Analysis of Silkworm Farming Business in Partnership with CV Kupu Sutera Pasuruan East Java

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Abstract. Silkworms are insects or moths that spawn high-quality thread. In general, this insect is beneficial in the production of silk fabrics. This fabric has tremendous economic worth; thus, many people are interested in cultivating silkworms. This research aimed to determine the costs, production, revenue, profits, and feasibility (RC ratio) of silkworm farming in Pasuruan, East Java. Descriptive analysis was employed in this study. The study was conducted in a community of silkworm farmers in Pasuruan in partnership with CV Kupu Sutera. A total of 72 people were considered as respondents. The findings revealed that: 1) silkworm farming production factors included eggs, labor, cage and equipment depreciation, and transportation fuel. 2) A business analysis was performed per silkworm production cycle, with a cost of IDR 37,646, dry cocoon output of 1.79 kg, wet cocoon production of 0.229 kg, revenue of IDR 453,225, and silkworm profit of 449,579. 3) The R/C on the silkworm farming business was 12.03. This rate indicated that for every IDR 1.00 spent cost, the silkworm farmer earns IDR 12.03 in revenue. Silkworm farming was thus feasible in Pasuruan, East Java.

1 Introduction

Silkworms possess significant potential for expansion. Indonesia is one of the nation's producing various fiber commodities, including cotton, hemp, sisal, kenaf, and silk [1]. The global demand for cocoons and silk threads has grown notably. However, the current supply still cannot fulfill the demand. Consequently, the government continues to depend on imports to fill the discrepancy between supply and demand. The expansion of silkworm farming is essential to fulfill domestic demands and enhance the nation's foreign exchange reserves [2]. The current level of natural silk production in Indonesia remains limited, with an annual output of no more than 500 tons and outlying short of the domestic demand estimated at approximately 2,000 tons per year [3].

Global Silk Production data shows that production declined from 202,072.83 tons in 2015 to 109,111.10 tons in 2019. According to FAO, demand for silk will continue to rise at a 5% annual rate [4]. Meanwhile, it can reach 12.2% in Indonesia [5]. As a result, it is possible to expect that sustainable silkworm farming could increase income [6].

Silkworms are cold-blooded animals (*Poikilotherms*), meaning their body temperature varies with the temperature of their surroundings. Silkworms are moth-like insects that receive complete metamorphosis from eggs to larvae, pupae, and imago [7,8]. If silkworms are produced from upstream to downstream, they have great economic value [9,10]. Many individuals and farmers

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are beginning to embrace the silkworm farming business since maintenance is simple and takes small capital. Silkworm growth cannot be individually performed since there are four phases from upstream to downstream. Therefore, a partnership is required to expand the silkworm farming business [11].

CV Kupu Sutera is one of the firms involved in the silkworm from upstream (egg supply) to downstream (silk fabric production). CV Kupu Sutera on the downstream side supplies farmers with ready-to-growth eggs. Farmers cultivate silkworms until they produce dry and wet cocoons and sell them to CV Kupu Sutera for further processing. CV Kupu Sutera produced one type of silkworm, *Samia Cynthia Ricini*, which eats castor plants, particularly *jatropha kapyar (Ricinus communis)*. According to previous research, mulberry leaves can be replaced with cassava as silkworm feed [3]. This type of silkworm has a 25-day production time for cocoons. Silkworm productivity depends on the feed management provided. If the feed management is good, favorable production is likely to be achieved [11]. Farmers contribute to the cultivation of silkworms under the supervision of CV Kupu Sutera.

The income silkworm farmers receive from selling empty cocoons (dry cocoons) and stuffed cocoons (wet cocoons) is very lucrative, and the business process is relatively simple. However, many farmers make this business as a side business, although some undertake it as a source of income. The silkworm business can thus be used as an alternative to increase the usability of resources and encourage the growth of the community's economy [12]. On the other hand, silkworm farmers in Pasuruan Regency and its surroundings have a source of income from the primary job. Hence, the management of this silkworm farming business becomes less focused. Another factor that causes the management of the silkworm business to be not focused is due to some farmers do not understanding the economic calculation. These constraints have an impact on the effectiveness of cocoon production. Inferior seed quality might lead to reduced cocoon production and eventually reduce the profits in silkworm farming since the harvest does not cover the costs. Climate, temperature, and nutrition are some factors that affect the decreasing cocoon production [13].

The aimed of this research is to a) examine the production factors in the silkworm business, b) examine production costs, revenue, and profit of the silkworm business, and c) analyze the feasibility by employing R/C in silkworm farming in Pasuruan, East Java.

2 Research Method

The research was carried out at Pasuruan, East Java, with a group of silkworm farmers who partnered with CV Kupu Sutera. CV Kupu Sutera was chosen since it had many partner farmers who undertook silkworm farming as a side business. Bangil, Pandaan, Lekok, and Purwodadi sub-districts and Batu City comprised the research location. The respondents were 72 silkworm farmers from five districts. The data used in this study was from the silkworm's last harvest season in Pasuruan, March-April 2023. The analysis technique employed in this research was cost, revenue, and profit analysis, and the feasibility of silkworm farming was explained as follows:

2.1 Cost

$$TC = FC + VC \tag{1}$$

where, *TC* was total cost (IDR); *FC* was fixed cost (IDR); and *VC* was variable Cost (IDR)

2.2 Revenue

$$TR = Py \, . \, Y \tag{2}$$

where, *TR* was total revenue (IDR), *Py* was product selling price (IDR); and *Y* was total production (Kg)

2.3 Profit

$$\pi = TR\text{-}TC \tag{3}$$

where, π was profit (IDR); TR was total revenue (IDR); and TC was total cost (IDR)

2.4 R/C Analysis

$$R/C = \frac{TR}{TC} \tag{4}$$

where, TR was total revenue (IDR) and TC was total cost (IDR)

Criteria:
R / C> 1 then the farm was feasible
R / C = 1 then the farm was break even
R / C < 1 then the farm was not feasible

3 Results and Discussion

3.1 Farmer Characteristics

Respondents in this study were a group of silkworm farmers from Pasuruan who partnered with CV Kupu Sutera. Respondent characteristics included age, education, agricultural experience, and primary and side jobs.

Age was a factor that affects the performance of an agricultural activity and farmers' thinking processes. Most silkworm farmers (32%) were in the millennial group aged 18 to 27 years, or 67% of farmers under 48 years. It indicated that the silkworm farming community was a very productive farmer with a strong desire to expand the silkworm business.

Table 1. Characteristics of silkworm farmer partners of CV Kupu Sutera Pasuruan

Age (Year)	Amount	Percentage (%)
18-27	23	32
28-37	7	10
38-47	18	25
48-57	10	14
58-67	14	19
Education level		
Not attending school	6	8
Elementary	7	10
Junior High School	13	18
Senior High School	36	50
University	10	14
Experience (Year)		
0-1	11	15
1- 2	36	50
2- 3	22	31
>3	3	4

The level of education is an important factor for assessing an individual's ability or knowledge in performing farming activities, involving both accepting and implementing new practices. In the case of silkworm farming, 64% of the farmers had a high school level or higher. It revealed that silkworm farmers had a high degree of education. This background suggested that these farmers can continue innovating and evolving silk farming.

Farming experience encompasses the information and abilities that farmers have learned through their practical involvement during agricultural activities, enabling them to produce various agricultural products effectively. Within the group of silkworm farmers, it was observed that the majority, precisely 81%, possess farming experience ranging from 1 to 3 years, with others still in the early phases (less than one year of experience). Experienced farmers, on the other hand, were the CV Kupu Sutera pioneers who have been involved in silk farming for a long time.

3.2 Analysis of Silkworm Farming Business

The analysis of silkworm business conducted to CV Kupu Sutera farmers takes place in farmers' houses, using cages of various sizes. This cage size depicts the area needed for silkworm farming.

Table 2. Distribution of cage use by cage size

Size of cage (m^2)	Area	Total (person)	Percentage (%)
3 x 1	3	3	4.17
3 x 2	6	3	4.17
2.5 x 2.5	6.25	2	2.78
3 x 2.5	7.5	1	1.39
4 x 2	8	3	4.17
3 x 3	9	7	9.72
3 x 4	12	17	23.61
6 x 2	12	1	1.39
3 x 5	15	9	12.50
4 x 4	16	2	2.78
6 x 3	18	9	12.50
5 x 4	20	1	1.39
6 x 4	24	3	4.17
5 x 5	25	11	15.28
Total		72	100

Table 2 indicates that 74% of silkworm farmers had a space of more than 12 m^2 with various sizes. The size of the drum was adjusted to fit the size of the farmer's land. Silkworm farming takes up an average of 14.8 m^2. This area provided the groundwork for examining the silkworm farming business.

3.3 Cost of Silkworm Farming Business

The analysis of the silkworm farming business encompasses production, revenue, and profit. The cost notions employed in this context include fixed costs and variable costs. The partner silkworm farming business of CV Kupu Sutera was a business or secondary job undertaken by farmers, predominantly relying on their familial labor. Another word for this phenomenon was *"disambi"* which involves the direct involvement of the farmer or his family members in the business. The life cycle of silkworm farming spans from the egg stage through the formation of a cocoon takes around 20 days.

The cost analysis technique employed in assessing the cost of silkworm production encompasses fixed and variable expenses directly paid by farmers, referred to as explicit costs. The fixed costs that were explicitly paid consist of the cage and equipment depreciation. Furthermore, the variable cost that was explicitly paid was non-family labor wage.

Equipment depreciation costs were one of the fixed costs that silkworm farmers need to pay. The kind and number of agricultural equipment used and owned by farmers on the silkworm farm determine this cost. The equipment used was a sickle, and its depreciation in the silkworm business was IDR 441 per silkworm production cycle. There was a cost for cage depreciation in addition

to equipment depreciation. Cage depreciation costs IDR 1,416 per silkworm production cycle, depending on the kind and number of cages made and owned by farmers in the silkworm farm.

The variable costs included eggs, labor, and other miscellaneous costs. The quantity of eggs needed for silkworm farming in an area of 14.8m2 was 1.86 grams, with an equivalent cost of IDR 4,650. These eggs were purchased from CV Kupu Sutera which was growth from the purchase of cocoons produced by farmers.

Silkworm farming predominantly relies on family labor to minimize cost expenses. The work pertains to maintaining, nourishing, and harvesting silkworm cocoons. The allocation of family labor towards the growth of silkworms is typically limited to part-time or intermittent engagement. An instance of this is observed in providing castor leaves as feed, which involves merely placing them in the silkworm cage. The utilization of non-family labor is employed to procure castor leaf feed. The cost paid for non-family labor to feed during one silkworm production cycle amounts to IDR 11,389. The number is small because only three of the 72 silkworm producers use outside family labor to procure feed.

An additional expense needed to be paid in silkworm farming was fuel cost, totaling IDR 19,750. The fuel was used to transport cocoon sales from the farmer's location to CV Kupu Sutera.

Table 3. Fixed Costs, Variable Costs and Total Costs of Silkworm farming business

Cost	Per business area (14.8m^2)
Fix cost:	-
Land rental	
Equipment depreciation	441
Cage depreciation	1,416
Amount	**1,857**
Variable cost:	
Eggs (gram)	4,650
Family labor	
Non-family labor	11,389
Other cost	19,750
Amount	**35,789**
Total Cost	**37,646**

The total cost of silkworm farming for each cycle per business area (14.8m2) was IDR 37,646, which includes Rp. 1,857 in fixed costs and Rp. 37,646 in variable costs. The costs are quite low since these are the actual spending by farmers for one cycle of silkworm farming for 20 days.

3.4 Production and Revenue

Silkworm farming produces dry and wet cocoons. Dry cocoons are cocoons that its pupae have released. Wet cocoons are cocoons that still have pupae. As the silkworm farmer's partner, CV Kupu Sutera purchases dry and wet cocoons. The revenue from silkworm farming was multiplied by the price CV Kupu Sutera determines [12]. The revenue and income of an agricultural business are heavily reliant on the active involvement of farmers in maintenance operations [14].

Table 4. Production and Revenue of Silkworm Farming Business

Type	Production (kg)	Price (IDR/kg)	Revenue (IDR)
Wet cocoons	0.229	25,000	5,725
Dry cocoons	1.79	250,000	447,500
Total revenue			453,225

The farmers mostly sell dry cocoons, as they command a higher market price. Furthermore, farmers can cultivate the resultant pupae into eggs, ready to growth as silkworms or as an

alternative source of nourishment for catfish and other animals. Farmers who sell wet cocoons are few since the farmers are unable to harvest their silkworm cocoons.

3.5 Profit

Profit is calculated as the disparity between revenue and total costs [15], whereas revenue is calculated by multiplying the selling price of dry and wet cocoons by the quantity of cocoons produced. As previously [16] stated, the costs included are fixed and variable costs specifically paid for by farmers; therefore, costs for renting premises and labor in the family are not included in the profit.

Table 5. Profit and R/C of Silkworm Farming per one cycle

Component	Amount (IDR)
Fix cost	**1,857**
Variable cost	35,789
Total cost	**37,646**
Revenue	453,225
Profit	449,579
RC ratio	12.03

The silkworm farming yielded an enormous profit of IDR 449,579, demonstrating a favorable cost-to-profit ratio. This discourse pertains to farmers who possess the necessary resources, including available land, leisure time, and family labor, to engage in a commercial venture that can augment their household income [17].

3.6 Analysis RC Ratio

The revenue-cost ratio (R/C) of 12.03 indicates that for every IDR 1.00 spent on costs, the silkworm farmer would receive IDR 12.03 in revenue. This result suggests that silkworm farming was economically feasible and proper for growth and expansion [18]. The production of silkworms in this business was a secondary business that exclusively relied on family labor. However, this business can be converted into a lucrative venture if effectively and professionally handled and focused on profitability [19]. Furthermore, the need for castor leaves as the feed was essential since feed usually becomes the constraint in livestock. Farmers need to seek out sources of feed at a considerable distance from their location. The nutritional requirements of the instar are minimal throughout its early stages but significantly increase as it reaches maturity. Hence, the availability of land for cultivating jatropha was necessitated to accommodate the feed necessity. Ideally, it is recommended to cultivate the jatropha before silkworm farming, as this supports feed availability upon commencing silkworm culture.

4 Conclusion and Recommendations

4.1 Conclusion

The cost of silkworm farming per business area for one production cycle was IDR 37,646. While revenue totaled IDR 453,225, profit totaled IDR 449,579. The costs considered in silkworm farming business are fixed costs and variable costs that were actually incurred by the farmers. The R / C on silkworm business with CV Kupu Sutera partners was 12.03, indicating that this business is feasible to cultivate.

4.2 Recommendation

The cultivation of silkworms for commercial purposes can be a lucrative ancillary enterprise, provided that the expenditures incurred are classified as explicit costs. Hence, to enhance this

business as profit-oriented and more efficient, it is imperative to establish a self-sustaining system for cultivating castor leaf feed within the premises. Furthermore, employing the by-products derived from silkworms, such as utilizing silkworm dung as an organic fertilizer and processing the pupa into animal feed, is imperative.

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