Policy and competitiveness of integrated agricultural-based technology for cocoa production in Indonesia: Application of a policy analysis matrix

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Abstrack

Cocoa is one of the plantation commodities that is a superior regional commodity in Bali and even a national superior commodity. Indonesia's cocoa production is the fifth largest after palm oil, coconut, rubber, and sugar cane (BPS, 2011). In 2021, cocoa production in Bali will reach 13,876 tons and production has increased since the last three years, (Arndt et al., 2016). Cocoa production has the opportunity to increase yields by controlling pests and diseases and proper fertilization. The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Tabanan. The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of organic rice farming. Measuring the competitiveness of organic rice in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price. Competitiveness at the social price level is placed on the second row of the PAM table, Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness. Furthermore, competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

Key word; cocoa, intercroping, comparatif and kompetitif of cocoa

Background

Cocoa is one of the plantation commodities that is a superior regional commodity in Bali and even a national superior commodity. Indonesia's cocoa production is the fifth largest after palm oil, coconut, rubber, and sugar cane (BPS, 2011). In 2021, cocoa production in Bali will reach 13,876 tons and production has increased since the last three years, (Arndt et al., 2016). Cocoa production has the opportunity to increase yields by controlling pests and diseases and proper fertilization (Kongor et al., 2018). Cocoa production can be seen in Table 1 below.

Table 1. Cocoa production by Regency/City in Bali Province

Regency/City	Cocoa Production by Regency/City in Bali Province (Tons)		
	2019	2020	2021
Jembrana	2942	3009	6341
Tabanan	895	921	4530
Badung	88	78	455
Gianyar	107	107	292
Klungkung	22	22	42
Bangli	76	62	228
Karangasem	172	169	727
Buleleng	649	628	1261
Denpasar City	0	0	0
Bali province	4951	4997	13876

Source: BPS Bali Province 2022

The development of cocoa cannot be separated from its role as one of the smallholder plantation commodities that farmers in rural areas depend on, even for export purposes for industry, cocoa shows a high comparative value for export, therefore cocoa is very competitive (Nwachukwu & Nwaru, 2015), both exports of cocoa beans broken or whole (Vivek et al., 2020). Cocoa development is an effort carried out to develop and improve quality to maintain existing local, national, and international market shares. Apart from that, cocoa development considers the ecological impact of planting, the economic viability of small farmers, and the area of planting land (Wessel & Quist-Wessel, 2015).

Cocoa plants, especially those managed by farmers (people's plantations) can be found in all provinces in Indonesia. One of them is in Bali Province, which is one of the people's cocoa plantations with the largest land area, namely *Jembara* which is capable of producing 6341 tons of cocoa per year.

Cocoa is the main superior commodity and is the most prominent compared to other types of plantation crops in Bali, so it is a commodity that has a big influence on the farmer's economy, according to (Gutiérrez García et al., 2020) which shows that the income of cocoa farmers is influenced by social factors and control of planting area. cocoa. Apart from that (Ntiamoah& Afrane, 2008) Cocoa production was chosen because of its significant position in the economy.

Farmers manage cocoa on community plantations by utilizing domestic factors owned by the farmers themselves, and taking advantage of the existence of farmer groups in marketing cocoa (Beg et al., 2017). Cocoa marketing encourages strong industrial growth. The marketing process is through marketing channels with fermented cocoa to produce the quality of cocoa desired by consumers.

The development of various aspects, starting from cultivation, maintenance, harvest/post-harvest, processing, to marketing, is very much paid attention to by farmers, especially the rainfall, soil conditions, and shade found on cocoa plants, (Zuidema, et al., 2005) the yield gap reaches 50% if the shade reaches 60% and the dry season is strong, the weather is unfavorable and the type of soil is clay.

With the potential, this farming business has the opportunity to have advantages both in the local market and in the international market. To increase the competitiveness of cocoa, it is necessary to identify the advantages of cocoa in the local market and the international market

Even though currently smallholder cocoa has been marketed through strengthening farmer groups, it is still not optimal because they do not yet know the advantages of cocoa at local prices and advantages in international markets, so to increase potential profits, intensive cocoa production is needed. Apart from that, improving the quality of cocoa has been done by fermenting cocoa beans because it requires additional time and energy, and the price received by farmers is considered not much different from non-fermented ones. The fermentation process can increase selling prices which has an impact on increasing farmers' overall income (Indratmi & Chanan, 2011; Rifin, 2012).

Farmers' desire to immediately receive payment for cocoa beans is one of the obstacles because the fermentation process is considered too long. This is also supported by the existence of collecting traders who make it easier for farmers to sell cocoa beans and in times of need, farmers can borrow funds or goods from collecting traders or by bond. According to Said (2010), the attachment of farmers to collecting traders through the bonded bond system makes its existence difficult to eliminate in several cocoa center areas. The research results of Abubakar, Yantu, & Asih (2013) show

Farmer institutions greatly contribute to increasing farmer independence and welfare (Anantanyu, 2011) because institutions have very strong ties to the techno-social conditions of farmers (Suradisastra, 2008). Hidayanto, Supiandi, Yahya, & Amien (2009) stated that the development of farmer institutions is very important for several reasons, namely (1) many agricultural problems can be solved by farmer institutions; (2) providing continuity in efforts to disseminate technology or technical knowledge to farmers; (3) preparing farmers to be able to compete in a more open economic structure; and (4) the existence of farmer cooperation which can encourage more efficient use of farmer resources. However, the condition that occurs is that cocoa farmer institutions are still very weak, making farmers' bargaining position weak in the face of the existing market system because the structure of the cocoa market at the farmer level is The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Tabanan.

RESEARCH METHOD

4.1 Research Design

The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of organic rice farming. Measuring the competitiveness of organic rice in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price. Competitiveness at the social price level is placed on the second row of the PAM table

The analytical method to measure the competitiveness of organic rice uses the Policy Analysis Matrix (PAM) or Policy Analysis Matrix (Pearson et al, 2005).
The stages of the approach using PAM are: (1) Determination of inputs for rice farming; (2) Determination of input and output shadow prices; (3) Segregation of farming costs into tradable and domestic groups; (4) Calculating revenue from rice farming; (5) Calculating and analyzing various indicators that can be generated from PAM analysis(Monke & Pearson, 1989)

The PAM table (Table 2) provides, among other things, indicators of comparative advantage and government policies. In detail, the resulting indicators are as follows.

Table 2 Components that make up the policy analysis matrix.

Components of	Revenue	Factor Cost of Production		Profit
		Tradable	*Non-tradable*	
Private Price	A	B	C	D
Social Price	AND	F	G	H
Divergence	I = A – E	J = B – F	K = C - G	L = D - H

Source: Pearson (2005)
Description:
A = Private Revenue
B = Private input Tradable Fee
C = Private *Input Non-Tradable* Fee
D = Private Profit
E = Social Revenue
F = Social *Input Tradable* fee
G = Social *Input Non Tradable* fee
H = Social Profit
I = *Output Transfer*
J = *Input Tradable* Transfer
K = Factor Transfer
L = Net Transfer

The competitiveness of organic rice farming in PAM analysis can be seen from the competitive advantage and comparative advantage. The competitive advantage of organic rice farming in Bali can be determined using the private cost ratio (PCR). PCR is the ratio between domestic factor costs and value-added output from domestic factor costs traded at private prices.

(1) *Private Cost Account* (PCR) = $\frac{Private\ Not\ Tradable\ Fee}{Private\ Revenue - Input\ Tradable\ Cost} = \frac{C}{A-B}$ ………………………………………………………………..…(1)

PCR's private profitability indicates the ability of the system to pay domestic resource costs and remain competitive.
Decision-making criteria:
1. PCR < 1, meaning that organic rice has a competitive advantage
2. PCR > 1, meaning that organic rice has no competitive advantage

(2)*Domestic Resource Cost Ratio* = $\frac{Social\ Input\ Non\ Trandable\ Cost}{Social\ revenue - input\ tradable} = \frac{G}{F-F}$ (2)

The comparative advantage of organic rice is known by using the ratio of domestic resource costs (DRC). DRC is the ratio between domestic factor costs and the value-added output of domestic factor costs traded at social prices.

Domestic Resource Cost (DRC) is an indicator of comparative advantage, showing the amount of domestic resources that can be saved to generate one unit of foreign exchange.

Decision-making criteria:

1. If DRC < 1, it means that organic rice has a comparative advantage. The smaller the DRC value means the system is more efficient and has a higher comparative advantage.
2. If DRC > 1, it means that there is no comparative advantage in organic rice commodities.

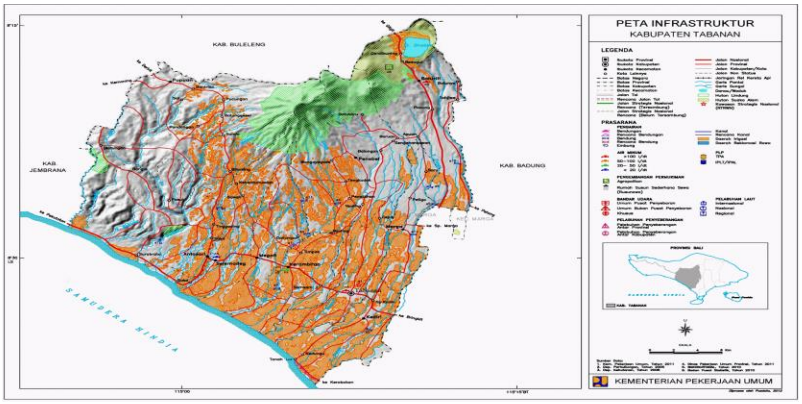
There is an impact of government policies on the policy analysis matrix, which can be seen from the following indicators. The impact of government policies on output is shown by the value of the Nominal Protection Coefficient Output (NPCO), and the impact of government policies on tradable inputs is shown by the value of

Results and Discussion

General description of the location of the People's Plantation Cocoa Farming Business

Tabanan Regency is located in the southern part of Bali Island. *Tabanan* Regency has an area of 1,013.88 km² or 17.54% of the area of Bali province which consists of mountainous and coastal areas in Indonesia. Geographically, the *Tabanan* Regency area is located between 114°54'52" - 115°12'57" east longitude and 8°14'30" - 8°30'70" south latitude. (Pakpahan et al., 2021)t Land cover plays an important role in determining land availability and understanding the spatial area of a research object. The existence of land cover can help determine the development of an area and its relationship to the development of the commodities being developed.

The topography of this district lies between an altitude of 0 – 2,276 meters above sea level, with details; at an altitude of 0 – 500 meters above sea level, it is a flat area with a slope of 2 – 15%. Meanwhile, at an altitude of 500 – 1,000 meters above sea level, it is a flat to sloping area with a slope of 15 – 40%. In areas that have slopes of 2 – 15% and 15 – 40%, these are areas that are quite fertile and can be used as agricultural land. (Mustofa, 2021)The geographical conditions of regions can be a basis for stating the potential of natural resources as a source of regional production and exports. In areas that have a height above 1,000 m above sea level and with a slope of 40% upwards, these are hilly and steep areas. Figure 1 shows an overview of *Tabanan* Regency.



Picture. I Map of Tabanan Regency.

The *Tabanan* Regency area is 23,358 Ha or 28.00% of the land area is moorland, so *Tabanan* Regency is known as an agricultural area. *Tabanan's* superior potential is in the agricultural sector because most of the livelihoods, regional economic pillars, and land use in the *Tabanan* region are still dominated by agriculture in the broadest sense. *Tabanan* Regency is in a tropical area with two different seasons, namely the dry season and the rainy season, interspersed with the transition season. Air temperature varies and is also determined by altitude, the average is around 27.6^0 C. Irrigation conditions are influenced by the shape of the coast and rainfall which is a source of water storage and irrigation source.

If we look at land ownership, from the existing area, around 22,562 km^2 (26.88%) of the *Tabanan* area is non-rice field land. Of the 73.12 percent of non-rice field land, 99.95 percent of it is dry land, mostly in the form of dry fields, gardens, and state forests, the remaining 0.05 percent is other land such as ponds, ponds, and swamps. From its topography, *Tabanan* Regency is a mountainous and coastal area. This results in temperature differences in each region in the *Tabanan* Regency area. These temperature differences can ultimately affect the level of rainfall in the month concerned, the frequency of rainfall is high.

People's Plantation cocoa farming system in Tabanan district

People's plantation cocoa farming in Tabanan Regency is a cocoa farming system that is carried out in an integrated manner using intercropping. An integrated cocoa farming system with cattle crops is an effort to use cattle waste or cow dung as raw material for fertilizer for cocoa plants. Fertilizer produced from cow dung as a natural organic fertilizer is obtained from the number of cattle kept by farmers around cocoa plantations. Organic fertilizer produced from cattle waste contains nutrients that are good for plants, consisting of NPK which plants need. According to (the Ministry of Agriculture, 2022) NPK fertilizer with 4 levels, namely P0 (0 grams), P1 (7.5 grams), P2 (15 grams), and P3 (22.5 grams). had a significant effect on the number of leaves, the wet weight of the canopy, and the dry weight of the canopy. Use of organic fertilizer from cow waste (Nappu et al., 2017) because it is easy to obtain and every farmer has cattle as a fertilizer producer. The advantage of using organic fertilizer on cocoa plants is that the input costs for cocoa production are cheaper. Excessive use of fertilizer does not pose a danger of poisoning farmers or cocoa plants. The lack of organic fertilizer can be supplemented by fertilizer produced by farmers from cattle waste.

The integrated system of cocoa production with cattle also provides additional benefits, namely cocoa waste which can be used as cattle feed for smallholder cocoa farmers in *Tabanan.*

Cocoa shells contain many important vitamins and nutrients for cows, so they are very good for cattle feed in addition to feeding ruminants. Animal feed needs can be obtained from cocoa waste or wild plants that grow around cocoa plants. This shows that the interdependence between farmers, crops, and cattle is one unit in cocoa production and cattle production.(Fikria et al., 2017)cocoa plantations are 169,441 kg/ha/year. (Nappu et al., 2017) Used as animal feed amounting to 27,420 kg/year.

The cocoa farming system with intercropping is a farming system that utilizes one piece of land by planting several production crops. Cocoa plants are intercropped with banana and coconut plants. This intercropping system provides harvests of several commodities at different times according to the farmer's needs. Between cocoa harvests, farmers will harvest bananas or coconuts. According to (Utomo, et al., 2016)Cocoa-coconut agroforestry systems have better environmental performance, compared to other cocoa-coconut agroforestry systems and cocoa monocultures. The suitability of temperature, rainfall, and soil greatly supports cocoa production (Singh et al., 2021). Based on the results of research in Tabanan, cocoa intercropping was carried out with banana and coconut plants as plants needed for farmers' household needs. Intercropping shows the optimal use of plantation land for several commodities which can produce production at different times beyond the main crop yield. The research results in line with Sukanteri, et al, 2023 show that cocoa products through intercropping show efficiency of using farm inputs of R/C of 5.95

Characteristics of Community Plantation Cocoa Farmers

Socially, cocoa farmers in *Tabanan* have various characteristics, especially farmer education, including having an education. (Septianti et al., 2020) farmer characteristics support the development of the cocoa population and the production technology used. Apart from that (Hulme et al., 2018) the importance of mastering knowledge in cocoa production. The research results show that the education of cocoa farmers is relatively high at 90%, this shows that farmers can absorb knowledge and technological information about cocoa production, and are even able to compare local cocoa prices with international cocoa prices and create cocoa products that can compete socially.

Competitiveness of cocoa farming in *Tabanan* Regency

Smallholder cocoa plantations carried out by cocoa farmers in Tabanan through an integrated agricultural system are analyzed through a policy analysis matrix to measure the comparative advantage and competitive advantage of smallholder plantation cocoa production in Tabanan.

The competitive advantage of cocoa farming is known using the private cost ratio (PCR), which measures the ratio between the costs of non-tradable domestic factors and the added value of output from the costs of privately traded tradable input factors. (Nappu et al., 2017)The cocoa supply chain includes farmers -Agrochemicals -Product Buyers-Exporters supporting the comparative advantage of cocoa in Nigeria (Siagian et al., 2014). The comparative advantage of smallholder cocoa farming in Tabanan can be measured using the domestic resources cost ratio, namely the ratio between the costs of non-tradable domestic factors and the added value of domestic input costs traded at social prices. The private nominal interest rate is 10.20% per year and the interest rate is (% per year) and the rupiah exchange rate per USD dollar. The nominal interest rate is obtained from formal credit interest rate information at commercial banks. All components of capital costs incurred reflect inflation.

Policy analysis matrix analysis shows the private benefits and social benefits of smallholder cocoa farming in *Tabanan*. (Franzen & Borgerhoff Mulder, 2007) Private profits are the difference between revenues and costs of cocoa farming at private prices, while social profits are the difference between social revenues and social costs. Social benefits and social costs are based on estimates from smallholder cocoa farming to measure the level of farming efficiency. Economic benefits (Aneani et al., 2012) are shown in the value of economic activity for its benefits to society as a whole without looking at who gives and who receives the benefits.

Measuring economic profits for both input and output using social or shadow prices. Social prices (Fitriana et al., 2020) are international prices according to CIF prices for imported commodities and FOB prices for exported commodities) for tradable inputs and outputs.

Table 1. Policy analysis results matrix analysis of smallholder cocoa farming in Tabanan

	Revenue	**Cost (Cost)**			**Profit**
		Input Tradable	**Labor**	**Capital**	**(Profit)**
Private	22.500.000	13.018.966	5.437.407	1.070.162	2.973.465
Social	28.528.500	13.763.566	5.437.407	426.902	8.900.625
Divergence	(6.028.500)	(744.600)	-	643.260	(5.927.160)

The output of smallholder farming, in this case cocoa, shows how to measure overall economic income by producing one unit of output (export commodity) or the savings that can be made by not importing one unit of imported commodity. Cocoa obtained at a selling price of IDR 30,000 per kg at the farmer level shows the private price received by farmers after selling it in the form of dry beans. The comparison of private prices with social prices reaches IDR 20,000 so social prices provide greater value. The efficiency price of all inputs is measured by estimating the amount of national income resulting from using resources to produce cocoa commodities. Efficiency shows how scarce resources are allocated to produce *output* and maximum income from cocoa farming. (Sutopo et al., 2016) If a farming system produces positive social benefits, it means that the farming can compete at international price levels, without the help of any government policy. The social benefits of farming systems (which reflect high efficiency) are very attractive to governments who prioritize high economic growth

Price measurement Parity price (World Bank, 2016) for cocoa commodities is the cost of shipping goods from the port to the nearest wholesaler, as well as converting the value of goods from processed goods to unprocessed goods. Cocoa is a commodity that has not been processed so consider storage costs. National efficiency for Indonesia is determined by the value of the opportunity cost of revenue from exports.

The research results show that private profits are IDR 2,973,465 and social profits from cocoa farming are IDR 8,900,625. Private profits indicate that private revenues are greater than private costs incurred by cocoa farmers. In Pam's analysis, profit is added value after all costs are taken into account. The research results show that cocoa farming obtains positive private profits, meaning that smallholder cocoa farming can compete at actual price levels, including the impact of policies and market failures.

Research on smallholder cocoa farming shows that the social revenue obtained is IDR 28,528,500. Cocoa production requires production costs for one harvest period of IDR 13,763,566 for tradable input costs, labor requirements of IDR 5,437,407, and capital expenditure of IDR 426,902 so the total costs required are IDR 19,627,875. The social benefits that can be obtained from smallholder cocoa farming are IDR 8,900,625 in one harvest period. The research results show that cocoa farming has a comparative advantage at the social price level.

The existence of divergence is indicated by the difference in private values (output and input) compared to social values, perhaps caused by distorted policies (*distorting policy*) or the market is running imperfectly so that it fails to create an efficient market (*market failure*) which causes private prices (actual market prices) to differ from social prices (efficiency prices or *social opportunity cost*). Divergence arises due to several reasons, namely 1) market failure, and 2) policy distortion. Market failure occurs when the market fails to create competition *outcome*s and price efficiency. A common type of market failure is caused by a monopoly. Distorted policies are government interventions that cause market prices to differ from efficiency prices. This could take the form of taxes or subsidies, trade barriers, or other interventions. Distortive policies are generally carried out to achieve non-efficient goals (equality or food security).

Divergence in acceptance (*revenue*), amounting to Rp6.028.500) is caused by the difference between private prices and social prices for tradable inputs. Divergence *input tradable* amounting to Rp. 744.600, caused by the difference between private prices and social prices. Only the labor factor does not show divergence, because there is no difference in private and social labor costs in cocoa farming in *Tabanan.* Divergence in the cost of capital arises as a result of the social cost of capital (interest rate) being lower than the private interest rate. The private interest rate is 10.2%/year, while the social interest rate is 15.79%/year.

The private expense ratio (*Private Cost Account* or PCR) is a comparison between domestic factor costs and added value *output* of costs *input tradable* at private prices. The PCR value shows a measure of competitiveness or efficiency in financial value or competitive advantage. This means that the competitiveness of organic rice farming is achieved if the PCR value is less than one (PCR < 1), conversely if the PCR value is > 1, it indicates that organic rice farming does not have a competitive advantage.

The results of the research show that smallholder cocoa farming carried out using an agricultural integration system with intercropping patterns has a PCR value of 0.69, meaning that to produce one unit of added value output, smallholder cocoa farming requires 69% of the cost of domestic resources. So smallholder plantation farming with intercropping patterns has a relatively low competitive advantage. To increase competitive advantage, a system of planting patterns other than intercropping is needed so that cocoa yields are more optimal.

According to (Widyatami & Wiguna, 2019) the monoculture cocoa planting system provides a greater PCR value so that when compared with the intercropping planting pattern, farmers need to make changes to the planting pattern system. This is caused by intercropping not providing space for a commodity at the correct planting distance so that the lighting requirements for cocoa plants are not optimal and the humus absorption space is not optimal.

The results of the PAM analysis show that smallholder cocoa farming has competitiveness as indicated by comparative advantage or ratio value *domestic resource cost* (DRC), amounting to 0.40 y, this is the ratio between domestic costs and added value of costs that can be traded at a social price. DRC ratio < 1, meaning that the commodity is more profitable if cultivated domestically rather than imported.

Analysis results using the method *Analysis Matrix* (PAM) show that the domestic resource ratio value or *Domestic Resource Cost* (DRC) of 0.4 means that to obtain the added value of one unit an additional domestic factor cost of 0.4 is required. This figure shows that national rice farming is quite efficient in using domestic economic resources, which means it also has a comparative advantage. To produce added value in cocoa farming, farmers only need 40% of tradable input costs from all costs incurred by farmers.

The results of research on smallholder cocoa plantations show an NPCO value of 0.79, this shows that the price of cocoa in Indonesia is lower than the price of cocoa abroad (international price). The low value of cocoa prices in Indonesia is caused by the private price received by farmers being lower than the social price of cocoa and the large tradable input costs incurred by farmers to produce cocoa, even though the fertilizer input has been subsidized by the government. According to (Mardones & Hernández, 2017) subsidy contributions provide increased production reduce the burden on farmers, and increase farmers' income in the production sector of a commodity. This is also caused by the intercropping system which causes the amount of cocoa to not be optimal because the land is still used to produce other crops. (Budiasa et al., 2012) (Sukanteri, et al,.2023), the intercropping system can only accommodate 600 cocoa trees, while the mono-cropping system can accommodate 1000 cocoa trees per ha. This is caused by the presence of other plants planted on the same land with irregular spacing. Differences in world cocoa prices (Gilbert, 2016) are caused in part by changes in consumption and uncertain harvest conditions, (Vivek et al., 2020) indicating that cocoa production is carried out manually with the machine technology used unchanged.

One of the causes of low private profits for farmers is not only the price but the cropping pattern system which greatly determines the cocoa production produced. An NPCO value < 1 means that smallholder cocoa farming has not received protection from the government, indicating that government policies for cocoa farmers have not been implemented effectively, resulting in a reduction in farmers' income from cocoa commodities. This reduction in revenue occurred because there was no private price protection carried out by the government, especially on the private price of cocoa.

Apart from the impact of policy on output, the results of the PAM analysis also show the impact of government policy on tradable input, namely the nominal protection coefficient on Input (NPCI). The results of PAM analysis on smallholder cocoa farming in Bali show a nominal protection coefficient on Input (NPCI) value of 1. (Septianti et al., 2020) inputs in the smallholder plantation industry tend to show positive results even though they are not yet optimal. The results of research on smallholder cocoa plantations show that cocoa production input is positive, which indicates that cocoa production input has a positive impact on government policy so that the price of private input is the same as the price of socially tradable input. The influence of government policy on cocoa production, especially on inputs, namely fertilizer. Fertilizer prices are still subsidized by the government so that farmers can reduce the costs incurred when producing cocoa. (Mason et al., 2013) with subsidies, farmers can pay (George Marechera and Joseph Ndwiga, 2015) back loans and fertilizer subsidies creating an increase in the planting area.

Based on the results of the analysis, it can be seen that the EPC value of smallholder cocoa farming is 0.64, which indicates that the EPC value is <1, meaning that the private added value is smaller than the social added value. The government's protection of tradable inputs and outputs for farmers has not been effective. government policies applied to cocoa farming inputs and outputs are less supportive or effective. so farmers only receive around 64% of the true social price. The government's policy on tradable input and output causes the added value received by cocoa farmers to be 36% lower than without the policy. The policies implemented cause private revenues received by cocoa farmers to be lower than social revenues. To obtain an increase in added value, it is necessary to implement policies on private tradable inputs that can reduce the costs of tradable inputs required during cocoa production. Apart from input subsidies in the form of fertilizer (Arndt et al., 2016), accompanying policies such as expansion of technology education are needed. Soil fertility and rural road investment and export opportunities.

PAM analysis of smallholder cocoa farming shows that the Subsidy Ratio to Producers (SRP) value is a measure of the combination of all transfer effects that occur. This ratio is a comparison between the net transfer value and income calculated at social prices. SRP shows the extent to which income increases or decreases due to transfers. The SRP value in cocoa farming is -0.208. The SRP value shows a negative value, SRP <1 means that government policy has an impact on smallholder cocoa farmers so that farmers pay production costs that are higher than their social costs, which is 20.8% higher than the costs that should be incurred. The results of the research show that government policies have caused smallholder cocoa farmers' income to decline.

Net Protection Transfer (NPT on cocoa commodities) shows the difference between profits at private prices and profits at social prices of negative Rp.5,927,160 per ha. A negative NPT value indicates that there is a transfer of surplus from cocoa producers or farmers to other parties, in other words, it shows that government policy has not had a positive impact on cocoa farming. Competitive and comparative advantages based on policy matrix analysis can be seen in Table 1.

Table 1. Cocoa analysis in policy matrix analysis.

No	**Coefficient**	**Mark**
		Ratio
1	NPCO [A/E] (Nominal Protection Coefficient on Output)	0.79
2	NPCI [B/F] (Nominal Protection Coefficient on Input)	1
3	PCR [C/(A-B)] (Private Cost Ratio)	0.69
4	DRC [G/(E-F)] (Domestic Resource Cost)	0.40
5	EPC [(A-B)/(E-F)] (Effective Protection Coefficient)	0.64
6	PC [D/H) (Profitability Coefficient)	0.33
7	SRP [L/E] (Subsidy Ratio to Producers)	-0.208
8	NPT [Private Benefit - Social Benefit}	(5,927,160)

Conclusion

Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness. Furthermore, competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

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Policy and competitiveness of integrated agricultural-based technology for cocoa production in Indonesia: Application of a policy analysis matrix

Comment [a1]: Select text Bolt

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Abstrack

Cocoa is one of the plantation commodities that is a superior regional commodity in Bali and even a national superior commodity. Indonesia's cocoa production is the fifth largest after palm oil, coconut, rubber, and sugar cane (BPS, 2011). In 2021, cocoa production in Bali will reach 13,876 tons and production has increased since the last three years, (Arndt et al., 2016). Cocoa production has the opportunity to increase yields by controlling pests and diseases and proper fertilization. The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Tabanan. The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of organic rice farming. Measuring the competitiveness of organic rice in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price. Competitiveness at the social price level is placed on the second row of the PAM table, Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness. Furthermore, competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

Comment [a3]: Abstract is too long, you need to condense this part

Comment [a4]: abstract must contain Purpose, Theoretical framework, Design/methodology/approach, Findings:, Research, Practical & Social implications, Originality/value: Originality/Value

Key word; cocoa, intercroping, comparatif and kompetitif of cocoa

Background

Cocoa is one of the plantation commodities that is a superior regional commodity in Bali and even a national superior commodity. Indonesia's cocoa production is the fifth largest after palm oil, coconut, rubber, and sugar cane (BPS, 2011). In 2021, cocoa production in Bali will reach 13,876 tons and production has increased since the last three years, (Arndt et al., 2016). Cocoa production has the opportunity to increase yields by controlling pests and diseases and proper fertilization (Kongor et al., 2018). Cocoa production can be seen in Table 1 below.

Comment [a5]: The novelty of the study is very low. Authors need to directly state the novelty of their research.

Table 1. Cocoa production by Regency/City in Bali Province

Regency/City	Cocoa Production by Regency/City in Bali Province (Tons)		
	2019	2020	2021
Jembrana	2942	3009	6341
Tabanan	895	921	4530
Badung	88	78	455
Gianyar	107	107	292
Klungkung	22	22	42
Bangli	76	62	228
Karangasem	172	169	727
Buleleng	649	628	1261
Denpasar City	0	0	0
Bali province	4951	4997	13876

Source: BPS Bali Province 2022

The development of cocoa cannot be separated from its role as one of the smallholder plantation commodities that farmers in rural areas depend on, even for export purposes for industry, cocoa shows a high comparative value for export, therefore cocoa is very competitive (Nwachukwu & Nwaru, 2015), both exports of cocoa beans broken or whole (Vivek et al., 2020). Cocoa development is an effort carried out to develop and improve quality to maintain existing local, national, and international market shares. Apart from that, cocoa development considers the ecological impact of planting, the economic viability of small farmers, and the area of planting land (Wessel & Quist-Wessel, 2015).

Cocoa plants, especially those managed by farmers (people's plantations) can be found in all provinces in Indonesia. One of them is in Bali Province, which is one of the people's cocoa plantations with the largest land area, namely *Jembara* which is capable of producing 6341 tons of cocoa per year.

Cocoa is the main superior commodity and is the most prominent compared to other types of plantation crops in Bali, so it is a commodity that has a big influence on the farmer's economy, according to (Gutiérrez García et al., 2020) which shows that the income of cocoa farmers is influenced by social factors and control of planting area. cocoa. Apart from that (Ntiamoah& Afrane, 2008) Cocoa production was chosen because of its significant position in the economy.

Farmers manage cocoa on community plantations by utilizing domestic factors owned by the farmers themselves, and taking advantage of the existence of farmer groups in marketing cocoa (Beg et al., 2017). Cocoa marketing encourages strong industrial growth. The marketing process is through marketing channels with fermented cocoa to produce the quality of cocoa desired by consumers.

The development of various aspects, starting from cultivation, maintenance, harvest/post-harvest, processing, to marketing, is very much paid attention to by farmers, especially the rainfall, soil conditions, and shade found on cocoa plants, (Zuidema, et al., 2005) the yield gap reaches 50% if the shade reaches 60% and the dry season is strong, the weather is unfavorable and the type of soil is clay.

With the potential, this farming business has the opportunity to have advantages both in the local market and in the international market. To increase the competitiveness of cocoa, it is necessary to identify the advantages of cocoa in the local market and the international market

Even though currently smallholder cocoa has been marketed through strengthening farmer groups, it is still not optimal because they do not yet know the advantages of cocoa at local prices and advantages in international markets, so to increase potential profits, intensive cocoa production is needed. Apart from that, improving the quality of cocoa has been done by fermenting cocoa beans because it requires additional time and energy, and the price received by farmers is considered not much different from non-fermented ones. The fermentation process can increase selling prices which has an impact on increasing farmers' overall income (Indratmi & Chanan, 2011; Rifin, 2012).

Farmers' desire to immediately receive payment for cocoa beans is one of the obstacles because the fermentation process is considered too long. This is also supported by the existence of collecting traders who make it easier for farmers to sell cocoa beans and in times of need, farmers can borrow funds or goods from collecting traders or by bond. According to Said (2010), the attachment of farmers to collecting traders through the bonded bond system makes its existence difficult to eliminate in several cocoa center areas. The research results of Abubakar, Yantu, & Asih (2013) show

Farmer institutions greatly contribute to increasing farmer independence and welfare (Anantanyu, 2011) because institutions have very strong ties to the techno-social conditions of farmers (Suradisastra, 2008). Hidayanto, Supiandi, Yahya, & Amien (2009) stated that the development of farmer institutions is very important for several reasons, namely (1) many agricultural problems can be solved by farmer institutions; (2) providing continuity in efforts to disseminate technology or technical knowledge to farmers; (3) preparing farmers to be able to compete in a more open economic structure; and (4) the existence of farmer cooperation which can encourage more efficient use of farmer resources. However, the condition that occurs is that cocoa farmer institutions are still very weak, making farmers' bargaining position weak in the face of the existing market system because the structure of the cocoa market at the farmer level is The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Tabanan.

RESEARCH METHOD

4.1 Research Design

The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of organic rice farming. Measuring the competitiveness of organic rice in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price. Competitiveness at the social price level is placed on the second row of the PAM table

Comment [a6]: In this section, you also can added roadmap of methodology research, so readers can know what's going on.

The analytical method to measure the competitiveness of organic rice uses the Policy Analysis Matrix (PAM) or Policy Analysis Matrix (Pearson et al, 2005).
The stages of the approach using PAM are: (1) Determination of inputs for rice farming; (2) Determination of input and output shadow prices; (3) Segregation of farming costs into tradable and domestic groups; (4) Calculating revenue from rice farming; (5) Calculating and analyzing various indicators that can be generated from PAM analysis(Monke & Pearson, 1989)

The PAM table (Table 2) provides, among other things, indicators of comparative advantage and government policies. In detail, the resulting indicators are as follows.

Table 2 Components that make up the policy analysis matrix.

Components of	Revenue	Factor Cost of Production		Profit
		Tradable	*Non-tradable*	
Private Price	A	B	C	D
Social Price	AND	F	G	H
Divergence	I = A – E	J = B – F	K = C - G	L = D - H

Source: Pearson (2005)
Description:
A = Private Revenue
B = Private input Tradable Fee
C = Private *Input Non-Tradable* Fee
D = Private Profit
E = Social Revenue
F = Social *Input Tradable* fee
G = Social *Input Non Tradable* fee
H = Social Profit
I = *Output Transfer*
J = *Input Tradable* Transfer
K = Factor Transfer
L = Net Transfer

The competitiveness of organic rice farming in PAM analysis can be seen from the competitive advantage and comparative advantage. The competitive advantage of organic rice farming in Bali can be determined using the private cost ratio (PCR). PCR is the ratio between domestic factor costs and value-added output from domestic factor costs traded at private prices.

(1) $$\text{Private Cost Account (PCR)} = \frac{Private\ Not\ Tradable\ Fee}{Private\ Revenue - Input\ Tradable\ Cost} = \frac{C}{A-B}$$ ……………………………………………………………..…(1)

PCR's private profitability indicates the ability of the system to pay domestic resource costs and remain competitive.
Decision-making criteria:
1. PCR < 1, meaning that organic rice has a competitive advantage
2. PCR > 1, meaning that organic rice has no competitive advantage

Comment [a7]: Please used mathematical equation in ms.word.

(2)*Domestic Resource Cost Ratio* = $\frac{Social\ Input\ Non\ Trandable\ Cost}{Social\ revenue-input\ tradable} = \frac{G}{F-F}$ (2)

The comparative advantage of organic rice is known by using the ratio of domestic resource costs (DRC). DRC is the ratio between domestic factor costs and the value-added output of domestic factor costs traded at social prices.

Domestic Resource Cost (DRC) is an indicator of comparative advantage, showing the amount of domestic resources that can be saved to generate one unit of foreign exchange.
Decision-making criteria:

1. If DRC < 1, it means that organic rice has a comparative advantage. The smaller the DRC value means the system is more efficient and has a higher comparative advantage.
2. If DRC > 1, it means that there is no comparative advantage in organic rice commodities.

There is an impact of government policies on the policy analysis matrix, which can be seen from the following indicators. The impact of government policies on output is shown by the value of the Nominal Protection Coefficient Output (NPCO), and the impact of government policies on tradable inputs is shown by the value of

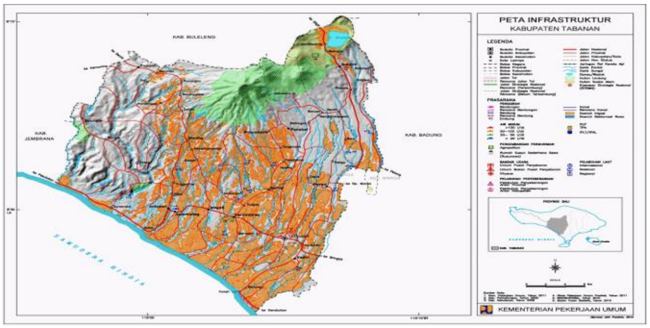
Results and Discussion

General description of the location of the People's Plantation Cocoa Farming Business

Tabanan Regency is located in the southern part of Bali Island. *Tabanan* Regency has an area of 1,013.88 km² or 17.54% of the area of Bali province which consists of mountainous and coastal areas in Indonesia. Geographically, the *Tabanan* Regency area is located between 114°54'52" - 115°12'57" east longitude and 8°14'30" - 8°30'70" south latitude. (Pakpahan et al., 2021)t Land cover plays an important role in determining land availability and understanding the spatial area of a research object. The existence of land cover can help determine the development of an area and its relationship to the development of the commodities being developed.

The topography of this district lies between an altitude of 0 – 2,276 meters above sea level, with details; at an altitude of 0 – 500 meters above sea level, it is a flat area with a slope of 2 – 15%. Meanwhile, at an altitude of 500 – 1,000 meters above sea level, it is a flat to sloping area with a slope of 15 – 40%. In areas that have slopes of 2 – 15% and 15 – 40%, these are areas that are quite fertile and can be used as agricultural land. (Mustofa, 2021)The geographical conditions of regions can be a basis for stating the potential of natural resources as a source of regional production and exports. In areas that have a height above 1,000 m above sea level and with a slope of 40% upwards, these are hilly and steep areas. Figure 1 shows an overview of *Tabanan* Regency.

Comment [a8]: The discussion is still too weak to maintain its credibility. The structure of the discussion is also not well organized.



Picture. I Map of Tabanan Regency.

The *Tabanan* Regency area is 23,358 Ha or 28.00% of the land area is moorland, so *Tabanan* Regency is known as an agricultural area. *Tabanan's* superior potential is in the agricultural sector because most of the livelihoods, regional economic pillars, and land use in the *Tabanan* region are still dominated by agriculture in the broadest sense. *Tabanan* Regency is in a tropical area with two different seasons, namely the dry season and the rainy season, interspersed with the transition season. Air temperature varies and is also determined by altitude, the average is around 27.6^0 C. Irrigation conditions are influenced by the shape of the coast and rainfall which is a source of water storage and irrigation source.

If we look at land ownership, from the existing area, around 22,562 km^2 (26.88%) of the *Tabanan* area is non-rice field land. Of the 73.12 percent of non-rice field land, 99.95 percent of it is dry land, mostly in the form of dry fields, gardens, and state forests, the remaining 0.05 percent is other land such as ponds, ponds, and swamps. From its topography, *Tabanan* Regency is a mountainous and coastal area. This results in temperature differences in each region in the *Tabanan* Regency area. These temperature differences can ultimately affect the level of rainfall in the month concerned, the frequency of rainfall is high.

People's Plantation cocoa farming system in Tabanan district

People's plantation cocoa farming in Tabanan Regency is a cocoa farming system that is carried out in an integrated manner using intercropping. An integrated cocoa farming system with cattle crops is an effort to use cattle waste or cow dung as raw material for fertilizer for cocoa plants. Fertilizer produced from cow dung as a natural organic fertilizer is obtained from the number of cattle kept by farmers around cocoa plantations. Organic fertilizer produced from cattle waste contains nutrients that are good for plants, consisting of NPK which plants need. According to (the Ministry of Agriculture, 2022) NPK fertilizer with 4 levels, namely P0 (0 grams), P1 (7.5 grams), P2 (15 grams), and P3 (22.5 grams). had a significant effect on the number of leaves, the wet weight of the canopy, and the dry weight of the canopy. Use of organic fertilizer from cow waste (Nappu et al., 2017) because it is easy to obtain and every farmer has cattle as a fertilizer producer. The advantage of using organic fertilizer on cocoa plants is that the input costs for cocoa production are cheaper. Excessive use of fertilizer does not pose a danger of poisoning farmers or cocoa plants. The lack of organic fertilizer can be supplemented by fertilizer produced by farmers from cattle waste.

The integrated system of cocoa production with cattle also provides additional benefits, namely cocoa waste which can be used as cattle feed for smallholder cocoa farmers in *Tabanan*.

Cocoa shells contain many important vitamins and nutrients for cows, so they are very good for cattle feed in addition to feeding ruminants. Animal feed needs can be obtained from cocoa waste or wild plants that grow around cocoa plants. This shows that the interdependence between farmers, crops, and cattle is one unit in cocoa production and cattle production.(Fikria et al., 2017)cocoa plantations are 169,441 kg/ha/year. (Nappu et al., 2017) Used as animal feed amounting to 27,420 kg/year.

The cocoa farming system with intercropping is a farming system that utilizes one piece of land by planting several production crops. Cocoa plants are intercropped with banana and coconut plants. This intercropping system provides harvests of several commodities at different times according to the farmer's needs. Between cocoa harvests, farmers will harvest bananas or coconuts. According to (Utomo, et al., 2016)Cocoa-coconut agroforestry systems have better environmental performance, compared to other cocoa-coconut agroforestry systems and cocoa monocultures. The suitability of temperature, rainfall, and soil greatly supports cocoa production (Singh et al., 2021). Based on the results of research in Tabanan, cocoa intercropping was carried out with banana and coconut plants as plants needed for farmers' household needs. Intercropping shows the optimal use of plantation land for several commodities which can produce production at different times beyond the main crop yield. The research results in line with Sukanteri, et al, 2023 show that cocoa products through intercropping show efficiency of using farm inputs of R/C of 5.95

Comment [a9]: you need to add a discussion about the use of cocoa intercroping

Characteristics of Community Plantation Cocoa Farmers

Socially, cocoa farmers in *Tabanan* have various characteristics, especially farmer education, including having an education. (Septianti et al., 2020) farmer characteristics support the development of the cocoa population and the production technology used. Apart from that (Hulme et al., 2018) the importance of mastering knowledge in cocoa production. The research results show that the education of cocoa farmers is relatively high at 90%, this shows that farmers can absorb knowledge and technological information about cocoa production, and are even able to compare local cocoa prices with international cocoa prices and create cocoa products that can compete socially.

Competitiveness of cocoa farming in *Tabanan* Regency

Smallholder cocoa plantations carried out by cocoa farmers in Tabanan through an integrated agricultural system are analyzed through a policy analysis matrix to measure the comparative advantage and competitive advantage of smallholder plantation cocoa production in Tabanan.

Comment [a10]: what is the analysis method? In the method section need to be added

The competitive advantage of cocoa farming is known using the private cost ratio (PCR), which measures the ratio between the costs of non-tradable domestic factors and the added value of output from the costs of privately traded tradable input factors. (Nappu et al., 2017)The cocoa supply chain includes farmers -Agrochemicals -Product Buyers-Exporters supporting the comparative advantage of cocoa in Nigeria (Siagian et al., 2014). The comparative advantage of smallholder cocoa farming in Tabanan can be measured using the domestic resources cost ratio, namely the ratio between the costs of non-tradable domestic factors and the added value of domestic input costs traded at social prices. The private nominal interest rate is 10.20% per year and the interest rate is (% per year) and the rupiah exchange rate per USD dollar. The nominal interest rate is obtained from formal credit interest rate information at commercial banks. All components of capital costs incurred reflect inflation.

Policy analysis matrix analysis shows the private benefits and social benefits of smallholder cocoa farming in *Tabanan*. (Franzen & Borgerhoff Mulder, 2007) Private profits are the difference between revenues and costs of cocoa farming at private prices, while social profits are the difference between social revenues and social costs. Social benefits and social costs are based on estimates from smallholder cocoa farming to measure the level of farming efficiency. Economic benefits (Aneani et al., 2012) are shown in the value of economic activity for its benefits to society as a whole without looking at who gives and who receives the benefits.

Measuring economic profits for both input and output using social or shadow prices. Social prices (Fitriana et al., 2020) are international prices according to CIF prices for imported commodities and FOB prices for exported commodities) for tradable inputs and outputs.

Comment [a11]: what is the analysis method? In the method section need to be added

Table 1. Policy analysis results matrix analysis of smallholder cocoa farming in Tabanan

	Revenue	**Cost (Cost)**			**Profit**
		Input Tradable	**Labor**	**Capital**	**(Profit)**
Private	22.500.000	13.018.966	5.437.407	1.070.162	2.973.465
Social	28.528.500	13.763.566	5.437.407	426.902	8.900.625
Divergence	(6.028.500)	(744.600)	-	643.260	(5.927.160)

The output of smallholder farming, in this case cocoa, shows how to measure overall economic income by producing one unit of output (export commodity) or the savings that can be made by not importing one unit of imported commodity. Cocoa obtained at a selling price of IDR 30,000 per kg at the farmer level shows the private price received by farmers after selling it in the form of dry beans. The comparison of private prices with social prices reaches IDR 20,000 so social prices provide greater value. The efficiency price of all inputs is measured by estimating the amount of national income resulting from using resources to produce cocoa commodities. Efficiency shows how scarce resources are allocated to produce *output* and maximum income from cocoa farming. (Sutopo et al., 2016) If a farming system produces positive social benefits, it means that the farming can compete at international price levels, without the help of any government policy. The social benefits of farming systems (which reflect high efficiency) are very attractive to governments who prioritize high economic growth

Price measurement Parity price (World Bank, 2016) for cocoa commodities is the cost of shipping goods from the port to the nearest wholesaler, as well as converting the value of goods from processed goods to unprocessed goods. Cocoa is a commodity that has not been processed so consider storage costs. National efficiency for Indonesia is determined by the value of the opportunity cost of revenue from exports.

The research results show that private profits are IDR 2,973,465 and social profits from cocoa farming are IDR 8,900,625. Private profits indicate that private revenues are greater than private costs incurred by cocoa farmers. In Pam's analysis, profit is added value after all costs are taken into account. The research results show that cocoa farming obtains positive private profits, meaning that smallholder cocoa farming can compete at actual price levels, including the impact of policies and market failures.

Research on smallholder cocoa farming shows that the social revenue obtained is IDR 28,528,500. Cocoa production requires production costs for one harvest period of IDR 13,763,566 for tradable input costs, labor requirements of IDR 5,437,407, and capital expenditure of IDR 426,902 so the total costs required are IDR 19,627,875. The social benefits that can be obtained from smallholder cocoa farming are IDR 8,900,625 in one harvest period. The research results show that cocoa farming has a comparative advantage at the social price level.

The existence of divergence is indicated by the difference in private values (output and input) compared to social values, perhaps caused by distorted policies (*distorting policy*) or the market is running imperfectly so that it fails to create an efficient market (*market failure*) which causes private prices (actual market prices) to differ from social prices (efficiency prices or *social opportunity cost*). Divergence arises due to several reasons, namely 1) market failure, and 2) policy distortion. Market failure occurs when the market fails to create competition *outcome*s and price efficiency. A common type of market failure is caused by a monopoly. Distorted policies are government interventions that cause market prices to differ from efficiency prices. This could take the form of taxes or subsidies, trade barriers, or other interventions. Distortive policies are generally carried out to achieve non-efficient goals (equality or food security).

Divergence in acceptance (*revenue*), amounting to Rp6.028.500) is caused by the difference between private prices and social prices for tradable inputs. Divergence *input tradable* amounting to Rp. 744.600, caused by the difference between private prices and social prices. Only the labor factor does not show divergence, because there is no difference in private and social labor costs in cocoa farming in *Tabanan*. Divergence in the cost of capital arises as a result of the social cost of capital (interest rate) being lower than the private interest rate. The private interest rate is 10.2%/year, while the social interest rate is 15.79%/year.

The private expense ratio (*Private Cost Account* or PCR) is a comparison between domestic factor costs and added value *output* of costs *input tradable* at private prices. The PCR value shows a measure of competitiveness or efficiency in financial value or competitive advantage. This means that the competitiveness of organic rice farming is achieved if the PCR value is less than one (PCR < 1), conversely if the PCR value is > 1, it indicates that organic rice farming does not have a competitive advantage.

The results of the research show that smallholder cocoa farming carried out using an agricultural integration system with intercropping patterns has a PCR value of 0.69, meaning that to produce one unit of added value output, smallholder cocoa farming requires 69% of the cost of domestic resources. So smallholder plantation farming with intercropping patterns has a relatively low competitive advantage. To increase competitive advantage, a system of planting patterns other than intercropping is needed so that cocoa yields are more optimal.
According to (Widyatami & Wiguna, 2019) the monoculture cocoa planting system provides a greater PCR value so that when compared with the intercropping planting pattern, farmers need to make changes to the planting pattern system. This is caused by intercropping not providing space for a commodity at the correct planting distance so that the lighting requirements for cocoa plants are not optimal and the humus absorption space is not optimal.

The results of the PAM analysis show that smallholder cocoa farming has competitiveness as indicated by comparative advantage or ratio value *domestic resource cost* (DRC), amounting to 0.40 y, this is the ratio between domestic costs and added value of costs that can be traded at a social price. DRC ratio < 1, meaning that the commodity is more profitable if cultivated domestically rather than imported.

Analysis results using the method *Analysis Matrix* (PAM) show that the domestic resource ratio value or *Domestic Resource Cost* (DRC) of 0.4 means that to obtain the added value of one unit an additional domestic factor cost of 0.4 is required. This figure shows that national rice farming is quite efficient in using domestic economic resources, which means it also has a comparative advantage. To produce added value in cocoa farming, farmers only need 40% of tradable input costs from all costs incurred by farmers.

The results of research on smallholder cocoa plantations show an NPCO value of 0.79, this shows that the price of cocoa in Indonesia is lower than the price of cocoa abroad (international price). The low value of cocoa prices in Indonesia is caused by the private price received by farmers being lower than the social price of cocoa and the large tradable input costs incurred by farmers to produce cocoa, even though the fertilizer input has been subsidized by the government. According to (Mardones & Hernández, 2017) subsidy contributions provide increased production reduce the burden on farmers, and increase farmers' income in the production sector of a commodity. This is also caused by the intercropping system which causes the amount of cocoa to not be optimal because the land is still used to produce other crops. (Budiasa et al., 2012) (Sukanteri, et al,.2023), the intercropping system can only accommodate 600 cocoa trees, while the mono-cropping system can accommodate 1000 cocoa trees per ha. This is caused by the presence of other plants planted on the same land with irregular spacing. Differences in world cocoa prices (Gilbert, 2016) are caused in part by changes in consumption and uncertain harvest conditions, (Vivek et al., 2020) indicating that cocoa production is carried out manually with the machine technology used unchanged.

One of the causes of low private profits for farmers is not only the price but the cropping pattern system which greatly determines the cocoa production produced. An NPCO value < 1 means that smallholder cocoa farming has not received protection from the government, indicating that government policies for cocoa farmers have not been implemented effectively, resulting in a reduction in farmers' income from cocoa commodities. This reduction in revenue occurred because there was no private price protection carried out by the government, especially on the private price of cocoa.

Apart from the impact of policy on output, the results of the PAM analysis also show the impact of government policy on tradable input, namely the nominal protection coefficient on Input (NPCI). The results of PAM analysis on smallholder cocoa farming in Bali show a nominal protection coefficient on Input (NPCI) value of 1. (Septianti et al., 2020) inputs in the smallholder plantation industry tend to show positive results even though they are not yet optimal. The results of research on smallholder cocoa plantations show that cocoa production input is positive, which indicates that cocoa production input has a positive impact on government policy so that the price of private input is the same as the price of socially tradable input. The influence of government policy on cocoa production, especially on inputs, namely fertilizer. Fertilizer prices are still subsidized by the government so that farmers can reduce the costs incurred when producing cocoa. (Mason et al., 2013) with subsidies, farmers can pay (George Marechera and Joseph Ndwiga, 2015) back loans and fertilizer subsidies creating an increase in the planting area.

Based on the results of the analysis, it can be seen that the EPC value of smallholder cocoa farming is 0.64, which indicates that the EPC value is <1, meaning that the private added value is smaller than the social added value. The government's protection of tradable inputs and outputs for farmers has not been effective. government policies applied to cocoa farming inputs and outputs are less supportive or effective. so farmers only receive around 64% of the true social price. The government's policy on tradable input and output causes the added value received by cocoa farmers to be 36% lower than without the policy. The policies implemented cause private revenues received by cocoa farmers to be lower than social revenues. To obtain an increase in added value, it is necessary to implement policies on private tradable inputs that can reduce the costs of tradable inputs required during cocoa production. Apart from input subsidies in the form of fertilizer (Arndt et al., 2016), accompanying policies such as expansion of technology education are needed. Soil fertility and rural road investment and export opportunities.

PAM analysis of smallholder cocoa farming shows that the Subsidy Ratio to Producers (SRP) value is a measure of the combination of all transfer effects that occur. This ratio is a comparison between the net transfer value and income calculated at social prices. SRP shows the extent to which income increases or decreases due to transfers. The SRP value in cocoa farming is -0.208. The SRP value shows a negative value, SRP <1 means that government policy has an impact on smallholder cocoa farmers so that farmers pay production costs that are higher than their social costs, which is 20.8% higher than the costs that should be incurred. The results of the research show that government policies have caused smallholder cocoa farmers' income to decline.

Net Protection Transfer (NPT on cocoa commodities) shows the difference between profits at private prices and profits at social prices of negative Rp.5,927,160 per ha. A negative NPT value indicates that there is a transfer of surplus from cocoa producers or farmers to other parties, in other words, it shows that government policy has not had a positive impact on cocoa farming. Competitive and comparative advantages based on policy matrix analysis can be seen in Table 1.

Table 1. Cocoa analysis in policy matrix analysis.

No	**Coefficient**	**Mark**
		Ratio
1	NPCO [A/E] (Nominal Protection Coefficient on Output)	0.79
2	NPCI [B/F] (Nominal Protection Coefficient on Input)	1
3	PCR [C/(A-B)] (Private Cost Ratio)	0.69
4	DRC [G/(E-F)] (Domestic Resource Cost)	0.40
5	EPC [(A-B)/(E-F)] (Effective Protection Coefficient)	0.64
6	PC [D/H) (Profitability Coefficient)	0.33
7	SRP [L/E] (Subsidy Ratio to Producers)	-0.208
8	NPT [Private Benefit - Social Benefit}	(5,927,160)

Conclusion

Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness. Furthermore, competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

Comment [a12]: please synchronize your suggestions with your findings in the results and discussion

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Policy and competitiveness of integrated agricultural-based technology for cocoa production in Indonesia: Application of a policy analysis matrix

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Abstrack

Purpose: The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Indonesia.

Theoretical framework: The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of cocoa farming.

Design/methodology/approach : Measuring the competitiveness of cocoa in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price

Findings: Competitiveness at the social price level is placed on the second row of the PAM table, Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness.

Research, Practical & Social implications: Competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

Originality/value: Originality/Value: This research is original. Implemented in smallholder cocoa plantations in Indonesia with integrated crop-livestock farming patterns to produce outputs that can compete at social prices and to motivate other cocoa farmers to develop farming system innovations that can increase cocoa production based on local resources.

Key word; cocoa, intercroping, comparative and competitive of cocoa

I. Background

Cocoa is one of the plantation commodities that is a superior regional commodity in Bali and even a national superior commodity. Indonesia's cocoa production is the fifth largest after palm oil, coconut, rubber, and sugar cane (BPS, 2011). In 2021, cocoa production in Bali will reach 13,876 tons and production has increased since the last three years, (Arndt et al., 2016). Cocoa production has the opportunity to increase yields by controlling pests and diseases and proper fertilization (Kongor et al., 2018). Cocoa production can be seen in Table 1 below.

Table 1. Cocoa production by Regency/City in Bali Province

Regency/City	Cocoa Production by Regency/City in Bali Province (Tons)		
	2019	2020	2021
Jembrana	2942	3009	6341
Tabanan	895	921	4530
Badung	88	78	455
Gianyar	107	107	292
Klungkung	22	22	42
Bangli	76	62	228
Karangasem	172	169	727
Buleleng	649	628	1261
Denpasar City	0	0	0
Bali province	4951	4997	13876

Source: BPS Bali Province 2022

The development of cocoa cannot be separated from its role as one of the smallholder plantation commodities that farmers in rural areas depend on, even for export purposes for industry, cocoa shows a high comparative value for export, therefore cocoa is very competitive (Nwachukwu & Nwaru, 2015), both exports of cocoa beans broken or whole (Vivek et al., 2020). Cocoa development is an effort carried out to develop and improve quality to maintain existing local, national, and international market shares. Apart from that, cocoa development considers the ecological impact of planting, the economic viability of small farmers, and the area of planting land (Wessel & Quist-Wessel, 2015).

Cocoa plants, especially those managed by farmers (people's plantations) can be found in all provinces in Indonesia. One of them is in Bali Province, which is one of the people's cocoa plantations with the largest land area, namely *Jembara* which is capable of producing 6341 tons of cocoa per year.

Cocoa is the main superior commodity and is the most prominent compared to other types of plantation crops in Bali, so it is a commodity that has a big influence on the farmer's economy, according to (Gutiérrez García et al., 2020) which shows that the income of cocoa farmers is influenced by social factors and control of planting area. cocoa. Apart from that (Ntiamoah& Afrane, 2008) Cocoa production was chosen because of its significant position in the economy.

Farmers manage cocoa on community plantations by utilizing domestic factors owned by the farmers themselves, and taking advantage of the existence of farmer groups in marketing cocoa (Beg et al., 2017). Cocoa marketing encourages strong industrial growth. The marketing process is through marketing channels with fermented cocoa to produce the quality of cocoa desired by consumers.

The development of various aspects, starting from cultivation, maintenance, harvest/post-harvest, processing, to marketing, is very much paid attention to by farmers, especially the rainfall, soil conditions, and shade found on cocoa plants, (Zuidema, et al., 2005) the yield gap reaches 50% if the shade reaches 60% and the dry season is strong, the weather is unfavorable and the type of soil is clay.

With the potential, this farming business has the opportunity to have advantages both in the local market and in the international market. To increase the competitiveness of cocoa, it is necessary to identify the advantages of cocoa in the local market and the international market

Even though currently smallholder cocoa has been marketed through strengthening farmer groups, it is still not optimal because they do not yet know the advantages of cocoa at local prices and advantages in international markets, so to increase potential profits, intensive cocoa production is needed. Apart from that, improving the quality of cocoa has been done by fermenting cocoa beans because it requires additional time and energy, and the price received by farmers is considered not much different from non-fermented ones. The fermentation process can increase selling prices which has an impact on increasing farmers' overall income (Indratmi & Chanan, 2011; Rifin, 2012).

Farmers' desire to immediately receive payment for cocoa beans is one of the obstacles because the fermentation process is considered too long. This is also supported by the existence of collecting traders who make it easier for farmers to sell cocoa beans and in times of need, farmers can borrow funds or goods from collecting traders or by bond. According to Said (2010), the attachment of farmers to collecting traders through the bonded bond system makes its existence difficult to eliminate in several cocoa center areas. The research results of Abubakar, Yantu, & Asih (2013) show

Farmer institutions greatly contribute to increasing farmer independence and welfare (Anantanyu, 2011) because institutions have very strong ties to the techno-social conditions of farmers (Suradisastra, 2008). Hidayanto, Supiandi, Yahya, & Amien (2009) stated that the development of farmer institutions is very important for several reasons, namely (1) many agricultural problems can be solved by farmer institutions; (2) providing continuity in efforts to disseminate technology or technical knowledge to farmers; (3) preparing farmers to be able to compete in a more open economic structure; and (4) the existence of farmer cooperation which can encourage more efficient use of farmer resources. However, the condition that occurs is that cocoa farmer institutions are still very weak, making farmers' bargaining position weak in the face of the existing market system because the structure of the cocoa market at the farmer level is The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Tabanan.

2. LITERATURE REVIEW

2.1 Produksi kakao berbasis Perkebunan rakyat

(Franzen & Borgerhoff Mulder, 2007) Kakao adalah tanaman yang sebagian besar ditanam oleh petani kecil di dataran rendah tropis, khususnya di Indonesia. Kakao berpotensi memberikan manfaat keanekaragaman hayati (Hulme et al., 2018) bila ditanam di bawah kondisi naungan tertentu, terutama jika dibandingkan dengan penggunaan lahan alternatif. diversifikasi pertanian mungkin merupakan cara paling efektif untuk mengoptimalkan hasil ekologi, ekonomi, dan sosial (Wessel & Quist-Wessel, 2015)
(Yahaya et al., 2015)petani kakao harus diberikan fasilitas kredit dari lembaga kredit formal dengan tingkat bunga yang terjangkau untuk meningkatkan produksi kakao.produksi dan ekspor mengalami peningkatan mencapai 5,3% dan 5,7% per tahun melalui dukungan pemerintah terhadap subsektor produksi(George Marechera and Joseph Ndwiga, 2015)(Kementan, 2022),(Saputro & Helbawanti, 2020)
(George Marechera and Joseph Ndwiga, 2015)Untuk meningkatkan produksi kakao dianjurkan memasukkan spesies pohon buah-buahan dan pohon hutan(Aneani et al., 2012) ke dalam perkebunan kakao berkontribusi terhadap intensifikasi agro-ekologi produksi kakao, sekaligus meningkatkan fleksibilitas dan ketahanan, yang penting bagi petani kecil yang menanam kakao 95% kakao dunia. (Delgado-Ospina et al., 2021)kehadiran genotipe jamur baru yang sangat agresif meningkatkan kekhawatiran terhadap penyakit yang disebabkan oleh jamur patogen dapat menurunkan produksi kakao

2.2 Upaya menciptakan daya saing komoditas kakao

(Puello-Mendez et al., 2017)Biji kakao dikeringkan setelah fermentasi untuk mengurangi kadar air, dengan pengeringan matahari di udara terbuka (pengering tenaga surya langsung) dan pengeringan rumah kaca (pengering tenaga surya atap plastik) dua metode yang digunakan di daerah pedesaan Kolombia. Berbeda dengan Indonesia memiliki keunggulan komparatif sebagai eksportir biji kakao dan kakao olahan di pasar internasional(Tresliyana et al., 2004), produk olahannya mempunyai banyak manfaat bagi kesehatan. Namun, kulit buah umumnya diangg yang mempengaruhi daya saing biji kakao dianggap sebagai limbah yang mampu mempengaruhi kualitas kakao(Wessel & Quist-Wessel, 2015). sistem pendukung dan kerangka kebijakan yang berkaitan dengan penyuluhan dan penelitian pertanian dikembangkan di tingkat petani(Dzomeku et al., 2014). (Uwagboe et al., 2012)Petani kakao telah dilatih mengenai penggunaan Pengendalian Hama Terpadu untuk mengendalikan hama.

2.3 Sistem pertanian terintegrasi pada komoditas kakao

(Sonwa et al., 2019)Cara pencampuran pohon-pohon terkait dalam sistem akan berdampak pada tanaman kakao dan tanaman yang terkait dengan pohon kakao dalam sistem wanatani, dan intensitas naungan pada perkebunan kakao. (Uwagboe et al., 2012)asosiasi fungsional/koperasi, untuk mendorong penggunaan teknik pembrantasan hama penyakit tanaman. Strategi peremajaan kakao diintegrasikan dengan pohon naungan dan penggunaan input agrokimia yang lebih besar dalam sistem sinar matahari (Smith Dumont et al., 2014). penanaman campuran tradisional antara kakao, hutan, pohon buah-buahan, serta beberapa pohon kelapa sawit dibahas sebagai alternatif terhadap pendekatan input tinggi(Wessel & Quist-Wessel, 2015), integrasi kakao dengan tanaman naungan yang bermanfaat bagi petani(Siagian et al., 2014) Indonesia memiliki daya saing tinggi untuk komoditas kakao pasta (Nilai Rata-Rata RCA 1,79), kakao butter (5,48) dan kakao bubuk (2,46), sedangkan cokelat Indonesia belum memiliki daya saing (0,23)(Nauly et al., 2014). Integrasi kakao-kambing memperoleh keuntungan sebesar Rp 60.293.000/tahun B/C ratio 2,7menunjukkan usaha kambing dan kakao dapat menguntungkan bagi peternak. Kemudian usaha tersebut layak secara finansial dan ekonomis(Rusdiana & Hutasoit, 2019).

2.4 Kelayakan usahatani kakao

usahatani tumpang sari kakao lebih baik dibandingkan usahatani kakao monokultur(Christina Pasaribu et al., 2016). pendapatan rumah tangga petani kakao ditunjukkan dengan angka Gini Ratio sebesar 0,46 (Oshima) atau Distribusi lahan petani kakao merata dengan nilai indeks Gini sebesar 0,36 (Oshima) dan 1,07 (Bank Dunia)(Gusti et al., 2013). Ratio integrasi kakao kambing sebesar B/C 1.8 menunjukkan usahatani layak dikembangkan (Rusdiana & Hutasoit, 2019) adanya peningkatan persentase harga produsen dengan subsidi pupuk secara signifikan meningkatkan pendapatan petani(George Marechera and Joseph Ndwiga, 2015). Model adopsi menunjukkan bahwa kredit, jumlah kebun kakao yang dimiliki oleh petani, jenis kelamin, usia kebun kakao, migrasi, luas kebun kakao, dan hasil kakao mempengaruhi keputusan adopsi petani kakao\r\nterkait dengan rekomendasi CRIG dalam upaya meningkatkan produktivitas kakao(Aneani et al., 2012)

RESEARCH METHOD

4.1 Research Design

The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of organic rice farming. Measuring the competitiveness of organic rice in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price. Competitiveness at the social price level is placed on the second row of the PAM table

The analytical method to measure the competitiveness of organic rice uses the Policy Analysis Matrix (PAM) or Policy Analysis Matrix (Pearson et al, 2005).
The stages of the approach using PAM are: (1) Determination of inputs for rice farming; (2) Determination of input and output shadow prices; (3) Segregation of farming costs into tradable and domestic groups; (4) Calculating revenue from rice farming; (5) Calculating and analyzing various indicators that can be generated from PAM analysis(Monke & Pearson, 1989)

The PAM table (Table 2) provides, among other things, indicators of comparative advantage and government policies. In detail, the resulting indicators are as follows.

Table 2 Components that make up the policy analysis matrix.

Components	Revenue	Factor Cost of Production	Profit

of		Tradable	Non-tradable	
Private Price	A	B	C	D
Social Price	AND	F	G	H
Divergence	I = A – E	J = B – F	K = C - G	L = D - H

Source: Pearson (2005)

Description:

A = Private Revenue
B = Private input Tradable Fee
C = Private *Input Non-Tradable* Fee
D = Private Profit
E = Social Revenue
F = Social *Input Tradable* fee
G = Social *Input Non Tradable* fee
H = Social Profit
I = *Output Transfer*
J = *Input Tradable* Transfer
K = Factor Transfer
L = Net Transfer

The competitiveness of organic rice farming in PAM analysis can be seen from the competitive advantage and comparative advantage. The competitive advantage of organic rice farming in Bali can be determined using the private cost ratio (PCR). PCR is the ratio between domestic factor costs and value-added output from domestic factor costs traded at private prices.

(1) *Private Cost Account* (PCR) = $\frac{Private\ Not\ \ Tradable\ Fee}{Private\ Revenue - \ Input\ Tradable\ Cost} = \frac{C}{A-B}$ ……………………………………………………………..…(1)

PCR's private profitability indicates the ability of the system to pay domestic resource costs and remain competitive.

Decision-making criteria:

1. PCR < 1, meaning that organic rice has a competitive advantage
2. PCR > 1, meaning that organic rice has no competitive advantage

(2)*Domestic Resource Cost Ratio* = $\frac{Social\ Input\ Non\ Trandable\ Cost}{Social\ revenue - input\ tradable} = \frac{G}{F-F}$ (2)

The comparative advantage of organic rice is known by using the ratio of domestic resource costs (DRC). DRC is the ratio between domestic factor costs and the value-added output of domestic factor costs traded at social prices.

Domestic Resource Cost (DRC) is an indicator of comparative advantage, showing the amount of domestic resources that can be saved to generate one unit of foreign exchange.

Decision-making criteria:

1. If DRC < 1, it means that organic rice has a comparative advantage. The smaller the DRC value means the system is more efficient and has a higher comparative advantage.
2. If DRC > 1, it means that there is no comparative advantage in organic rice commodities.

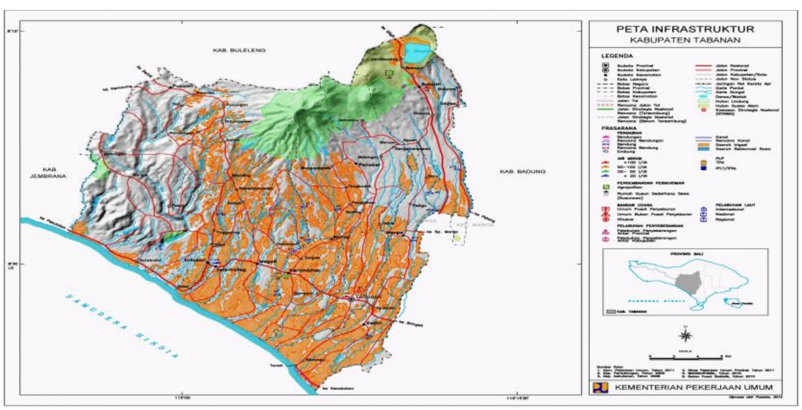
There is an impact of government policies on the policy analysis matrix, which can be seen from the following indicators. The impact of government policies on output is shown by the value of the Nominal Protection Coefficient Output (NPCO), and the impact of government policies on tradable inputs is shown by the value of

Results and Discussion

General description of the location of the People's Plantation Cocoa Farming Business

Tabanan Regency is located in the southern part of Bali Island. *Tabanan* Regency has an area of 1,013.88 km² or 17.54% of the area of Bali province which consists of mountainous and coastal areas in Indonesia. Geographically, the *Tabanan* Regency area is located between 114°54'52" - 115°12'57" east longitude and 8°14'30" - 8°30'70" south latitude. (Pakpahan et al., 2021)t Land cover plays an important role in determining land availability and understanding the spatial area of a research object. The existence of land cover can help determine the development of an area and its relationship to the development of the commodities being developed.

The topography of this district lies between an altitude of 0 – 2,276 meters above sea level, with details; at an altitude of 0 – 500 meters above sea level, it is a flat area with a slope of 2 – 15%. Meanwhile, at an altitude of 500 – 1,000 meters above sea level, it is a flat to sloping area with a slope of 15 – 40%. In areas that have slopes of 2 – 15% and 15 – 40%, these are areas that are quite fertile and can be used as agricultural land. (Mustofa, 2021)The geographical conditions of regions can be a basis for stating the potential of natural resources as a source of regional production and exports. In areas that have a height above 1,000 m above sea level and with a slope of 40% upwards, these are hilly and steep areas. Figure 1 shows an overview of *Tabanan* Regency.



Picture. I Map of Tabanan Regency.

The *Tabanan* Regency area is 23,358 Ha or 28.00% of the land area is moorland, so *Tabanan* Regency is known as an agricultural area. *Tabanan's* superior potential is in the agricultural sector because most of the livelihoods, regional economic pillars, and land use in the *Tabanan* region are still dominated by agriculture in the broadest sense. *Tabanan* Regency is in a tropical area with two different seasons, namely the dry season and the rainy season, interspersed with the transition season. Air temperature varies and is also determined by altitude, the average is around 27.6^{0} C. Irrigation conditions are influenced by the shape of the coast and rainfall which is a source of water storage and irrigation source.

If we look at land ownership, from the existing area, around 22,562 km^2 (26.88%) of the *Tabanan* area is non-rice field land. Of the 73.12 percent of non-rice field land, 99.95 percent of it is dry land, mostly in the form of dry fields, gardens, and state forests, the remaining 0.05 percent is other land such as ponds, ponds, and swamps. From its topography, *Tabanan* Regency is a mountainous and coastal area. This results in temperature differences in each region in the *Tabanan* Regency area. These temperature differences can ultimately affect the level of rainfall in the month concerned, the frequency of rainfall is high.

People's Plantation cocoa farming system in Tabanan district

People's plantation cocoa farming in Tabanan Regency is a cocoa farming system that is carried out in an integrated manner using intercropping. An integrated cocoa farming system with cattle crops is an effort to use cattle waste or cow dung as raw material for fertilizer for cocoa plants. Fertilizer produced from cow dung as a natural organic fertilizer is obtained from the number of cattle kept by farmers around cocoa plantations. Organic fertilizer produced from cattle waste contains nutrients that are good for plants, consisting of NPK which plants need. According to (the Ministry of Agriculture, 2022) NPK fertilizer with 4 levels, namely P0 (0 grams), P1 (7.5 grams), P2 (15 grams), and P3 (22.5 grams). had a significant effect on the number of leaves, the wet weight of the canopy, and the dry weight of the canopy. Use of organic fertilizer from cow waste (Nappu et al., 2017) because it is easy to obtain and every farmer has cattle as a fertilizer producer. The advantage of using organic fertilizer on cocoa plants is that the input costs for cocoa production are cheaper. Excessive use of fertilizer does not pose a danger of poisoning farmers or cocoa plants. The lack of organic fertilizer can be supplemented by fertilizer produced by farmers from cattle waste.

The integrated system of cocoa production with cattle also provides additional benefits, namely cocoa waste which can be used as cattle feed for smallholder cocoa farmers in *Tabanan.* Cocoa shells contain many important vitamins and nutrients for cows, so they are very good for cattle feed in addition to feeding ruminants. Animal feed needs can be obtained from cocoa waste or wild plants that grow around cocoa plants. This shows that the interdependence between farmers, crops, and cattle is one unit in cocoa production and cattle production.(Fikria et al., 2017)cocoa plantations are 169,441 kg/ha/year. (Nappu et al., 2017) Used as animal feed amounting to 27,420 kg/year.

The cocoa farming system with intercropping is a farming system that utilizes one piece of land by planting several production crops. Cocoa plants are intercropped with banana and coconut plants. This intercropping system provides harvests of several commodities at different times according to the farmer's needs. Between cocoa harvests, farmers will harvest bananas or coconuts. According to (Utomo, et al., 2016)Cocoa-coconut agroforestry systems have better environmental performance, compared to other cocoa-coconut agroforestry systems and cocoa monocultures. The suitability of temperature, rainfall, and soil greatly supports cocoa production (Singh et al., 2021). Based on the results of research in Tabanan, cocoa intercropping was carried out with banana and coconut plants as plants needed for farmers' household needs. Intercropping shows the optimal use of plantation land for several commodities which can produce production at different times beyond the main crop yield. The research results in line with Sukanteri, et al, 2023 show that cocoa products through intercropping show efficiency of using farm inputs of R/C of 5.95

Characteristics of Community Plantation Cocoa Farmers

Socially, cocoa farmers in *Tabanan* have various characteristics, especially farmer education, including having an education. (Septianti et al., 2020) farmer characteristics support the development of the cocoa population and the production technology used. Apart from that (Hulme et al., 2018) the importance of mastering knowledge in cocoa production. The research results show that the education of cocoa farmers is relatively high at 90%, this shows that farmers can absorb knowledge and technological information about cocoa production, and are even able to compare local cocoa prices with international cocoa prices and create cocoa products that can compete socially.

Competitiveness of cocoa farming in *Tabanan* Regency

Smallholder cocoa plantations carried out by cocoa farmers in Tabanan through an integrated agricultural system are analyzed through a policy analysis matrix to measure the comparative advantage and competitive advantage of smallholder plantation cocoa production in Tabanan.

The competitive advantage of cocoa farming is known using the private cost ratio (PCR), which measures the ratio between the costs of non-tradable domestic factors and the added value of output from the costs of privately traded tradable input factors. (Nappu et al., 2017)The cocoa supply chain includes farmers -Agrochemicals -Product Buyers-Exporters supporting the comparative advantage of cocoa in Nigeria (Siagian et al., 2014). The comparative advantage of smallholder cocoa farming in Tabanan can be measured using the domestic resources cost ratio, namely the ratio between the costs of non-tradable domestic factors and the added value of domestic input costs traded at social prices. The private nominal interest rate is 10.20% per year and the interest rate is (% per year) and the rupiah exchange rate per USD dollar. The nominal interest rate is obtained from formal credit interest rate information at commercial banks. All components of capital costs incurred reflect inflation.

Policy analysis matrix analysis shows the private benefits and social benefits of smallholder cocoa farming in *Tabanan*. (Franzen & Borgerhoff Mulder, 2007) Private profits are the difference between revenues and costs of cocoa farming at private prices, while social profits are the difference between social revenues and social costs. Social benefits and social costs are based on estimates from smallholder cocoa farming to measure the level of farming efficiency. Economic benefits (Aneani et al., 2012) are shown in the value of economic activity for its benefits to society as a whole without looking at who gives and who receives the benefits.

Measuring economic profits for both input and output using social or shadow prices. Social prices (Fitriana et al., 2020) are international prices according to CIF prices for imported commodities and FOB prices for exported commodities) for tradable inputs and outputs.

Table 1. Policy analysis results matrix analysis of smallholder cocoa farming in Tabanan

	Revenue	**Cost (Cost)**			**Profit**
		Input Tradable	**Labor**	**Capital**	**(Profit)**
Private	22.500.000	13.018.966	5.437.407	1.070.162	2.973.465
Social					

	28.528.500	13.763.566	5.437.407	426.902	8.900.625
Divergence	(6.028.500)	(744.600)	-	643.260	(5.927.160)

The output of smallholder farming, in this case cocoa, shows how to measure overall economic income by producing one unit of output (export commodity) or the savings that can be made by not importing one unit of imported commodity. Cocoa obtained at a selling price of IDR 30,000 per kg at the farmer level shows the private price received by farmers after selling it in the form of dry beans. The comparison of private prices with social prices reaches IDR 20,000 so social prices provide greater value. The efficiency price of all inputs is measured by estimating the amount of national income resulting from using resources to produce cocoa commodities. Efficiency shows how scarce resources are allocated to produce *output* and maximum income from cocoa farming. (Sutopo et al., 2016) If a farming system produces positive social benefits, it means that the farming can compete at international price levels, without the help of any government policy. The social benefits of farming systems (which reflect high efficiency) are very attractive to governments who prioritize high economic growth

Price measurement Parity price (World Bank, 2016) for cocoa commodities is the cost of shipping goods from the port to the nearest wholesaler, as well as converting the value of goods from processed goods to unprocessed goods. Cocoa is a commodity that has not been processed so consider storage costs. National efficiency for Indonesia is determined by the value of the opportunity cost of revenue from exports.

The research results show that private profits are IDR 2,973,465 and social profits from cocoa farming are IDR 8,900,625. Private profits indicate that private revenues are greater than private costs incurred by cocoa farmers. In Pam's analysis, profit is added value after all costs are taken into account. The research results show that cocoa farming obtains positive private profits, meaning that smallholder cocoa farming can compete at actual price levels, including the impact of policies and market failures.

Research on smallholder cocoa farming shows that the social revenue obtained is IDR 28,528,500. Cocoa production requires production costs for one harvest period of IDR 13,763,566 for tradable input costs, labor requirements of IDR 5,437,407, and capital expenditure of IDR 426,902 so the total costs required are IDR 19,627,875. The social benefits that can be obtained from smallholder cocoa farming are IDR 8,900,625 in one harvest period. The research results show that cocoa farming has a comparative advantage at the social price level.

The existence of divergence is indicated by the difference in private values (output and input) compared to social values, perhaps caused by distorted policies (*distorting policy*) or the market is running imperfectly so that it fails to create an efficient market (*market failure*) which causes private prices (actual market prices) to differ from social prices (efficiency prices or *social opportunity cost*). Divergence arises due to several reasons, namely 1) market failure, and 2) policy distortion. Market failure occurs when the market fails to create competition *outcome*s and price efficiency. A common type of market failure is caused by a monopoly. Distorted policies are government interventions that cause market prices to differ from efficiency prices. This could take the form of taxes or subsidies, trade barriers, or other interventions. Distortive policies are generally carried out to achieve non-efficient goals (equality or food security).

Divergence in acceptance (*revenue*), amounting to Rp6.028.500) is caused by the difference between private prices and social prices for tradable inputs. Divergence *input tradable* amounting to Rp. 744.600, caused by the difference between private prices and social prices. Only the labor factor does not show divergence, because there is no difference in private and social labor costs in cocoa farming in *Tabanan.* Divergence in the cost of capital arises as a result of the social cost of capital (interest rate) being lower than the private interest rate. The private interest rate is 10.2%/year, while the social interest rate is 15.79%/year.

The private expense ratio (*Private Cost Account* or PCR) is a comparison between domestic factor costs and added value *output* of costs *input tradable* at private prices. The PCR value shows a measure of competitiveness or efficiency in financial value or competitive advantage. This means that the competitiveness of organic rice farming is achieved if the PCR value is less than one (PCR < 1), conversely if the PCR value is > 1, it indicates that organic rice farming does not have a competitive advantage.

The results of the research show that smallholder cocoa farming carried out using an agricultural integration system with intercropping patterns has a PCR value of 0.69, meaning that to produce one unit of added value output, smallholder cocoa farming requires 69% of the cost of domestic resources. So smallholder plantation farming with intercropping patterns has a relatively low competitive advantage. To increase competitive advantage, a system of planting patterns other than intercropping is needed so that cocoa yields are more optimal.

According to (Widyatami & Wiguna, 2019) the monoculture cocoa planting system provides a greater PCR value so that when compared with the intercropping planting pattern, farmers need to make changes to the planting pattern system. This is caused by intercropping not providing space for a commodity at the correct planting distance so that the lighting requirements for cocoa plants are not optimal and the humus absorption space is not optimal.

The results of the PAM analysis show that smallholder cocoa farming has competitiveness as indicated by comparative advantage or ratio value *domestic resource cost* (DRC), amounting to 0.40 y, this is the ratio between domestic costs and added value of costs that can be traded at a social price. DRC ratio < 1, meaning that the commodity is more profitable if cultivated domestically rather than imported.

Analysis results using the method *Analysis Matrix* (PAM) show that the domestic resource ratio value or *Domestic Resource Cost* (DRC) of 0.4 means that to obtain the added value of one unit an additional domestic factor cost of 0.4 is required. This figure shows that national rice farming is quite efficient in using domestic economic resources, which means it also has a comparative advantage. To produce added value in cocoa farming, farmers only need 40% of tradable input costs from all costs incurred by farmers.

The results of research on smallholder cocoa plantations show an NPCO value of 0.79, this shows that the price of cocoa in Indonesia is lower than the price of cocoa abroad (international price). The low value of cocoa prices in Indonesia is caused by the private price received by farmers being lower than the social price of cocoa and the large tradable input costs incurred by farmers to produce cocoa, even though the fertilizer input has been subsidized by the government. According to (Mardones & Hernández, 2017) subsidy contributions provide increased production reduce the burden on farmers, and increase farmers' income in the production sector of a commodity. This is also caused by the intercropping system which causes the amount of cocoa to not be optimal because the land is still used to produce other crops. (Budiasa et al., 2012) (Sukanteri, et al,.2023), the intercropping system can only accommodate 600 cocoa trees, while the mono-cropping system can accommodate 1000 cocoa trees per ha.

This is caused by the presence of other plants planted on the same land with irregular spacing. Differences in world cocoa prices (Gilbert, 2016) are caused in part by changes in consumption and uncertain harvest conditions, (Vivek et al., 2020) indicating that cocoa production is carried out manually with the machine technology used unchanged.

One of the causes of low private profits for farmers is not only the price but the cropping pattern system which greatly determines the cocoa production produced. An NPCO value < 1 means that smallholder cocoa farming has not received protection from the government, indicating that government policies for cocoa farmers have not been implemented effectively, resulting in a reduction in farmers' income from cocoa commodities. This reduction in revenue occurred because there was no private price protection carried out by the government, especially on the private price of cocoa.

Apart from the impact of policy on output, the results of the PAM analysis also show the impact of government policy on tradable input, namely the nominal protection coefficient on Input (NPCI). The results of PAM analysis on smallholder cocoa farming in Bali show a nominal protection coefficient on Input (NPCI) value of 1. (Septianti et al., 2020) inputs in the smallholder plantation industry tend to show positive results even though they are not yet optimal. The results of research on smallholder cocoa plantations show that cocoa production input is positive, which indicates that cocoa production input has a positive impact on government policy so that the price of private input is the same as the price of socially tradable input. The influence of government policy on cocoa production, especially on inputs, namely fertilizer. Fertilizer prices are still subsidized by the government so that farmers can reduce the costs incurred when producing cocoa. (Mason et al., 2013) with subsidies, farmers can pay (George Marechera and Joseph Ndwiga, 2015) back loans and fertilizer subsidies creating an increase in the planting area.

Based on the results of the analysis, it can be seen that the EPC value of smallholder cocoa farming is 0.64, which indicates that the EPC value is <1, meaning that the private added value is smaller than the social added value. The government's protection of tradable inputs and outputs for farmers has not been effective. government policies applied to cocoa farming inputs and outputs are less supportive or effective. so farmers only receive around 64% of the true social price. The government's policy on tradable input and output causes the added value received by cocoa farmers to be 36% lower than without the policy. The policies implemented cause private revenues received by cocoa farmers to be lower than social revenues. To obtain an increase in added value, it is necessary to implement policies on private tradable inputs that can reduce the costs of tradable inputs required during cocoa production. Apart from input subsidies in the form of fertilizer (Arndt et al., 2016), accompanying policies such as expansion of technology education are needed. Soil fertility and rural road investment and export opportunities.

PAM analysis of smallholder cocoa farming shows that the Subsidy Ratio to Producers (SRP) value is a measure of the combination of all transfer effects that occur. This ratio is a comparison between the net transfer value and income calculated at social prices. SRP shows the extent to which income increases or decreases due to transfers. The SRP value in cocoa farming is -0.208. The SRP value shows a negative value, SRP <1 means that government policy has an impact on smallholder cocoa farmers so that farmers pay production costs that are higher than their social costs, which is 20.8% higher than the costs that should be incurred. The results of the research show that government policies have caused smallholder cocoa farmers' income to decline.

Net Protection Transfer (NPT on cocoa commodities) shows the difference between profits at private prices and profits at social prices of negative Rp.5,927,160 per ha. A negative NPT value indicates that there is a transfer of surplus from cocoa producers or farmers to other parties, in other words, it shows that government policy has not had a positive impact on cocoa farming. Competitive and comparative advantages based on policy matrix analysis can be seen in Table 1.

Table 1. Cocoa analysis in policy matrix analysis.

No	**Coefficient**	**Mark**
		Ratio
1	NPCO [A/E] (Nominal Protection Coefficient on Output)	0.79
2	NPCI [B/F] (Nominal Protection Coefficient on Input)	1
3	PCR [C/(A-B)] (Private Cost Ratio)	0.69
4	DRC [G/(E-F)] (Domestic Resource Cost)	0.40
5	EPC [(A-B)/(E-F)] (Effective Protection Coefficient)	0.64
6	PC [D/H) (Profitability Coefficient)	0.33
7	SRP [L/E] (Subsidy Ratio to Producers)	-0.208
8	NPT [Private Benefit - Social Benefit}	(5,927,160)

Conclusion

Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness. Furthermore, competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

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REVISTA DE GESTÃO SOCIAL E AMBIENTAL

Policy and Competitiveness of Integrated Agricultural-Based technology for Cocoa Production in Indonesia: Application of a Policy Analysis Matrix

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Keywords: Cocoa, Intercroping, Comparative, Competitive of Cocoa

ABSTRACT

Purpose: The research aimed to evaluate the competitiveness of smallholder cocoa plantations and the efficiency of input use in cocoa farming by strengthening farmer groups Indonesia.

Theoretical framework: The research design includes the steps taken in conducting research, data sources, and how to obtain data and data analysis. The research clearly describes the variables, data collection, and data analysis methods to have a clear picture of the competitiveness of cocoa farming.

Design/methodology/approach : Measuring the competitiveness of cocoa in Bali using the Policy Analysis Matrix (PAM) method. PAM analysis is used to calculate private profit, which is a measure of farm competitiveness at the market price level or the actual price

Findings: Competitiveness at the social price level is placed on the second row of the PAM table, Indonesia is an agricultural country and the development of the main agricultural sector, especially cocoa commodities which are managed through community plantations in rural areas, shows the ability to be comparatively competitive, even competitive, even though some components such as private farmer profits can be achieved at 69% compared to what cocoa farmers should receive. Farmers can receive social benefits of up to 40%. Even though cocoa production receives output subsidies, cocoa farmers are only able to obtain a price of 79%, or 21% lower than the world cocoa price, but it is still competitively profitable for farmers. The inputs needed by farmers in cocoa production can be managed by farmers so that the price of tradable inputs at the farmer level shows the same price at the economic level so that it is said to have comparative and competitive competitiveness.

Research, Practical & Social implications: Competitive cocoa in Indonesia provides benefits to farmers at small-scale plantations of up to 69 %, and the profits received by farmers are 40% when measured comparatively.

Originality/value: Originality/Value: This research is original. Implemented in smallholder cocoa plantations in Indonesia with integrated crop-livestock farming patterns to produce outputs that can compete at social prices and to motivate other cocoa farmers to develop farming system innovations that can increase cocoa production based on local resources.

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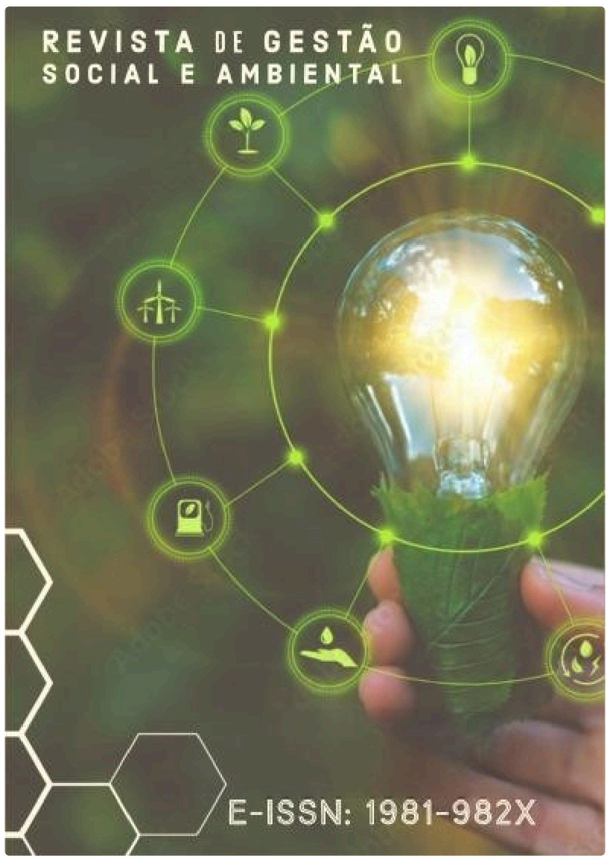

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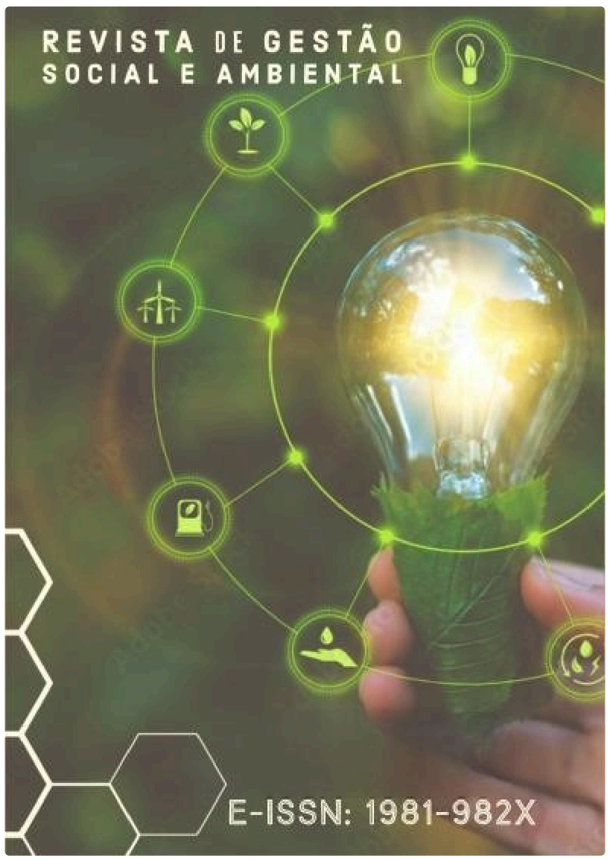

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The **Environmental and Social Management Journal (Revista de Gestão Social e Ambiental e-ISSN: 1981-982X, DOI: 10.24857)**, is a scientific publication aiming to provoke discussion and dissemination of the social and environmental theme resulting from academic research. Its editorial line is grounded on issues relating to areas of social and environmental management and company policies.

The RGSA accepts articles in Portuguese, English and Spanish. The Scientific Committee is committed to the purpose of gradually developing a journal having international reach, with adequate indexing in bibliometric databases.

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The mission of the RGSA is to promote and disseminate scientific knowledge and use of social and environmental management within organizations.

Objective

Disseminate scientific knowledge in research groups dealing with sustainability and social and environmental management within organizations.

Focus Point

The RGSA seeks to integrate the academic field of Administration with other branches of knowledge related to social and environmental management, including organizational practices, environmental policies and the actions of non-governmental organizations. All submitted articles must approach themes according to the following classification:

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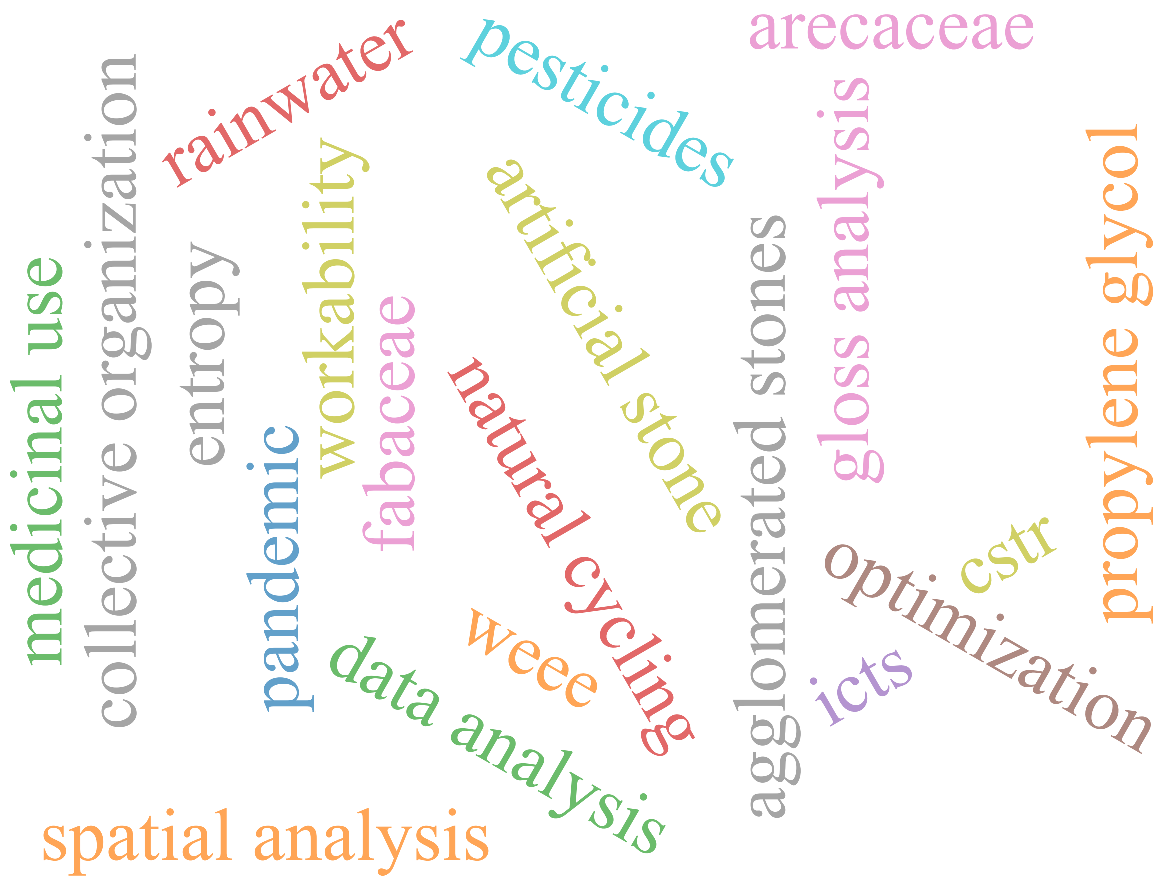

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