertilizer	0	100
KCL fertilizer	0	100
Pesticide	0	100
Harvesting equipment	0	100
Labor	100	0
Capital cost	100	0
Land lease	100	0
Soybean transportation	55	45
Soybean handling	65	35

Source: Author's justification

Determination of Shadow Prices

The justification for determining shadow prices on inputs and outputs in soybean farming in Jember Regency is as follows:

- Imported soybean prices are based on the average monthly CIF price for one year (January 2020-January 2021), which is then converted using the average exchange rate for one year. The next step is to add transport costs from the port to the provincial wholesaler (PB), and then adjust for domestic and imported soybean competition at the provincial wholesale level by subtracting transportation costs from the provincial to district-level wholesalers and from the district-level wholesalers to the farmers, and then subtracting handling costs to obtain the social price of soybeans.
- Soybean seed procurement is sourced domestically and there are no distortions either due to government policy or market distortions, therefore the determination of its social price is approximated from its actual price.
- According to the trade balance, fertilizers (excluding Urea), NPK, and TSP are net imports. Therefore, the social price of fertilizers is approximated by the CIF parity price at Indonesian ports, adding some costs (transportation and handling) until it reaches the level of farmers. The social price of Urea fertilizer is derived from its FOB price.
- The social price of pesticides, in both liquid and solid form, is based on the actual private price at the research location.
- The social price of land is approximated by the actual land lease value. This is based on two factors: a) the land market mechanism in rural areas is functioning well, and b) it is difficult to determine the opportunity cost of land.
- The social price of labor is calculated using the actual prevailing wage at the research location. This is based on the idea that the accessibility of soybean production locations is generally sufficient, thus promoting the functioning of the rural labor market and the integration of labor markets, both between regions and sectors.
- Most soybean farmers obtain financing through bank loans (KUR) with an interest rate of 1.5 percent per month. The shadow price of capital interest

is calculated using the real interest rate from the bank without any government subsidies.

Data Analysis

The analysis employed to address the objectives of this research is the Policy Analysis Matrix (PAM). This method is utilized to evaluate the private benefits of agriculture and to analyze the extent of soybean competitiveness in Jember Regency, based on its competitive advantages (financial) and comparative advantages (economic), as well as to assess the impact of government policies that affect the inputs and outputs of commodities (Shehata & Mickaiel, 2015). The PAM matrix table can be found in Table 3.

Tabel 3. Standard Matrix for PAM Composition.

Component	Reception	Costs of production factor		Profit
		Tradable	Non tradable	
Private cost	A	B	C	D
Social cost	E	F	G	H
Divergent effect	I	J	K	L

Source: Pearson, *et al.* (2005)

where:

Output Revenue (A)	=	Pq x Q
Output Price	=	Pq
Total Output	=	Q
Financial Benefit (D)	=	A-(B+C)
Economic Benefit (H)	=	E-(F+G)
Output Transfer (OT) (I)	=	A-E
Tradeable Input Transfer (IT) (J)	=	B-F
Non Tradeable Input Transfer (K)	=	C-G
Net Transfer (NT) (L)	=	I-(K+J)
Private Cost Ratio (PCR)	=	C/(A-B)
BSD Ratio (DRC)	=	G/(E-F)
Nominal Protection Coefficient Output	=	A/E
Nominal Protection Coefficient Input	=	B/F
Effective Protection Coefficient	=	(A-B)/(E-F)
Profit Coefficient (PC)	=	D/H
Subsidy Ratio for Producers (SRP)	=	L/E

Analysis of Competitiveness

The PAM analysis results provide information on both private and social benefits, namely the competitiveness of a commodity from economic efficiency (comparative and competitive advantage) and financial efficiency, as well as the impact of government policies on the commodity system (Rita et al., 2015; Sukmaya & Rachmina, 2015). The PAM model calculation is carried out through the PAM matrix found in Table 3. The Domestic Resource Cost Ratio (DRCR) criterion is used to test the presence or absence of soybean commodity advantage comparison. DRCR is a comparative advantage indicator that shows the amount of domestic resources that can be saved to produce one unit of foreign exchange. The system is said to have a comparative advantage if DRCR ≤ 1, and conversely, if DRCR> 1, it does not have a comparative advantage. Competitive advantage is known by using the Private Cost Ratio (PCR) criterion. PCR is a private profitability indicator that shows the commodity system's ability to pay for domestic resource costs and remain competitive. If PCR equals 1, it means the commodity system does not have a competitive advantage.

Impacts of Government Policies

The impact of government policies on soybean farming can be observed through the following indicators:

- The impact of government policies on output can be observed through the Output Transfer (OT) and Nominal Protection Coefficient on Output (NPCO) indicators.
- The Output Transfer (OT) can be defined as the difference between income at private prices and income at social prices, where OT = A-E. If the value of OT > 0, it indicates a transfer from consumers to producers, while if the value of OT < 0, there is no transfer from consumers to producers.
- The Nominal Protection Coefficient on Output (NPCO) is an indicator of the level of government protection for domestic output, where NPCO = A/E. If the value of NPCO > 1, it indicates a policy that protects domestic production. Conversely, if NPCO < 1, it shows the absence of policies that protect domestic output or disincentivize such policies.
- The government's policies on inputs can be analyzed through the Input Transfer, Nominal Protection Coefficient on Input, and Factor Transfer indicators to determine the extent of the government's impact on farmers.
- The Input Transfer (IT) can be defined as the difference between the tradable input costs at private prices and at social prices, where IT = B-F. If the value of IT > 0, it indicates a transfer, while if it is < 0, it shows no transfer from farmers.
- The Nominal Protection Coefficient on Input (NPCI) is an indicator of the level of government protection for domestic agricultural input prices, where NPCI = B/F. A policy is considered protective of domestic input if the value of NPCI < 1, indicating that there are subsidies for tradable inputs, and vice versa.
- Factor Transfer (FT) can be defined as the difference between the income received by producers for non-tradable factor payments at private prices and at social prices, where FT = C-G. A value of FT > 0 indicates a transfer from farmer-producers to non-tradable input producers and vice versa.

Government policies on input-output

The impact of government policies on soybean farming input-output can be observed through the following indicators:

- Effective Protection Coefficient (EPC), EPC = (A-B)/(E-F), is an indicator that shows the level of simultaneous protection of output and inputable values. A policy is considered effective if the EPC value is greater than 1. The higher the EPC value, the higher the level of domestic government protection for agricultural commodities.

- Net Transfer: NT = D-H. Net Transfer (NT) is the difference between the net profit received by the producer and the net social benefit. A value of NT > 0 indicates the presence of additional producer surplus caused by government policies applied to inputs and outputs, and vice versa.
- Profitability Coefficient: PC = D/H. The comparison between the actual net profit received by producers and the social profit. If the PC value is greater than 0, it indicates that the overall government policies provide incentives to producers.
- Subsidy Ratio to Producer: SRP = L/E = (D-H)/E, is an indicator that shows the proportion of receipts at the social price that is needed if subsidies or taxes are used as a substitute for government policies. A positive value of SRP indicates a positive impact of government policies..

RESULTS AND DISCUSSION

Input-Output Soybean Farming

The policy analysis technique using the PAM method requires a compilation of input and output data from soybean farming, as PAM is based on farming costs (Shehata & Mickaiel, 2015). The soybean farming cost in Jember Regency can be depicted through the input-output coefficient in Table 4. The characteristics of farmers in Jember Regency are divided into those who own private land and those who rent. The land ownership characteristics will bring different consequences in determining competitiveness and policy implications on soybean production (Sukmaya & Rachmina, 2015).

According to the table of private costs, it can be shown that soybean farming with owned and rented land generates incomes of 11,538,198 Rupiah and 12,112,500 Rupiah per hectare per season, respectively. When considering the percentage contribution of input costs to the total soybean farming cost, it can be seen that the domestic factor cost component is very dominant in the total soybean farming cost. This result is consistent with Sukmaya et al. (2017) research on soybean farming analysis conducted in Lamongan Regency, East Java. In the analysis of domestic factor cost components for soybean farming in the Jember region, it can be seen that labor costs contribute greatly to soybean farmers' expenditures. The high contribution of labor costs in soybean farming in the region is influenced by the large component of using non-family labor during land processing, spraying, maintenance, and harvesting. Meanwhile, family labor is only used in the cultivation process, especially in fertilization and maintenance stages (Niadii et al., 2020). Therefore, labor is one of the biggest contributors to the cost components in this case study. Moreover, the significant proportion of domestic factor costs compared to the total cost of tradable inputs indicates that the development of domestic soybean farming is quite extensive in terms of labor absorption.

Table 4. Revenue and Private Costs of Soybean Farming Business (In Rupiah)

Variable	Description	Private Land		Lease Land	
		Price	Cost	Price	Cost
Output					
Soybean productivity	Kg/ha	8,931	11,536,198	8,500	12,112,500
Input					
a. Tradable					
UREA	Kg/ha	2,000	87,833	2,000	92,500
SP-36	Kg/ha	2,300	262,583	2,300	313,375
NPK/KCL	Kg/ha	3,300	182,875	3,300	226,875
Pesticide	Liter/ha	181,667	620,694	160,000	600,000
Harvest tools	Rupiah/Kwintal	30,000	385,000	30,000	427,500
b. Domestic					
Seed	Kg/ha	14,917	601,639	15,000	607,500
Plant	HKO/ha	69,167	207,500	68,750	137,500
Treatment	HKO/ha	69,167	703,194	68,750	584,375
Harvest	HKO/ha	69,167	714,722	68,750	773,438
Watering	Rupiah/ha	191,667	431,250	200,000	450,000
Capital cost	Rupiah/ha			600,000	600,000
Land lease	Rupiah/ha			2,337,500	2,337,500
Transporting	Rupiah/ha	175,000	291,667	175,000	262,500
Soybean handling	HKO/ha	67,917	401,840	68,750	395,313

Source: Resources interview, 2022

The Social Revenue and Costs of Soybean Farming Business

The determination of social prices is done by approximation, estimating the social prices of input-output for soybean farming as shown in Table 5. Based on the estimation results of the social budget, it can be shown that the income from soybean farming in the group with private land (13,874,050 Rupiah) is lower than that of rented land (5,306,210 Rupiah per hectare per season). This finding is consistent with the research conducted by Suciaty and Hidayat (2019), which identified similar results in a soybean farming case study in Indramayu, West Java.

In the social budget structure of soybean farming business, it can be seen in more detail that inputs that have a significant contribution to soybean farming costs are respectively land rentals, labor wages, fertilizer, and seeds. The amount of money spent by farmers in buying these inputs is closely related to the amount used and the price of the inputs themselves. If farmers use excessive labor, it will lead to a decrease in labor productivity and, in turn, may increase costs and reduce profits. Similarly, using inputs beyond the recommended dosage, besides being detrimental to the plants, will affect farmers' profits because the costs incurred are greater than they should be. The proper and efficient use of inputs can help farmers to reduce the cost of soybean farming and increase their profits.

Table 5. Shows the Social Revenue and Costs of The Soybean Farming Business (In Rupiah)

Variable	Description	Private Land		Lease Land	
		Price	Cost	Price	Cost
Output					
Soybean productivity	Kg/ha	10,741	13,874,050	10,741	15,306,210
Input					
a. Tradable					
UREA	Kg/ha	4,491	197,229	4,491	207,708
SP-36	Kg/ha	4,910	560,558	4,910	668,987
NPK/KCL	Kg/ha	6,760	374,616	6,760	464,750
Pesticide	Liter/ha	181,666	620,694	160,000	600,000
Harvest tools	Rupiah/Kwintal	30,000	385,000	30,000	427,500
b. Domestic					
Seed	Kg/ha	14,916	601,638	15,000	607,500
Plant	HKO/ha	69,166	207,500	68,750	137,500
Treatment	HKO/ha	69,166	703,194	68,750	584,375
Harvest	HKO/ha	69,166	714,722	68,750	773,437
Watering	Rupiah/ha	191,666	431,250	200,000	450,000
Capital cost	Rupiah/ha			1,600,000	1,600,000
Land lease	Rupiah/ha			2,337,500	2,337,500
Transporting	Rupiah/ha	175,000	291,666	175,000	262,500
Soybean handling	HKO/ha	67,916	401,840	68,750	395,312.5

Source: Resources interview, 2022

The Financial and Economic Benefits of Soybean Farming Business

According to the PAM analysis matrix in Tables 6 and 7, it can be shown that soybean farming in Jember Regency is profitable and feasible to cultivate, as evidenced by the positive private benefit and social benefit analysis results for both farmers with private land and rented land. These findings are consistent with the research results indicating that the private benefits of soybean farming are 6,645,399 Rupiah and 4,304,125 Rupiah per hectare per season. The analysis of social or economic costs and benefits shows that soybean farming in Jember Regency is also economically profitable. The social benefits of soybean farming in Jember Regency are 8,384,138 Rupiah and 5,789,138 Rupiah per hectare per season for farmers with private land and rented land. From Table 6, it can be seen that the economic benefits of soybean farming are higher than the private benefits. This indicates that the input prices paid by farmers are higher and/or the output prices received by farmers are lower than the social prices. The profit analysis using soybean farming analysis can be seen in Tables 6 and 7.

Table 6. PAM Analysis Matrix of Soybean Farming Business for Farmers with Private Land (In Rupiah)

Description	Reception	Input cost		
		Tradable	Nontradable (domestic)	Profit
Private	11,536,197.92	1,538,986.11	3,351,812.5	6,645,399.306
Social	13,874,050	2,138,099.19	3,351,812.5	8,384,138.306
Divergent effect	-2,337,852.083	-599,113.08	0	-1,738,739

Source: Author’s estimate, 2022

The higher private income compared to social income indicates that soybean farming in Jember Regency is more efficient and has a high comparative advantage. This is consistent with Suhardedi et al. (2017) assertion that farming activities with a private benefit greater than 0 and higher than their social benefit indicate that the farming activities are already efficient and have a comparative advantage. The difference between private and social costs and benefits is suspected to be due to government policies, especially in the form of subsidies. In line with these results, Niadii et al. (2020) identified that soybean farming in Tasikmalaya Regency generates economic profits, where land, seeds, fertilizers, pesticides, and labor significantly affect the farming production output. However, the seed and labor factors have already exceeded their optimal levels, and if continually added, it will result in a decrease in farmers' income. Similar results can also be found in soybean farming in Wonogiri Regency (Sari & Prajanti, 2016). Similar results were also found for soybean farming in Tebo Regency, South Sulawesi (Kata, 2021). This means that soybean farming in Indonesia still has the potential to provide both economic and social benefits. These findings can be compared with the analysis of soybean production in China, which also shows that it is still economically profitable. Microeconomic analysis reveals that more than two-thirds of the production in the competitive study area is profitable. Formal education investment for managers, public and private investment in infrastructure, and technology play a crucial role in the production benefits of the region.

Referring to these results, it cannot be denied that soybean farming in Indonesia still yields negative profits for most areas. Some regions in Lamongan and Grobogan are small examples where soybean farming in those areas is not profitable (Setyawan & Huda, 2022; Sukmaya et al., 2017). This supports previous research indicating that soybean is not economically beneficial (Setyawan & Huda, 2022; Sukmaya et al., 2017). Soybean farming in Java has declined, as shown by the inefficiency of soybean farming in three provinces in Java. Furthermore, there have been no new breakthroughs in technology (superior varieties) that can increase soybean productivity. The comparative advantage performance of soybeans outside Java is better than in Java due to lower economic costs per unit of output. Responding to these issues, a more in-depth analysis is needed regarding various components of soybean farming efforts in Indonesia, especially related to the analysis of competitive, comparative advantages, and the effects of government policies. This is done to identify how to improve soybean farming in Indonesia in the future.

Table 7. PAM Analysis Matrix of Soybean Farming Business for Farmers with Rented Land (In Rupiah)

Description	**Reception**	**Input Cost**		**Profit**
		Tradable	**Non tradable (domestic)**	
Private	12,112,500	1660,250	6,148,125	4,304,125
Social	15,306,210	2,368,946.25	7,148,125	5,789,138.75
Divergent effect	-3,193,710	-708,696.25	-1,000,000	-1,485,013.75

Source: Author’s estimate, 2022

Competitive and Comparative Advantages of Soybean Farming Business

The analysis of a commodity's competitive advantage can be seen through the Private Cost Ratio (PCR), while the comparative advantage can be seen through the Domestic Resource Cost Ratio (DRCR). Based on the analysis results in Table 8, the PCR coefficients for soybean commodities in Jember Regency were found to be 0.34 and 0.59 for farmers with private and leased land, respectively. The PCR coefficient value for soybean commodities indicates a value <1, indicating that soybean farming activities conducted privately in Jember Regency have a competitive advantage. Based on these results, it can be stated that producing one unit of added value output of soybeans at a private price requires less than one unit of domestic resource cost. Efforts to save one unit of foreign exchange at a private price require a smaller sacrifice than one unit of domestic resource cost.

Table 8. Financial and Economic Profit Analysis, PCR, and DRCR Results

Parameter	Value	
	Private	Lease
Financial Profit (Rupiah/ha)	6,645,399	4,304,125
Economic Profit (Rupiah/ha)	8,384,138	5,789,139
PCR	0.34	0.59
DRCR	0.29	0.55

Source: Author's estimate, 2022

Based on the DRCR values of 0.29 and 0.55 for private and leased land, it can be concluded that soybean farming in Jember Regency has a comparative advantage. From the analysis results, it can be concluded that for Jember Regency, producing one unit of soybean output at the social price requires a smaller sacrifice of domestic resource costs at the social price than one unit. This indicates that to save one unit of foreign exchange, a smaller sacrifice of domestic resource balance costs is required. The conclusion drawn is that economically, it would be more beneficial for Jember Regency to produce local soybeans rather than importing.

These findings corroborate the results of previous research by Suhardedi et al. (2017), Niadii et al. (2020), and Qori'ah et al. (2023), which showed that soybean commodities in some regions have a comparative advantage due to favorable environmental conditions such as suitable soil and climate, as well as well-managed irrigation. Similarly, soybean farming on irrigated and rain-fed paddy fields yields better results compared to dry fields (Zakaria et al., 2010). This is evidenced by the high profit values obtained by farmers on irrigated and rain-fed paddy fields compared to dry fields. This case was found for farmers in Jember.

The successive values of DRCR for soybean farming are smaller than those for farmers with irrigated rice fields, rain-fed fields, and dry fields, which means that with suitable land and climate conditions and good water management, the comparative advantage of soybean commodities can be increased, as a smaller DRCR value <1 indicates that the soybean farming system is more efficient and has a high comparative advantage. Similar results were also found in Sumatra Utara (DRCR-0.55) and Sulawesi Utara (DRCR=0.55) in Agustian & Friyatno (2014).

In response to the above results, it is important to note that soybean farming in other regions such as Lamongan and Grobogan Sahaya (2013) is prone to inefficiency. The potential failure of soybean farming to achieve comparative and competitive advantages is influenced by several factors. Soybean farming in Java has already declined, as evidenced by the inefficiency of soybean farming in three provinces in Java. In addition, there have been no new breakthroughs in technology (superior varieties) that can increase soybean productivity. The comparative advantage performance of soybeans outside of Java is better than in Java due to lower economic costs per unit output.

Government Policies on Input and Output

According to the analysis, the impact of government policies on soybean farming in Jember Regency are as follows:

Government Policy for Output. It can be seen through the transfer output (TO) value or nominal protection coefficient of output (NPCO). Based on the TO value, farmers experienced negative losses of -2337852.083 and -3193710/ha/season. This occurred because the social price of soybeans received by farmers was higher than the actual price received by them. The social price of soybeans at the farmer level is calculated based on the import price of soybeans, which is higher than the domestic soybeans with the same quality. These findings are consistent with several previous studies. In the study on soybean competitiveness in Tebo Regency, South Sulawesi, Kata (2021) stated that the low price of soybeans offered by farmers can be an advantage in facing the entry of imported soybeans into the market. The high value of negative output revenue distortion is due to the low price of soybeans received by farmers, which prevents them from optimizing their profits.

The nominal protection coefficient of output (NPCO) is a ratio of receipts calculated based on private prices and social prices. NPCO is an indication of output transfers. In this policy analysis, NPCO values of 0.83 and 0.79 were obtained, indicating that soybean farmers receive prices that are 22 percent lower than they should be. Lestari (2020) findings on the national competitiveness of soybeans support the argument that this condition is due to government policies or interventions that favor consumers by allowing them to purchase soybean output at lower prices than the actual price. Sukmaya et al. (2017) identifies that these findings can be characterized as a situation where there is a transfer of surplus from producers to consumers.

Table 9. Impact Indicators of Government Policies on Soybean Farming in Jember Regency

Coefficient Parameter	Value		Description
	Private Land	Lease	
Policy Impact on Output			
Output transfer	-2,337,852.08	-3,193,710	OT < 0
Non Tradable Output (NPCO)	0.831494619	0.7913454	NPCO < 1
Policy Impact on Input			
Input transfer	-599,113.0833	-708,696.25	IT < 0
Factor transfer	0	-1,000,000	FT < 0
On Tradable Inputs (NPCI)	0.719791727	0.7008390	NPCI < 1
Policy Impact on Input-Output			
Effective Protection Coefficient (EPC)	0.851845067	0.80791813	EPC > 1
Net Transfer	-2,936,965.16	-4,902,406.2	NT > 1
Profitability Coefficient (PC)	0.792615659	0.74348278	PC < 1
Subsidy Ratio to Producers (SRP)	-0.12532310	-0.0970203	SRP < 0

Source: Author's estimate, 2022

The impact of government policies on inputs can be seen through the transfer input value and transfer factor, as well as the nominal protection coefficient of input/NPCI (Tossou et al., 2023). In Jember Regency, soybean farming input policies have resulted in farmers paying lower prices for tradable inputs compared to social prices. This can be seen from the transfer input value of -2,337,852 Rupiah and -3,193,710 Rupiah for private and leased land. The government policy of Maximum Retail Price (HET) on fertilizer has resulted in lower actual fertilizer prices. This policy is in the form of price subsidies given by the government to fertilizer factories. On the other hand, input policies that affect private costs occur with the input of Fuel Oil (BBM).

The National Input Protection Coefficient (NPCI) is a ratio of tradable input costs based on private and social prices. This ratio indicates the level of government protection for domestic input prices (Niadii et al., 2020). The NPCI value obtained was 0.72 and 0.7, which indicates a value < 1, meaning that there is a subsidy policy for tradable inputs. The exchange rate of tradable inputs also affects the size of social costs. An increasing exchange rate is expected to increase the social costs of these inputs. This causes the NPCI value to decrease, indicating that government policies increasingly support farmers. Suciaty & Hidayat (2019) state that if there is no tariff policy on tradable inputs, policies can also be implemented by applying export barriers so that domestic soybean farming uses domestic inputs, for example in the case of Urea fertilizer.

In soybean farming in Jember Regency, non-tradable inputs are also required, in addition to tradable inputs. The price of non-tradable inputs is determined by the domestic market mechanism. The impact of government policies on non-tradable inputs can be determined by analyzing the Transfer Factor (TF) value. TF is a value that indicates the difference between private and social prices for the payment of production factors that are not traded internationally. The transfer factor value for soybean farming in Jember Regency is 100,000. Budiharti & Wardana (2021) translate this value as indicating that the domestic factor price incurred by producer farmers at the private price level is higher than the domestic factor cost incurred at the social price level. This shows that there are government policies that protect domestic producers, for example through interest subsidies provided. Input producers receive an additional profit of 100,000 per hectare per planting season.

Based on various findings mentioned above, it can be shown that soybean farming in Jember Regency has lower private prices compared to its social prices. For instance, fertilizer subsidies are enforced through the implementation of Maximum Retail Price (HET) for certain brands. Zakiah (2011) concludes that fertilizer prices significantly affect soybean productivity. A rise in fertilizer prices results in a decrease in productivity, harvest area, production, and prices at the trader and producer levels. These findings are in line with Sukmaya et al. (2017) study, which states that subsidy policies are still necessary for farmers in soybean farming activities. If subsidy policies on inputs are removed or reduced by the government, the profits gained by farmers will disappear and approach losses. According to Tossou et al. (2023) and Dossou et al. (2017), government subsidies for input production play a crucial role in increasing agricultural productivity, especially for crops with low efficiency levels, such as soybeans.

The impact of government policies on inputs and outputs can be assessed through various measures, such as Net Transfer (NT), Effective Protection Coefficient (EPC), Profitability Coefficient (PC), and Subsidy Ratio to Producer (SRP) as stated by Nastiti et al. (2015). Based on Table 9, it can be shown that the net transfer value is greater than zero (NT>0), indicating that there is an additional surplus for producers due to government policies applied to inputs and outputs simultaneously. Net transfer (NT) also describes whether government policies benefit or harm soybean farmers in Jember Regency (Kata, 2021). The analysis of net transfer (NT) for soybean commodities in Jember Regency obtained a negative value. This negative value implies that there are government policies or market distortions on inputs (tradable inputs and domestic factors) and outputs overall that harm soybean farmers.

The net transfer value (NT) for soybean farming in Jember Regency is -2936965.167 and -4902406.25 per hectare per planting season. These results are consistent with Kata (2021) findings, which identify that the lack of government policies providing economic incentives to soybean farmers has resulted in the underperformance of soybean production development programs in the research location. Lestari (2020) adds that this factor is also a contributing factor to the lack of development in soybean cultivation in Indonesia, both in the main production centers and in new development areas.

The Effective Protection Coefficient (EPC) value indicates the extent to which government policies protect or hinder domestic production (Sukmaya et al., 2017). An EPC value greater than one (EPC>1) indicates that the current government policies are protecting domestic production. The EPC coefficient value for soybean commodities is 0.85 and 0.8. Rita et al. (2015) identify these EPC coefficient values as a condition where there is no government protection or support for soybean producers or farmers. Farmers even have to subsidize input producers and soybean consumers because the value added enjoyed by soybean farmers is smaller than the social value added. Government policies on inputs and outputs hinder soybean farmers in producing domestic soybeans. Budiharti & Wardana (2021) adds that this condition occurs due to the ineffective implementation of the basic selling price policy by the government because there is no specific body that buys soybeans from farmers at the basic price set by the government. This is consistent with the analysis of soybean farming in Indonesia conducted by Sari & Prajanti (2016).

The Profitability Coefficient (PC) is a measure of the profit gained by farmers with government intervention or market distortions. A PC value greater than one (PC>1) indicates that overall government policies provide incentives to producers, and vice versa (Suciaty & Hidayat, 2019). The PC coefficient value in Jember Regency is 0.79 and 0.74. Tossou et al. (2023) explain that the government policies or market distortions in soybean farming do not provide incentives to farmers, as farmers do not receive higher profits than they should.

The Subsidy Ratio to Producer (SRP) coefficient is an indicator that shows the proportion of receipts at the social price required if subsidies or taxes are used as a substitute for policy. If the SRP value is greater than zero (SRP>0), it indicates that the government policy supports or benefits the farming of a commodity because the costs invested by farmers are greater than the added value of profits received by farmers. The SRP coefficient value for soybean commodities in the research location is -0.0125 and -0.09, which means that in general, the existing government policies have a negative impact on soybean farmers. Suminartika (2020) mentions that soybean farmers receive negative subsidies or have to pay taxes, compared to if there were no government policies. Government policies have a negative impact on production cost structure, as the costs incurred by farmers are greater than the added value of profits received by farmers.

Sensitivity to Policy Changes

Sensitivity analysis is used to determine the sensitivity of efficiency in soybean cultivation to changes in the components that affect production. Some scenarios analyzed include:

1. Productivity increases 25 percent
2. Output price increases 25 percent
3. A 25 percent reduction in subsidized fertilizer prices
4. A 25 percent reduction in wage labor

The adverse impact of changes in inputs and outputs on the private and social profits of soybean farming in Jember Regency can be observed in Table 10. Overall, the least favorable scenario is depicted in scenario 4 for tenant farmer groups. This is mainly due to the higher prices offered compared to before the increase. The second position is shown by the scenario of a 25% reduction in subsidized fertilizer prices.

Table 10. Impact of Changes in Inputs and Outputs on Private and Social Profits (In Rupiah)

Scenario	Profitability			
	Private	Social	Private	Social
Initial Condition	6,645,399.30	8,384,138.31	4,304,125	5,789,138.75
Productivity increases 25%	9,529,448.78	11,852,650.8	7,332,250	9,615,691.25
Output Price increases 25%	9,529,448.78	11,852,650.8	7,332,250	9,615,691.25
Fertilizer price decreases 25%	6,512,076.38	8,101,037.12	4,292,065.9	5,736,884.61
Wage labor decreases 25%	6,645,399.30	8,384,138.31	3,804,125	5,289,138.75

Source: Author’s estimate, 2022

The beneficial impact. It can be observed in various scenarios for soybean farmers in the region, such as an increase in productivity and a 25% increase in soybean prices. An increase in productivity can significantly increase both private and social profits for farmers with both owned and leased land. Sari & Prajanti (2016) support the finding that the implementation of policies on soybean farming output prices also has a positive impact on profits, but this policy has not yet been applied in actual conditions. Soybean farmers still receive low prices. Buana & Rusdarti (2018) shows that this is due to import policies that impose a zero percent tariff, which is not beneficial for domestic soybean producers. Imported soybeans in the market cause domestic soybean prices to decline. Budiharti & Wardana (2021) states that changes in policies towards inputs and outputs have an impact on changes in soybean competitiveness in the research location. The policies implemented can have both positive and negative impacts on soybean competitiveness. Policies that can enhance the competitive and comparative advantages of soybean farming are productivity policies and output price determination. These findings are consistent with Sukmaya et al. (2017) research, where factors such as fertilizer subsidies, technological assistance, and an increase in soybean prices at the farmer level have a significant impact on soybean production in Lamongan Regency. Kata (2021) adds that government policies towards soybean farming inputs and outputs through the UPSUS PAJALE program and fertilizer subsidies have improved soybean competitiveness on dry land in Tebo Regency through their impact on revenue and costs, but soybean HPP policy and zero percent soybean import tariff policy have not been able to improve soybean competitiveness.

Referring to the findings, the impact of changes in inputs and outputs on soybean farming competitiveness in Jember Regency can be seen in Table 11 scenarios that will create increased productivity and soybean prices, which, in reality, can promote increased competitive advantages for soybean commodities in Jember Regency. The increase in competitive advantage applies to both farmers with owned and leased land. The competitive advantage increases by 0.08 and 0.13, respectively, for owned and leased land.

Other scenarios in the form of fertilizer price increases and loan interest rate increases tend to be detrimental to farmers. This finding is supported by the research results of Sukmaya et al. (2017), where both scenarios lead to a decrease in profits received by farmers. The decrease in competitive advantage due to an increase in the interest rate is 0.05 for farmers who borrow capital from banks. Other farmers are relatively unaffected by the policy of increasing interest rates (Suciaty & Hidayat, 2019). On the other hand, the increase in fertilizer prices has a significant impact on decreasing competitive advantage, which is 0.1.

Table 11. Impact of Changes in Inputs and Outputs on Soybean Competitive Advantage (PCR) in Percent

Scenario	Competitive Advantage		Changes		Elasticity	
	Private	Lease	Private	Lease	Private	Lease
Initial Condition	0.34	0.59	0.00	0.00	0.00	0.00
a 25% increase in productivity	0.26	0.46	-0.08	-0.13	-0.22	-0.22
Output price saw a 25% increase	0.26	0.46	-0.08	-0.13	-0.22	-0.22
Fertilizer prices rises by 25%.	0.44	0.69	0.10	0.10	0.29	0.17
Loan interest rates increases by 25%	0.34	0.64	0.00	0.05	0.00	0.08

Source: Author's estimate

The calculation of elasticity values is then carried out to examine the sensitivity of soybean competitiveness to policy changes. The higher the elasticity value, the more it indicates that the policy is effective in influencing soybean competitiveness (Budiharti & Wardana, 2021). Based on the above values, it can be known that the policies that are sensitive to soybean competitiveness in Jember Regency are productivity and output price policies. This is indicated by the highest elasticity value compared to other policy scenarios, which is 0.22. The elasticity of the fertilizer policy changes on soybean competitiveness is 0.29 and 0.17 for farmers with owned and leased land, respectively.

The evaluation of the impact of the fourth policy scenarios on soybean comparative advantage in Jember Regency can be assessed by examining their effects on the DRCR value (Lestari, 2020). The changes in the DRCR indicator values due to the applied policy scenarios can be seen in Table 12. The policy scenario that provides the highest comparative advantage is productivity policy in scenario one. This is indicated by a decrease in the DRCR of 0.37 and 0.13 for farmers with owned and leased land, respectively. The second policy that has a positive impact on increasing comparative and competitive advantage is the increase in the output price obtained by farmers when selling soybeans. The comparative advantage increases by 0.37 and 0.13.

Table 12. Impact of Changes in Inputs and Outputs on Soybean Comparative Advantage (DRCR) In Percent

Scenario	**Competitive Advantage**		**Changes**		**Elasticity**	
	Private	**Lease**	**Private**	**Lease**	**Private**	**Lease**
Initial Condition	0.59	0.55	0.00	0.00	0.00	0.00
a 25% increase in productivity	0.22	0.43	-0.37	-0.13	-0.63	-0.23
Output price saw a 25% increase	0.22	0.43	-0.37	-0.13	-0.63	-0.23
Fertilizer prices rises by 25%.	0.29	0.69	0.30	0.14	0.50	0.25
Loan interest rates increases by 25%	0.59	0.59	0.00	0.04	0.00	0.07

Source: Author's estimate

The implementation of policies that increase input production prices has resulted in a decrease in comparative advantage. The increase in fertilizer prices has led to a comparative advantage decline of 0.3 and 0.14 for farmers with owned and leased land, respectively. Suminartika (2020) explains that the increase in interest rates is actually only felt by farmers whose capital is obtained from banks, resulting in a comparative advantage decline of 0.04.

The policies that most sensitively affect the comparative advantage of soybeans are indicated by changes in productivity and soybean prices, which are 0.63 and 0.23, respectively. These results indicate that a 1% increase in productivity and output prices can increase the comparative advantage of soybeans by 0.63 for farmers with owned land and 0.23 for leased land. The scenario of increasing fertilizer prices also has a significant impact on the change in comparative advantage of soybeans, which is 0.5 and 0.25, meaning that a 1% increase in fertilizer prices will lead to a decrease in comparative advantage of soybeans by 0.5 for farmers with owned land and 0.25 for leased land. Based on the elasticity results, it was found that productivity and output price policies are the most sensitive among other policies.

CONCLUSION

Based on the analysis and discussion, several conclusions can be drawn. Soybean farming analysis using the Policy Matrix Analysis (PAM) method shows that the soybean farming business is capable of generating economic profits. The analysis of soybean competitiveness in this area also shows that soybean farming can generate comparative and competitive advantages. Furthermore, in the policy analysis, it is known that the impact of soybean policies on farming in the region is not yet optimal. Therefore, new governance policies are needed. The analysis parameters in the PAM analysis show that price and productivity variables have a potential role in increasing soybean production and competitiveness.

1. Soybean farming analysis using the Policy Matrix Analysis (PAM) method shows that the soybean farming business in Jember Regency is capable of

generating positive and efficient private benefits. This positive value can be interpreted as economically advantageous for soybean farming in Jember Regency.

2. The Private Cost Ratio (PCR) value of soybean farming in Jember Regency indicates a value less than 1, which means that soybean farming is financially efficient or has a competitive advantage and can drive production growth. The Domestic Resource Cost Ratio (DRCR) value shows a value less than one, which means that soybean farming is economically efficient or has a comparative advantage.
3. The government policies have a positive impact or favor soybean farming in terms of both tradable outputs and inputs, as shown by the values of NPCO (Nominal Protection Coefficient Output), EPC (Effective Protection Coefficient), and PC (Profit Coefficient) being greater than one, NPCI (Nominal Protection Input Coefficient) being less than one, and the values of NPT (Net Protection Transfer) and SRP (Subsidi Ratio to Producer) indicating positive results. However, it can be shown that the values of these indicators indicate that the impact of soybean policies on farming in the region is not yet optimal. Therefore, new governance policies are needed. The analysis parameters in the PAM analysis show that price and productivity variables have a potential role in increasing soybean production and competitiveness.

POLICY RECOMMENDATION

Considering the urgency of each problem in soybean cultivation, the results of this research show that price strategies and increasing productivity have a strategic role in pursuing soybean production in Indonesia. Therefore, it is hoped that the government and stakeholders can focus on completely resolving the problem of soybean prices and productivity.

First, the government's productivity policy strategy should be to (i) provide national seed regulations and collaborate with research institutions and universities to produce superior varieties of soybean seeds, (ii) regulate the prices of subsidized fertilizers and pesticides as well as agricultural equipment assistance programs, (iii) policies that lead to increasing the area planted and developing soybean agricultural technology.

Second, policies related to prices can be implemented by (i) providing national soybean business institutional governance regulations, (ii) making national soybean product import and protection regulations, (iii) providing national soybean supply chain and value chain regulations, and (iv) help improve Bulog's role in price stabilization down to the farmer level.

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