

# ECONOMIC PERFORMANCE OF VANILLA CULTIVATION (*Vanilla planifolia*): A CASE STUDY IN KANDY DISTRICT

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**Abstract:** Vanilla (*Vanilla planifolia*) is the main vanilla species cultivated in Sri Lanka, with cultivation is mainly concentrated in the Kandy District. The Kandy District was selected as the study area to obtain detailed information on vanilla cultivation practices in Sri Lanka. Although vanilla is considered a minor export crop, it has significant potential for expansion due to the favorable agro-climatic conditions available in the country. Therefore, this study aimed to conduct an economic analysis of vanilla cultivation in Sri Lanka to assess its profitability and potential contribution to the national economy. A total of 150 vanilla farmers registered under the Gangai Ihala Korale Divisional Secretariat Division constituted the study population, from which 80 farmers were selected using Simple random sampling. Primary data on the economic aspects of vanilla cultivation were collected through face-to-face interviews, while secondary data were gathered through an extensive literature review. The results revealed that the total annual variable cost was Rs. 15,750, accounting for 29.1% of the total cost, while the total annual fixed cost was Rs. 38,214, representing 70.8% of the total cost. Accordingly, the total annual cost of vanilla cultivation was Rs. 53,964.29. The gross income per acre was Rs. 259,370.10, with a cumulative gross income from the establishment period to the present amounting to Rs. 889,814.60. The average annual yield was 73.38 kg, and the gross profit margin per plant was Rs. 1,134.22 during the final year of harvesting. The net profit margin was calculated as Rs. 205,405.90. The benefit–cost ratio was 4.8, the gross revenue ratio was 0.21, and the expense structure ratio was 2.43. The payback period was estimated at 3.2 years, and the return on investment was 4.37. Since the benefit–cost ratio exceeded unity, the findings indicate that vanilla cultivation is economically profitable. The study highlights that vanilla cultivation represents a promising income-generating activity for farmers and has potential to contribute to rural economic development. Therefore, it is recommended to promote vanilla cultivation, particularly among women and youth. Furthermore, improvements in protection methods against wild animal damage, dissemination of technical knowledge on improved cultivation practices, and enhanced extension services are recommended to strengthen the sustainability and expansion of vanilla cultivation in Sri Lanka.

**Keywords:** economic analysis, income, Vanilla, Sri Lanka

## 1. Introduction

Vanilla (*Vanilla planifolia*) is Identified as one of the most valuable cash crops in the global market due to its wide application across the food, pharmaceutical, beverage, and cosmetic industries. It is the most famous and highly used natural flavouring agent in the world, and it is also very important economically because the demand from the processed food industry and the global consumer preference for organic flavouring agents are increasing. Vanilla production in the world is highly concentrated in tropical

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countries, with leading producers such as Madagascar, Indonesia, and Mexico dominating global exports. The global vanilla market is highly sensitive to political, environmental, and economic conditions, particularly in major producing countries like Madagascar, where political instability has had a notable impact on export performance (Andriamahery et al., 2018). Due to rising demand, the global vanilla trade continues to expand, creating opportunities for new producer countries to enter the market (the observatory of economic complexcity, n.d.).

Botanically, *Vanilla planifolia* is classified as a perennial climbing orchid that grows well under humid tropical conditions, and it belongs to the family *Orchidaceae*. This crop requires specific environmental conditions for optimal development, including moderate shade, high humidity levels, and evenly distributed rainfall throughout the year. Successful vanilla cultivation highly depends on proper management practices such as manual pollination in most production systems, effective pest and disease management, and the adoption of suitable harvesting and curing methods (Pemberton et al., n.d.). However, vanilla production faces several challenges. It is often affected by pests, diseases, and fungal infections that can significantly reduce yield and productivity of vanilla cultivation (Suseela Bhai & Dhanessh, 2008)(Ab. Kadir et al., 2019). In addition, sustainable risk control measures are essential to maintain productivity and ensure long term profitability in vanilla farming systems (Wahyudi et al., 2021).

Due to high market value and strong profitability potential of Vanilla, this cultivation has gradually expanded beyond its traditional production regions. Many countries have adopted Vanilla cultivation as a new strategy to enhance rural livelihoods and increase agricultural export income. Empirical studies conducted in countries like Tanzania have identified that Vanilla production plays a significant role in improving their household income and strengthening the livelihoods of smallholder farmers. (Muzanila & Assenga, 2022a). Furthermore, the development of vanilla agribusiness has been identified as an important strategy for promoting rural economic growth and enhance export opportunities (Wahyuningsih et al., 2022). The vanilla value chain plays a significant role in connecting farmers and markets, ensuring product quality, and improving overall economic efficiency (Shriver, 2013a).

Due to the country's favourable agro climatic conditions, in Sri Lanka vanilla cultivation has gained increased attention as a promising minor export crop, mainly within the wet zone regions. Sri Lanka has highly suitable climatic conditions for vanilla cultivation, including adequate rainfall distribution, high humidity, and suitable temperature ranges for successful vanilla cultivation. According to the Sri Lanka Export Development Board, Sri Lanka natural vanilla production demonstrates considerably high potential for expansion in international markets due to its superior quality and the growing global demand for natural vanilla products. (Export Development Board (2026). As a high-value crop, vanilla production makes it an attractive option for smallholder farmers seeking alternative income sources, although vanilla cultivation remains relatively limited in scale compared to major spice crops.

Vanilla cultivation plays an crucial role in enhancing income generation and livelihood diversification among rural farming households. Previous studies related to adoption of multipurpose and high-value crops have indicated that smallholder farmers get experience notable economic benefits, including higher household income and increased productivity, when shifting toward the cultivation of commercially valuable crops (Asmarahman et al., 2023). The profitability of agricultural enterprises highly depends on household income farmers' knowledge, and access to improved technologies (Jabbar et al., 2003). In many cases, farmers face some problems such as limited technical knowledge, pest and disease problems, and inadequate access to extension services, which affect profitability and production efficiency (D. K. Singh et al., 2015)(M. Singh et al., 2013).

Since there is high potential for vanilla cultivation in Sri Lanka, only a very limited number of studies have been conducted to evaluate its economic performance. Most existing research focuses on cultivation practices such as pest and disease management, agronomic practices, and export potential. However, very limited research has been conducted on the detailed economic analysis of vanilla cultivation in Sri Lanka. A clear understanding of production costs, profitability levels, and return on investment is essential for determining the economic viability of vanilla cultivation as a sustainable agricultural enterprise. Economic performance analysis is commonly applied in agricultural research to assess financial feasibility and to support informed investment decisions among farmers. (Masudul Hassan, 2015)(Mgeni & Temu, 2010).

Among all the vanilla-growing regions in Sri Lanka, the Kandy District remains an important area due to the increasing number of farmers engaged in vanilla cultivation and its suitable agro-climatic conditions. The Kandy District is an ideal location for vanilla cultivation due to the presence of registered vanilla farmers and favorable environmental conditions, making it suitable for conducting an in-depth economic analysis. However, there is limited empirical evidence regarding the economic performance of vanilla cultivation in this region, particularly at the smallholder level. Therefore, assessing the economic viability of vanilla cultivation in the Kandy District is essential to support informed decision-making among farmers and policymakers.

In view of the above context, this study aims to analyze the economic performance of vanilla cultivation in the Kandy District of Sri Lanka. The specific objectives of the study are:

2. To analyze the economic performance of vanilla cultivation.
3. To make appropriate suggestions to improve vanilla cultivation practices.

## **2. Background**

### **2.1 Global Importance of Vanilla Cultivation**

In the global context, vanilla cultivation has emerged as a profitable agricultural enterprise, particularly among smallholder farmers in tropical countries. The crop is considered an important cash crop that contributes significantly to export earnings and rural income generation (Shriver, 2013a). Studies conducted in Madagascar, which has a large number of vanilla farmers relying on it as their primary source of income, have shown that vanilla cultivation supports the livelihoods of thousands of rural households and plays a major role in regional economic development (Hänke et al., 2018). With the increase in income and livelihoods of farmers, vanilla cultivation has also contributed to improved household welfare and enhanced access to social services such as education and healthcare (Vasconcelos et al., 2025).

### **2.2 Agronomic and Production Characteristics of Vanilla**

Vanilla is a perennial climbing plant belonging to the orchid family. Favourable conditions for vanilla cultivation include moderate shading, high humidity, and evenly distributed rainfall. The success of this cultivation depends largely on pollination, pest and disease control, and other agronomic practices (Pemberton et al. (2023). Among pest and disease impacts, fungal pathogens such as *Fusarium* wilt and soft rot are major constraints, causing substantial reductions in yield and overall crop productivity (Suseela Bhai & Dhanesh, 2008); (Ab. Kadir et al., 2019). Vanilla is largely determined by factors such

as planting density, agronomic management practices, and environmental conditions (Martin et al., 2020). As well, to ensure the long-term productivity and profitability of vanilla farming, risk control systems and sustainable cultivation practices have been recommended (Wahyudi et al., 2021).

### **2.3 Economic Importance of Vanilla Cultivation**

Vanilla cultivation significantly contributes to the improvement of the economic well-being of rural communities. Due to the high market value of vanilla, it plays an important role in increasing the income generation capacity of smallholder farmers (Muzanila & Assenga, 2022a). In Tanzania, where vanilla cultivation has been widely adopted, it has enhanced household income and strengthened the financial stability of smallholder farmers. Additionally, it has contributed to the generation of employment opportunities for rural communities and the accumulation of productive assets (Armenta-Montero et al., 2022).

Vanilla cultivation profitability is closely linked to market demand for vanilla and the efficiency of the vanilla value chain. The value chain of vanilla consists of many actors, including farmers, collectors, processors, exporters, and other middlemen. These value chain actors play an important role in determining prices, market value, product quality, and overall profitability (Shriver, 2013a). The importance of market linkages, contract farming, and cooperative participation in improving vanilla farmers' income can be better understood through the study of value chain development (Wahyuningsih et al., 2022). Additionally, innovations in the vanilla supply chain have been found to enhance production efficiency and sustainability (Watteyn et al., 2022).

### **2.4 Socio-Economic Contributions of Vanilla Cultivation**

Vanilla cultivation plays a crucial role in enhancing livelihood diversification and fostering rural development. In many developing countries, vanilla farming serves as a main source of income for smallholder farmers and contributes to the overall economic growth of rural communities (Andriamparany et al., 2021). Research conducted in Madagascar has shown that vanilla cultivation significantly contributes to strengthening the socio-economic stability of farming communities and improving household food security. Additionally, the expansion of vanilla farming is closely linked to improvements in education within rural communities and to enhancing their overall living standards (Hänke et al., 2018).

At present, it is very important for the agricultural sector to adopt new technologies to achieve maximum output from cultivation or agricultural enterprises, improve productivity and profitability, save time in enterprise management, and reduce production costs. The adoption of new technologies is largely influenced by farmers' knowledge and education levels, as well as access to extension services (Jabbar and Saleem, 2003). Several studies have shown that farmers often face challenges such as limited access to credit, lack of technical knowledge, and inadequate training, which negatively affect productivity levels (Singh et al., 2015; Singh et al., 2013).

### **2.5 Vanilla Production Efficiency and Profitability**

To assess the viability and profitability of agricultural enterprises, economic performance analysis is widely employed. Several studies have investigated the technical efficiency and profitability of vanilla cultivation in different countries. Research conducted in the Kandy District of Sri Lanka revealed that vanilla farmers had relatively low technical efficiency, with an average efficiency level of 37.32%,

indicating substantial potential for productivity improvement through the adoption of improved management practices. (Kariyawasam et al., 2019).

At the same time, some research has revealed that profitability depends on yield levels, production costs, and market prices (Masudul Hassan, 2015). Economic analysis of agricultural enterprises commonly involves indicators such as net profit margin, benefit–cost ratio, return on investment, and payback period. These metrics are essential for evaluating the profitability and financial viability of farming activities (Mgeni & Temu, 2010).

## 2.6 Constraints and Challenges in Vanilla Cultivation

Although vanilla production has strong profitability potential, it faces several problems that limit both expansion and productivity. Pest and disease problems in vanilla cultivation primarily contribute to low production levels and negatively affect crop performance in many production regions (Vanitha et al., 2011). In addition to that, climate variability and natural disasters significantly influence yield stability and production efficiency (Ab. Kadir et al., 2019).

Global context and market-related factors also affect vanilla cultivation. Fluctuations in global market prices can discourage farmers from making long-term production and investment decisions in vanilla cultivation (Andriamahery et al., 2018).

Even though numerous studies have examined the economic performance of vanilla cultivation in different countries, research on the economic performance of vanilla cultivation in Sri Lanka remains very limited. Most previous studies have concentrated on agronomic practices, value chain development, and pest and disease management rather than providing detailed analyses of production costs and profitability. Additionally, empirical evidence on key economic performance indicators such as net profit and return on investment among vanilla farmers in the Kandy District is scarce.

### Conceptual Framework

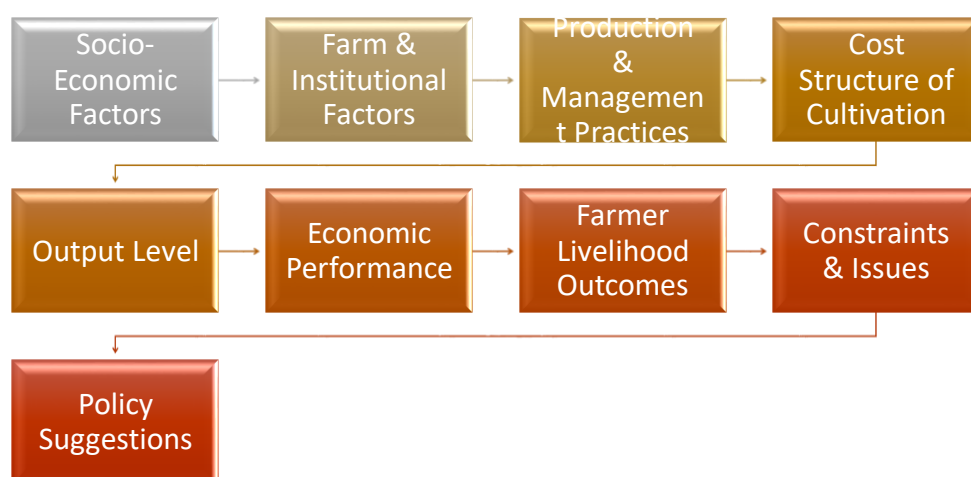


Figure 1: Conceptual Framework

Above conceptual framework shows the interrelation among different factors and how they perform collectively and individually. Socio-economic factors of farmers such as education level, age,

experience in farming, and income level play a significant role in decision-making for policy makers. These factors directly affect the efficiency and effectiveness of farm management. Next, farm and institutional factors such as labour utilization, land availability, access to capital, extension services, and training opportunities will affect the final output of production and govern the resources accessible for vanilla cultivation and influence the adoption of appropriate production practices. The above both factors affect production factors and management practices including pollination techniques, shade regulation, fertilizer application, pest and disease management, and other agronomic interventions. Proper implementation of these practices is essential for maximizing productivity and minimizing production risks.

This cost structure, including both variable cost and fixed cost of vanilla cultivation, coupled with production efficiency, determines output levels, typically measured as yield per acre. Output level of vanilla cultivation directly affects the economic performance which includes financial indicators such as gross income, net profit, benefit–cost ratio (BCR), return on investment (ROI), and payback period. These metrics provide a proper idea about the profitability and viability of vanilla farming. These economic factors affect the livelihood level of farmers including increased income, enhanced financial stability, and better living standards and also constraints like market volatility, pest and disease outbreaks, , wildlife damage, and insufficient technical knowledge, which can adversely affect profitability and productivity. Overall, this conceptual framework offers a systematic approach to understanding the determinants of economic performance in vanilla cultivation and supports the formulation of targeted strategies to improve both farm productivity and farmer livelihoods.

### **3. Methodology**

#### **3.1 Study Area**

In Sri Lanka, vanilla cultivation is mainly concentrated within the wet and intermediate zones. Key vanilla-producing districts include Matale, Kandy, Nuwara Eliya, Kegalle, Ratnapura, Badulla, and Galle. Among those districts, Kandy District is identified as the most highly cultivated area in Sri Lanka. Within the Kandy District, vanilla cultivation is mainly carried out in hilly areas where climatic conditions, including high humidity, adequate rainfall, and sufficient shade, are conducive to crop growth. Accordingly, the Gangai Ihala Korale Divisional Secretariat Division (DSD) was selected as the study area, as it is recognized as one of the leading smallholder vanilla-producing divisions in the Kandy District of Sri Lanka (Kariyawasam et al., 2019).

#### **3.2 Sample Size and Sampling Procedure**

The target population for this study is vanilla growers in Sri Lanka. It consists especially of farmers in the Kandy District. A list of registered vanilla farmers was obtained from the Extension Officer of the Gangai Ihala Korale Divisional Secretariat Division, which served as the sampling frame for the study.

Based on official records, 150 registered vanilla farmers were identified as cultivating vanilla within the selected area. From this sampling frame, 80 farmers were chosen using a purposive random sampling technique as a sample for this study. Only farmers cultivating more than 10 vanilla vines were included to ensure that respondents possessed adequate experience in vanilla cultivation and could provide reliable information on production costs and profitability.

### 3.3 Data Collection Methods

Both primary and secondary data were collected to conduct a comprehensive analysis of the economic performance of Vanilla cultivation. Data collection was essential for gaining ideas into farmers' production practices, yield levels, cost structures and knowledge regarding Vanilla cultivation.

### 3.4 Primary Data Collection

Primary data were collected through semi-structured questionnaires and face-to-face interviews with the 80 selected Vanilla farmers. The questionnaire contain both open-ended and close-ended questions, enabling respondents to provide detailed information on their farming practices, income, production costs yield levels and challenges encountered during cultivation.

Apart from the interviews, field observations were carried out to gather first hand information on plant health, cultivation practices, management techniques, and farm infrastructure. These observations helped verify the accuracy of farmers' responses and provided a better understanding of the actual conditions of Vanilla cultivation.

### 3.5 Secondary Data Collection

Secondary data were collected from multiple sources, including:

- Published journal articles
- Research reports
- Government publications
- Books available in libraries
- Online databases and websites
- Agricultural extension records

These sources provided background information related to vanilla cultivation, economic performance indicators, production techniques, and previous research findings relevant to the study.

### 3.6 Analytical Methods

The economic analysis was done using gross profit, gross margin per acre, benefit-cost ratio, profitability ratio.

Gross income is the complete earnings or revenue produced by an individual, business, or entity before subtracting any expenses. This represent all sources of income, including wages, salaries, interest, dividends, and other revenue streams, and it is calculated without deductions. Gross income calculated by total yield multiply with price of Vanilla as following.

- $Gross\ Income = Total\ Yield \times Price$

Gross margins were calculated by subtracting variable costs, such as input costs, variable costs of equipment, and service costs from total revenues (yield times product price), but fixed costs, such as labor costs, subsidies, insurance and interest were not taken into account (Reckling et al., 2016)

Gross margin is a financial measure that illustrates the variance between total revenue and the cost of goods sold. This metric is determined by deducting the cost of goods sold from the overall revenue and can be presented either as a percentage or in monetary terms. Gross margin was calculated by following formula.

- $\text{Gross Margin Per Acre} = (\text{Gross Income} - \text{Variable Cost})$

Net profit margin was financial metric to assess the profitability and efficiency of a business. This is important to profitability analysis, comparative analysis, operation efficiency.

- $\text{Net profit Margin} = \text{Gross profit Margin} - \text{Fixed Cost}$

Profitability ratios were important to investors to identify profitability of Vanilla cultivation against other crops during specific time period.

The Benefit-Cost Ratio (BCR) is a financial metric used to evaluate the economic feasibility of a project or investment by comparing the benefits to the costs. Benefit cost ratio important to Vanilla cultivation profit analysis, cultivation viability assessment whether cultivation was economically viable or not, provide quantitative data of economic return to compare with other cultivations, risk management of Vanilla cultivations. Using following equation, benefit cost ratio was measured.

- $\text{Benefit Cost Ratio} = (\text{Present Value of Benefit of The Cultivation} / \text{Present Value of Cost of The Cultivation}) \times 100$

The rate of return is a fundamental metric that plays is important to investment analysis, decision-making, risk assessment, and financial planning. It provides valuable insights into the profitability and success of investments. This metric calculated by following equation.

- $\text{Rate of Return} = \text{Net Return} / \text{Total Cost}$

The more commonly used financial ratios related to revenue are the Gross Profit Margin and the Revenue-to-Expense Ratio.

Gross revenue ratio was calculated how mush spend for one unit of earning for Vanilla cultivation. That is comparative measure to evaluate the cultivation profitability. Following equation show how calculated the gross revenue ratio.

- $\text{Gross Revenue Ratio} = \text{Total Farm Expenses} / \text{Gross Income}$

The expense ratio is crucial for investors as it reflects the cost of managing and operating the fund.

- $\text{Expense structure ratio} = \text{fixed cost} / \text{variable cost}$  (Olaoye et al., 2013)

Payback period- The Payback Period (PBP) was a measure used to determine the time required, typically expressed in years, to recoup an investment. It helped identify the break-even point for the investment. To calculate the Payback Period (PBP) of a project, you can divide the initial cash outlay of the project by the annual net cash inflow it generates (Kiran, 2022).

- Payback period= initial investment/net annual cash inflow.

Spearman Correlation and regression analysis was done to find relationship.

Analysis was done using SPSS and Microsoft excel.

#### 4. Result and Discussion

The primary objective of this study was to evaluate the economic performance of Vanilla cultivation by analyzing income generation, its cost structure, and key profitability indicators. All relevant cost components and income variables were measured, considering both implicit costs including family labor and land value and without implicit costs, given that Vanilla cultivation in the study area relied entirely on family labor.

##### 4.1 Cost Structure of Vanilla Cultivation

Vanilla cultivation in the study area exhibited a distinctive cost structure, characterized by high dependence on moderate investment in materials and labor. Plant per acre is 215. The total production cost per acre for approximately was LKR 272,956.35 with implicit costs and LKR 53,964.29 when without implicit cost (Table 1). Fixed costs constituted 19.5% of the total cost with implicit cost consideration, compared to 70.8% when without implicit cost. Conversely, variable costs accounted for 80.5% of total costs with implicit costs and 29.2% without implicit cost.

Pollination was identified as the most significant cost component, accounting for 45% of the total production cost with implicit costs. This highlights the labor intensive nature of Vanilla cultivation. Due to the necessity of manual pollination, which is widely recognized as a key operation affecting productivity and yield. Similar findings have been identified in other Vanilla production systems, where pollination represents a substantial portion of cost owing to the lack of natural pollinators in many cultivation regions (Shriver, 2013a).

Other material costs including shade nets and fencing materials made for 12.6% of the total cost Under implicit cost conditions, whereas under non-implicit cost conditions, they accounted for 45.4%. These expenditures are used for preserving the ideal microclimatic conditions required for plant growth and safeguarding vines. Additionally, for crop establishment accounted 12.4% highlighting the need of early stage management techniques, appropriate planting and in attaining favorable cultivation results.

Overall, the findings indicate that compared to other perennial crops, vanilla cultivation requires a comparatively need low direct financial investment. This is because family labor is used extensively and there are no more expenses related to specific agronomic practices like fertilizer application, irrigation and pesticide use in the study area. This cost structure suggests a production strategy that is comparatively adaptable and resource efficient, making it especially appropriate for smallholder farmers.

Table 1: Cost Components

Cost component for (215 plants)						
	Implicit	cost	Cost %	Without	implicit	Cost %
	(Rs)			(Rs)	cost	

<b>Pretreatment of cutting</b>				
<b>Mulching</b>	2000.00	0.70%		
<b>Training and pruning</b>	1000.00	0.40%		
<b>Flower induction</b>	2000.00	0.60%		
<b>shading</b>	2000.00	0.70%		
<b>Total land preparation cost</b>	8000.00	3.00%		
<b>Crop establishment</b>	34000.00	12.40%		
<b>Fertilizer</b>				
<b>Pesticide</b>				
<b>Fungicide</b>				
<b>Weedicide</b>	10000.00	0.40%		
<b>Irrigation</b>				
<b>Harvesting</b>	2000.00	0.70%		
<b>Post harvesting</b>				
<b>Cost of pollination</b>	123611.10	45.00%		
<b>Transportation</b>	5000.00	2.00%	5000.00	9.20%
<b>Other</b>	10750.00	4.00%	10750.00	19.90%
<b>Other Material cost</b>	34500.00	12.60%	24500.00	45.40%
<b>Land value</b>	5000.00			
<b>Planting material cost</b>	13714.29	5.00%	13714.29	25.40%
<b>Fixed cost</b>	53214.29	19.50%	38214.29	70.80%
<b>Variable cost</b>	219742.10	80.50%	15750.00	29.20%
<b>Total cost</b>	272956.35	100%	53964.29	100%

#### 4.2 Income Generation from Vanilla Cultivation

An analysis of income (Table 2) showed that cultivating vanilla leads to significant income earnings once the plants are fully developed. On average, there are 215 (214.8) plants per acre, with the total gross income for the entire production period amounting to LKR 889,814.60. The gross income reached LKR 259,370.10 in the last year alone (Table 2), reflecting a relatively high market value for vanilla products. The average price for a kilogram of fresh vanilla pods was LKR 3,332.64.

Average plant per acre was around 215 according to results (Table 2) Gross income for total year was LKR 889814.6. Gross income for last year was LKR 259370.1. Average price for one kilo of green Vanilla beans was 3332.6.

Table 2: Income

<b>Income component</b>	
<b>No. of plant</b>	214.80
<b>Gross income for total years</b>	889814.60
<b>Gross income for last year</b>	259370.10
<b>Price per kilo of Vanilla pod</b>	3332.64

Small holder Vanilla farmers earn high income than non-Vanilla growers (Muzanila & Assenga, 2022b). That was further prove by result obtained.

This results indicate that Vanilla cultivation provides important income potential for smallholder farmers. This observation aligns with previous studies, which have showed that smallholder Vanilla growers generally achieve higher incomes compared to non-Vanilla farmers, due to strong market demand and the higher pricing of Vanilla products (Muzanila & Assenga, 2022a).

Vanilla is a perennial vine crop that has a relatively long gestation period before yielding economic returns. Consequently, income and profitability metrics were calculated separately for both the total cultivation period and the most recent production year, providing a more comprehensive assessment of economic viability at different stages of production.

(Shriver, 2013) Previous studies have demonstrated that Vanilla cultivation can be a profitable cultivation. Although initial profits are often low during the first 2–3 years, profitability increases, once the plants begin producing pods. The results of this study connect these findings, confirming that economic returns improve significantly after the initial gestation period.

#### **4.3 Profitability Analysis**

Profitability of the cultivation highlight the long-term financial viability of Vanilla cultivation. the gross margin per acre was LKR 39,628.07, For the most recent production year with implicit costs and LKR 243,620.10 without explicit cost (Table 3). The gross margin was LKR 184.50 with implicit costs in plant per basis and LKR 1,134.22 without implicit cost, demonstrating substantial profitability, particularly when family labor costs are not monetized.

Analysis of net profit margins revealed differing outcomes depending on the inclusion of implicit costs. the net profit margin for the most recent year was negative (–LKR 13,586.21) When implicit costs were considered, whereas without implicit costs resulted in a positive net profit margin of LKR 205,405.90. This Difference underscores the substantial impact of valuing family labor on profitability assessments and highlights the economic advantage in family based farming systems.

The Benefit–Cost Ratio (BCR) confirmed again the economic viability of Vanilla cultivation., the BCR was 3.25 when implicit costs were included for the total cultivation period and 16.49 without implicit cost. During the most recent production year, the BCR values were 0.95 and 4.81 with and without implicit cost respectively. Since a BCR greater than one indicates financial feasibility, these results suggest that Vanilla cultivation is economically profitable, particularly under family labor-based production systems.

The Gross Revenue Ratio (GRR) for the most recent production year was 0.21 which calculated without implicit costs, indicating that farmers spent only 0.21 units to generate one unit of income, reflecting efficient utilization of resources. The Expense Structure Ratio (ESR) was 2.43, showing that 2.43 units of variable cost were incurred for each unit of fixed cost. This relatively higher proportion of variable

costs highlights the operational flexibility of Vanilla cultivation, enabling farmers to adjust production levels according to resource availability and prevailing market conditions.

Table 3: Economic Analysis

	For total period			For last year		
	With cost (Rs./ac)	Implicit cost (Rs./ac)	Without implicit cost (Rs./ac)	With cost (Rs./ac)	Implicit cost (Rs./ac)	Without cost (Rs./ac)
<b>Gross margin</b>	670072.50		874064.60	39628.07		243620.10
<b>Gross profit margin per plant</b>	3119.63		4069.36	184.50		1134.22
<b>Net profit margin</b>	616858.23		835850.30	-13586.21		205405.90
<b>Net profit margin per plant</b>	2871.89		3891.45	-63.25		956.30
<b>Benefit cost ratio</b>	3.25		16.49	0.95		4.81
<b>Gross revenue ratio</b>	0.75		0.98	1.05		0.21
<b>Expense structure ratio</b>				0.24		2.43
<b>Period for crop establishment to first flowering</b>				2.2		year
<b>Payback Period</b>	01		3.2 years			
<b>Return on investment</b>	9.59		20.87	-1.23		4.37

#### 4.4 Investment Recovery and Economic Sustainability

The economic sustainability of Vanilla cultivation was further assessed using return on investment (ROI) indicators and payback period. The average duration from crop establishment to first flowering was approximately 2.2 years, followed by an additional year required for pod development and harvesting, resulting in a total estimated payback period of 3.2 to 4.8 years.

ROI values corroborated the profitability of Vanilla cultivation. For the total cultivation period, ROI was 9.59 with implicit costs and 20.87 without implicit costs. For the most recent production year, ROI was -1.23 with implicit costs and 4.37 without. These results suggest that although initial returns may be limited during the early years of production, profitability increases substantially once the plants reach full pod-bearing capacity.

These findings are consistent with earlier research, which indicates that Vanilla cultivation becomes economically viable only after the initial establishment period of **2–3 years**, with profitability increasing substantially once plants begin bearing pods regularly (Shriver, 2013a).

#### **4.5 Overall Economic Implications**

Overall, the results indicate that Vanilla cultivation represents a profitable and economically viable agricultural enterprise in the study area, particularly for smallholder farmers who utilize family labor. The relatively high benefit–cost ratio, moderate payback period, and substantial income potential underscore Vanilla’s suitability as a high-value crop for income diversification and livelihood enhancement.

Additionally, the flexible expense structure and moderate initial investment requirements make Vanilla cultivation an attractive option for small-scale farmers seeking sustainable agricultural income. These findings reinforce the recognition of Vanilla as a promising agro-enterprise in tropical regions and highlight its potential contribution to rural economic development.

### **5. Conclusion**

This study assessed the economic performance of Vanilla cultivation by examining cost structures, income generation, and key profitability indicators among smallholder farmers. The findings demonstrate that Vanilla cultivation is a financially viable and economically promising enterprise, particularly for farmers who rely on family labor.

Cost analysis revealed that variable costs accounted for the largest share of total production expenses, with pollination identified as the most significant cost component, contributing approximately 45% of total costs. This underscores the labor-intensive nature of Vanilla cultivation and highlights the critical role of effective pollination management in achieving optimal yields. The relatively low fixed costs observed indicate flexibility in resource allocation and reduced long-term financial burden for farmers.

Income analysis confirmed that Vanilla cultivation generates substantial economic returns, especially after the initial establishment phase. Observed gross income levels suggest that Vanilla farming can significantly enhance household income among smallholders. Profitability indicators, including high benefit–cost ratios, favorable gross margins, and positive return on investment, further support the economic feasibility of Vanilla production.

Although profitability in the most recent production year varied depending on whether implicit costs were included, the results show that Vanilla cultivation becomes increasingly profitable once the crop reaches maturity. The estimated payback period of approximately 3.2–4.8 years indicates that while the crop requires a relatively long-term investment, it provides sustainable financial benefits over time. These findings are consistent with previous research demonstrating that Vanilla cultivation typically achieves profitability after the first few years of establishment (Shriver, 2013).

Overall, Vanilla cultivation represents a high-value agricultural opportunity with significant potential to enhance rural livelihoods, improve farm-level income, and promote agricultural

diversification. The combination of high market value, favorable profitability indicators, and flexible production costs highlights Vanilla as a reliable source of income for smallholder farmers. Promoting Vanilla cultivation through technical support, efficient management practices, and improved access to markets could substantially contribute to the sustainable development of the agricultural sector.

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