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Cost of production and profitability analysis of gambier business in Babat toman Subdistrict, Musi Banyuasin Regency

Nadhila Mizvi [1], Elisa Wildayana [2,*] and Muhammad Yazid [2]

[1] *Department of Magister Agribusiness Study Program, Sriwijaya University, Palembang City, Indonesia.*
[2] *Department of Agricultural Social Economics, Faculty of Agriculture, Sriwijaya University, Palembang City, Indonesia.*

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Abstract

Gambier (*Uncaria gambier Roxb*.) is a strategic plantation commodity in Indonesia with significant economic and industrial value. However, its productivity and efficiency at the farmer level remain relatively low and fluctuating, particularly in Babat Toman Subdistrict, Musi Banyuasin Regency, the only gambier production center in South Sumatra. This study aims to analyze the cost structure, cost of production, and profitability of gambier farming. The research employed a case study method with a quantitative descriptive approach, involving 50 respondents consisting of farmers and other actors in the gambier value chain. Data were collected through interviews, observation, and documentation, and analyzed using production cost and cost of production formulas. The results show that the average total production cost is IDR 7,662,933 per cultivated area per year, consisting of fixed costs of IDR 3,147,833 and variable costs of IDR 4,515,100, with pesticides and seeds as dominant inputs. Production is dominated by liquid gambier (85%) compared to solid gambier (15%). The cost of production is IDR 18,250 per stick for solid gambier and IDR 3,130 per liter for liquid gambier. Compared to the prevailing selling price of IDR 55,000–60,000 per stick, gambier farming generates a positive margin, indicating profitability. These findings suggest that gambier farming in the study area is economically feasible, efficient, and has strong potential for further development. Improving input management and production efficiency is essential to enhance farmers' income and ensure the sustainability of the gambier agribusiness.

Keywords: Agribusiness; Cost of production; Gambier farming; Profitability; Production cost

1. Introduction

Gambier (*Uncaria gambier Roxb*) is positioned as one of Indonesia's strategic flagship plantation commodities, whose fundamental economic value is sourced from the content of unique bioactive compounds, namely catechins and tannins. These polyphenol compounds are raw material inputs that are in great demand by various downstream industry sectors, ranging from the pharmaceutical industry that utilizes the antioxidant properties of catechins for health products, the food industry as a natural preservative, the textile industry as an environmentally friendly natural dyes, to the tanning industry that traditionally relies on tannins for the processing of leather raw materials [1].

More than just an industrial commodity, gambier business also has a significant socio-economic role, where it directly becomes a pillar of the local economy through the provision of jobs in the cultivation and simple processing sectors, becomes a primary source of income for thousands of farming households, and makes an important contribution to the country's foreign exchange earnings through export activities. Indonesia's position as a major supplier in the global market confirms the strategic role of this commodity, where its contribution is historically and economically concentrated in the production center areas on the island of Sumatra [2].

* Corresponding author: Elisa Wildayana

However, the productivity of gambier in Indonesia is still fluctuating and tends to be low compared to the potential that should be achieved. Gambier productivity at the farmer level is reported to be still fluctuating and often below its optimal potential. This raises a strong suspicion that there are problems related to production efficiency. This condition is generally influenced by the use of suboptimal production factors, limited farmers' knowledge, and traditional cultivation techniques [3]. The performance of Indonesian gambier production and exports shows a positive trend but is colored by significant fluctuations. These fluctuations indicate structural challenges at the cultivation and post-harvest levels that affect supply to global markets. This causes the output of the gambier business to not fully reflect the potential of the resources it has.

South Sumatra Province is one of the important agricultural areas on the island of Sumatra, but in the context of gambier commodities, it has very unique characteristics. Based on official data, Musi Banyuasin Regency (Muba) is the only area in South Sumatra Province that cultivates gambier plants commercially, making it a leading commodity that is very location-specific [4]. This uniqueness places Muba, especially Babat Toman District, as a single production center that plays a vital role for the existence of gambier at the provincial level.

Musi Banyuasin Regency from 2020-2024. In 2020, it can be seen that the productivity of gambier is at 0.89 (Ton/Ha). Then, productivity experienced a consistent but very slow increase in the following years, where in 2021 it increased slightly to 0.90 (Ton/Ha), continued to rise to 0.91 (Ton/Ha) in 2022, and reached 0.92 (Ton/Ha) in 2023. Until 2024, the productivity of gambier will be at 0.93 (Ton/Ha), indicating a very stable growth trend but tends to not change much during the five-year period. Average growth of only 0.01 Tons/Ha per year can be categorized as marginal growth that is not economically significant [4].

Babat Toman District was chosen because it is a commercial gambier production center in Musi Banyuasin Regency so that case studies in this sub-district are representative for value chain analysis and downstream product development such as Gambo Muba. However, the productivity of gambier in this region is relatively low and stagnant (0.89-0.93 tons/ha, 2020-2024),

Empirically, Babat Toman District is the geographical and economic center for gambier businesses in Muba. Total area of gambier plants in this sub-district reached 177 hectares. This commodity not only serves as a source of income for hundreds of families, but has also become an integral part of the local socio-economic and cultural identity. The local government's initiative in developing the typical batik "Gambo Muba", which uses gambier sap as an environmentally friendly natural dye, further strengthens the strategic position of this commodity as a driver of the creative economy and regional tourism.

This typical Musi Banyuasin batik gambo uses the sap of a plant that specifically only grows in Toman Village and is recorded in the 2023 Agricultural Census as an eco-fashion natural dyes.Gambo Muba is a typical batik of Musi Banyuasin with the jumputan method whose dye base comes from the sap of the gambier plant. Gambo Muba is a type of batik typical of Musi Banyuasin which is made using the jumputan method and dyed with gambier sap as a natural dye. Initially considered waste, gambier sap is now used to produce Gambo Muba, making it an eco-fashion product that is environmentally friendly because it uses natural dyes. The dye from gambier sap waste produces elegant earth-tone colors, such as gray, brown, and gold, giving a calm and earthy impression [4].

The economic dependence of rural communities in Babat Toman on gambier is very high. Since decades, this business has been the main support of farmers' lives, inherited from generation to generation [5]. Economic activities ranging from cultivation, leaf harvesting, to simple processing processes at the village level create a multiplier effect through the absorption of local labor. Given its central role, both in terms of production and marketing, it will have a direct impact on income stability and farmers' welfare. Gambier cultivation in its main center in Babat Toman District is facing a setback. The sustainability of Gambo Muba products as Muba's typical batik is highly dependent on the development of gambier cultivation in its production center to ensure a stable supply of natural dye raw materials [6]. If the problem of inefficiency and cost of production at the farmer level is not resolved, downstream innovation will risk experiencing a scarcity of sustainable raw materials, which can ultimately threaten the status of local eco-fashion and its potential contribution to the regional economy.

The fundamental problems identified in the gambier business in Babat Toman District are faced with problems of suboptimal productivity and production cost efficiency. Analysis of cost structures, such as labor costs and production facilities, is essential to know the Cost of Production. The determination of Cost of Production is a fundamental benchmark to assess whether the selling price received by farmers has provided decent profits [7]. Without accurate Cost of Production calculations, farmers find it difficult to assess the profitability of their farming objectively. Based on

the gaps that have been identified, this research has a high urgency. This study aims to fill the empirical and methodological gap by providing a comprehensive analysis production cost analysis at the farmer level.

2. Material and methods

2.1. Place and Time of Research

The location of the research was determined deliberately (purposive) in Babat Toman District, Musi Banyuasin Regency. This selection is based on the consideration that the area is one of the centers of gambier production and is the only producer of gambier in the province of South Sumatra, so it is relevant to be the object of study. The research was carried out from February to March 2026.

2.2. Research Methods

This study uses a case study method with a quantitative descriptive approach. The case study method was chosen because the research was focused on one specific location, namely Babat Toman District, Musi Banyuasin Regency, so a deep understanding of the actual condition of the agribusiness system and the gambier value chain in the region is needed. Data collection was carried out through structured interviews (questionnaires), in-depth discussions, and direct observation. Respondents include all households of gambier farmers, business actors, and other related parties. The selection of respondents used the census method, because the population is relatively small and allows for comprehensive data collection to comprehensively describe the characteristics of the cases.

2.3. Sample Withdrawal Method

The sample withdrawel method used in this study involved 50 respondents consisting of gambier farmers and non-farmer actors in the gambier business. The determination of farmer respondents was carried out by a census method consisting of 10 gambier farmers. As for non-farmer actors, the sample was determined using the purposive sampling method, taking into account the direct involvement and relevance of actors in the gambier value chain. These non-farmer actors include middlemen, collectors, MSME business actors, end consumers and expert expert representatives. This study involved as many as 50 respondents consisting of gambier farmers and various non-farmer actors involved in the gambier business. The respondents included 10 gambier farmers, 4 middlemen, 5 collector traders, and 15 gambier business actors or MSMEs. In addition, 14 final consumers, and this study also involved 1 expert representative each from the Musi Banyuasin Regency Plantation Office and lecturer academics. The composition of these respondents reflects the involvement of various parties in the gambier agribusiness chain, from upstream to downstream. The census method is often used in small population research to obtain accurate and representative data, while purposive sampling is used to select non-farmer respondents who are considered to understand the phenomenon best [8].

2.4. Data Collection Methods

This study uses two types of data, namely primary data and secondary data. Primary data were collected through direct observation, interviews (questionnaires), and in-depth discussions in the field. Secondary data were obtained from literature studies and related agencies, such as the Central Statistics Agency (BPS), the Musi Banyuasin Regency Agriculture Office, as well as scientific journals and previous research. This data is used to support the analysis and provide an overview of the condition of the gambier business in the research area [9].

2.5. Data Processing Methods

The calculation of the cost of production use production cost analysis method. This analysis is carried out by identifying, classifying, and accumulating all components of costs incurred by farmers in a single production cycle, consisting of fixed *costs* and *variable costs* to obtain the total cost. Furthermore, the total cost will be divided by the total production *output* to get the value of the Cost of Production Price in units of Rupiah per Kilogram (Rp/Kg). Cost of Production is the total production cost incurred to produce one output unit (1 Kg of gambier). To calculate the total cost of production, the following formula can be used:

2.5.1. Total Production Cost

$$\mathbf{TC = TFC + TVC}$$

Description:
TC = Total Production Cost (Rp/Ha/Year)
TFC = Total Fixed Costs (Rp/Ha/Year)

TVC = Total Variable Cost (Rp/Ha/Year)

2.5.2. Cost of Production

To calculate the cost of production (COP) using the following formula:

$$\mathbf{COP = TC/Y}$$

Description:

COP = Cost of Production (Rp/Kg)

TC = Total Production Cost (Rp/Ha/Year)

Y = Total Gambier Production (Kg/Ha/Year)

3. Results and discussion

3.1. Gambier Business Conditions

Gambier is a product produced from the process of extracting the leaves of the gambier plant (*Uncaria gambier Roxb*.). This product is obtained through a series of stages of processing gambier leaves to produce solid gambier. Because it comes from the results of leaf extraction, the composition of gambier is dominated by active compounds that are naturally contained in the leaves of the plant. This content is the main characteristic of gambier as well as determining the quality and use value of the products produced.

Based on the results of field observations and interviews with business actors, the area of gambier plants in Toman Village was recorded at around 49 hectares. However, until now there are only about 10 farmers who are still actively cultivating gambier plants with a total land area of about 35 hectares. The decline in the number of farmers and the shrinking of land area are influenced by several factors. Volatile fluctuations in the price of gambier have prompted some farmers to switch to other commodities that are considered more profitable and have a more secure market, such as palm oil and crude oil refining businesses.

The gambier processing process which is quite long and requires a high level of precision is one of the obstacles in production activities. The limited skills of farmers in producing gambier with good quality also affect the quality of the products produced. Low quality has an impact on the selling price which tends to be lower in the market. This condition ultimately reduces the economic incentives received by farmers, so that it can affect the interest and sustainability of gambier farming in the long term.

Gambier plants can begin to be harvested at the age of about 8 months to one year. Harvesting is carried out by picking young twigs which generally consist of four to six pairs of leaves. Gambier cultivation activities are not much different from other plantation commodities, including plant maintenance, fertilization, and pest and disease control. However, the success of the gambier business is not only determined by the cultivation process, but also by the quality of the processed products after harvest. The boiling, pressing, and printing process greatly determines the quality of the gambier produced. In addition, the economic value received by farmers is greatly influenced by market prices. Therefore, improving the quality of production and access to market information is an important factor in increasing the income and welfare of gambier farmers.

In this context, the development of derivative products is one of the alternative strategies to increase the added value of gambier commodities in Babat Toman District. Until now, a derivative product that has developed and is relatively advanced is gambo batik fabric, which is batik that uses gambier extract as a natural dyes. This product is able to survive and develop because it has a clearer market, higher selling value, and relatively more efficient production costs compared to other derivative products.

In addition to gambo batik, there are also other derivative product innovations such as gambier tea, gambier coffee, and gambier candy. However, the three products have not been developed optimally. Low consumer interest, limited market scale, and high production costs are the main obstacles in its development. Compared to these processed food products, gambo batik is considered more prospective because it has greater advantages and a more standardized production

process. Therefore, most of the gambier business actors or MSMEs in Babat Toman focus their efforts more on the development of gambo batik as a form of diversification and strategy to increase the added value of gambier.

3.2. Gambier Production Costs

Production costs can be interpreted as all expenses incurred by farmers in the process of producing processed gambier. Production costs are the costs incurred by farmers from the stage of land preparation, maintenance of gambier plants, harvesting leaves and twigs, to post-harvest processing processes such as boiling, pressing, printing, and drying of sap.

3.3. Fixed Fees

Fixed costs are costs that amount relatively unchanged in the short term, regardless of the size of the production volume [10]. In the gambier business, fixed costs can be in the form of shrinkage of production tools such as liquid and solid gambier molds, presses/presses, knives, pots/pans, drying tools/marap, and grinding machines.

Table 1 Fixed Cost of Gambier Business

No.	Components	Price (Rp/Unit)	Useful Life (Years)	Depreciation (Rp/Year)
1.	Liquid Gambier Mold	470.000	5	940.000
2.	Solid Gambier Mold	185.000	5	37.000
3.	Pump/Press	10.500.000	15	700.000
4.	Knife	132.000	2	114.500
5.	Pot/Pan	940.000	5	188.000
6.	Dry/Dry Tools	47.000	2	235.000
7.	Milling Machine	14.000.000	15	933.333
	Total			3.147.833

The average fixed cost of gambling business is IDR 3,147,833 per year. This fixed cost is the cost of depreciating equipment used in the gambier production process for one year. The largest fixed cost component comes from liquid gambier molds with a depreciation value of IDR 940,000 per year, followed by milling machines of IDR 933,333 per year, and presses of IDR 700,000 per year. The three equipment are subsidies from the government, but in the analysis of fixed costs, they are still considered as depreciation costs based on their value and economic life. This is done to illustrate the value of using assets economically in the production process and to show the amount of investment that is actually needed if farmers have to provide the equipment independently. Other depreciation costs include pots/cauldrons of IDR 188,000 per year, drying utensils of IDR 235,000 per year, knives of IDR 114,500 per year, and solid gambier molds of IDR 37,000 per year.

3.4. Variable Cost of Gambier Business

Variable costs are all costs whose amount changes according to the level of production activities [11]. The larger the volume of gambier production produced, the greater the cost incurred, and the smaller the volume of gambier production produced, the smaller the cost incurred. In this study, variable costs include expenses for seeds, pesticides, urea, firewood, sacks, diesel, oil, mill machine rental, and labor wages.

The average variable cost of the gambier business is IDR 4,515,100 per year or 100% of the total variable cost. This cost is an irregular expense and is greatly influenced by the intensity of production activities in gambier farming. Of all variable cost components, the largest expenditure is found in the use of pesticides, which is IDR 2,550,000 or reaches 56% of the total variable cost. This shows that pest and disease control is a very dominant factor in maintaining the productivity of gambier plants. Furthermore, the cost of seeds ranks second with a value of IDR 1,050,000 or around 23%, which indicates the importance of using planting materials in supporting production sustainability. Other cost components are relatively smaller, such as urea fertilizer of IDR 301,500 or around 7%, and labor wages of IDR 150,000 or 3%. Meanwhile, the cost of a sack of IDR 80,000 or around 2% is used as a means of packaging production products.

Tabel 2 Variable Cost of Gambier Business

No	Components	Quantity	Price (Rp/Lg/Year)	Total (Rp/Year)	Present (%)
1	Seeds (kg)	3.5	300.000	1.050.000	23
2	Pesticide (L)	25.5	100.000	2.550.000	56
3	Urea (sac)	1.7	177.500	301.500	7
4	Firewood (M^2)	1	12.000	12.000	1
5	Sack (Unit)	1.9	80.000	142.000	2
6	Solar (L)	4.7	8000	37.600	1
7	Oil (L)	5	30.000	150.000	1
8	Milling Machine Rental (Unit)	1.7	10.000	17.000	1
9	Labor Wages (HOK)	1.7	150.000	255.000	3
	Total			4.515.100	100

The cost components with the smallest contribution are firewood, diesel, oil, and machine rental, each of which is only 1% of the total variable cost. The low percentage of cost on these components indicates that their use is relatively efficient or not too intensive in the production process. The variable cost structure of the gambier business is dominated by pesticide and seed costs, while other components have a relatively small contribution. This illustrates that the success of gambier production is greatly influenced by the management of key inputs, especially in crop protection and the provision of planting materials [12].

3.5. Total Cost of Gambier Business

The total cost is all expenses incurred by farmers in one production period to produce gambier commodities. The value of this total cost is obtained from the sum between fixed costs and variable costs. In the context of this study, the total cost reflects all forms of economic sacrifice made by farmers in carrying out gambier farming, both fixed ones, such as the cost of depreciation of equipment and land rent that is not affected by the amount of production, or variable costs, such as the use of fertilizers, pesticides, and labor whose amount changes according to the level of activity and production volume.

Tabel 3 Total Cost of Gambling Business

No.	Fixed Fee (Rp/Ha/Yr)	Variable Cost (Rp/Ha/Yr)	Total (Rp/Ha/Yr)
1.	3.973.333	5.655.000	9.628.333
2.	3.973.333	5.270.000	9.243.333
3.	3.948.333	4.995.000	8.943.333
4.	3.953.333	5.645.000	9.598.333
5.	2.633.333	4.660.000	7.293.333
6.	3.953.333	5.120.000	9.073.333
7.	2.550.000	3.492.000	6.042.000
8.	3.973.333	5.075.000	9.048.333
9.	1.275.000	2.627.000	3.902.000
10.	1.245.000	2.612.000	3.857.000
Quantity	31.478.333	45.151.000	76.629.333
Average	3.147.833	4.515.100	7.662.933

the average fixed cost is IDR 3,147,833 per year, while the average variable cost is IDR 4,515,100 per year. Thus, the average total production cost incurred by farmers in one year is IDR 7,662,933. Showing that variable costs are greater than fixed costs, it means that most of the business expenses come from operational costs. Meanwhile, fixed costs come from the depreciation of production equipment used for one year. Overall, the total production costs of all respondents reached Rp76,629,333 per year, consisting of Rp31,478,333 fixed costs and Rp45,151,000 variable costs. This shows that the gambier processing business is dominated by variable costs. The highest total production cost was found in the first respondent of IDR 9,628,333 per year, while the lowest in the tenth respondent was IDR 3,857,000 per year. This difference is likely influenced by the scale of the business and the amount of production input usage.

3.6. Revenue and Revenue

Revenue is calculated based on the result of multiplying the amount of gambier production produced and the selling price applicable at the farmer level, which is expressed in rupiah (Rp).

Tabel 4 Revenue and Benefit

No.	Description	Total (Rp/Ha/yr)	Total (Rp/Ha/month)
A.	Revenue		
1.	Revenue of Gambier Balok	27.818.000	2.318.166
2.	Revenue of Liquid Gambier Extract	3.181.440	265.120
B.	Benefit		
1.	Benefit (Rp/Lg/Year)	23.336.506	1.944.708

The average revenue from the sale of gambier blocks is IDR 27,818,000 per cultivated area per year or equivalent to IDR 2,318,166 per cultivated area per month, while the average revenue from liquid gambier extract is IDR 3,181,440 per cultivated area per year or equivalent to IDR 265,120 per cultivated area per month. Thus, the total revenue obtained by the sample farmers shows a considerable contribution to the overall results of gambier farming. Furthermore, the average income obtained by the sample farmers is IDR 23,336,506 per cultivated area per year or equivalent to IDR 1,944,708 per cultivated area per month. The amount of income obtained shows that gambier farming undertaken by sample farmers is profitable and feasible to develop. This can be seen from the greater revenue value compared to the production costs incurred

3.7. Cost of Production

The Cost of Production in this study is defined as the total cost incurred to produce one unit of processed gambier products. Cost of Production reflects the magnitude of the economic sacrifices that farmers must make to produce gambier from the cultivation stage to become ready-to-sell products. Cost of Production is calculated by dividing the total cost of production by the amount of gambier production produced in a given period. The total production cost in question is the sum of fixed costs and variable costs.

Tabel 5 Cost of Production

No.	Description	Total (Rp/Ha/Yr)	Present (%)
A.	Total Production Cost	7.662.933	
B.	Total Production		
1.	Solid Production (Stem)	448	15
2.	Liquid Production (Liters)	2.605	85
C.	Cost of Production		
1.	Solid Cost of Production	18.250	85
2.	Cost of Production Liquid	3.130	15

The average total production cost of the gambier business in Toman Village is IDR 7,662,933 per cultivated area per year. This production cost is an overall expense consisting of fixed costs and variable costs. Furthermore, the average total production of gambier produced consists of solid gambier production of 448 sticks or 15% of total production, and liquid gambier production of 2,605 liters or 85% of total production. This shows that most of the production of gambier is dominated by liquid gambier products, while the production of solid gambier has a relatively smaller proportion. Based on the total production cost and the total production produced, the average Cost of Production solid gambier is IDR 18,250 per stick or 85%, while the cost of production liquid gambier is IDR 3,130 per liter or 15%. This shows that the production cost per unit of solid gambier is relatively higher than liquid gambier. The high cost of production solid gambier is due to more intensive production and processing processes, so it requires greater cost sacrifice per unit of product.

It is known that the selling price of solid gambier (blocks) at the farmer level ranges from Rp55,000 to Rp60,000 per stem. Meanwhile, the selling price of liquid gambier extract is set at IDR 40,000 for every 35 liters. If associated with the value of cost of production, this condition shows that there is a significant difference between production costs and selling prices, especially in solid gambier products that have a larger profit margin. This indicates that solid gambier products provide higher economic added value than liquid gambier, even though the proportion of production is smaller [13].

It can be concluded that gambier farming in Babat Toman District is at an economically viable level. This is shown by the ability of farmers to produce gambier products at a per unit production cost that is still possible to make a profit, especially because the total income obtained by farmers is greater than the total production costs incurred. Thus, gambier farming in the research area can be said to be efficient and profitable, and has the potential to continue to be developed to increase farmers' income.

4. Conclusion

The gambier business in Babat Toman Subdistrict has an average total production cost of IDR 7,662,933 per cultivated area per year, consisting of fixed costs of IDR 3,147,833 and variable costs of IDR 4,515,100, primarily driven by pesticide and seed inputs. Production is dominated by liquid gambier (85%) compared to solid gambier (15%), with cost of production values of IDR 18,250 per stick and IDR 3,130 per liter, respectively. Compared to the prevailing farm-gate selling price of IDR 55,000–60,000 per stick, the business generates a positive margin, indicating that gambier farming is economically feasible and has strong potential for further development.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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