



## Financial feasibility evaluation of BSF maggot cultivation at Bumi Farm, Cipaku Village, Bogor City

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### ABSTRACT

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The problem of food waste management, which continues to increase and dominate the composition of waste, necessitates circular economy-based solutions that not only solve the problem of waste accumulation but also provide economic benefits. One such solution is the cultivation of Black Soldier Fly (BSF) maggots, as maggots can reduce food waste by 90%. One of the businesses that cultivates BSF maggots is Bumi Farm, but since its establishment in 2020, no financial feasibility evaluation has been conducted. Therefore, this study aims to evaluate the financial feasibility of BSF maggot cultivation at Bumi Farm using NPV, IRR, PP, and Net B/C. The results of this study indicate that the BSF maggot cultivation business at Bumi Farm shows the following values NPV with a Bi Rate of 5.75% is IDR 152,700,000, which is considered feasible because the NPV value is  $> 0$ ; IRR value of 36.71% is considered feasible because the IRR value is  $>$  Bi Rate; The Payback Period of 2 years and 10 months is feasible because the PP value is  $<$  Economic Life, and the Net B/C of 2.32 is feasible because the Net B/C value is  $> 1$ . The results of the analysis show that all financial feasibility indicators are met, so that the BSF Maggot Cultivation business at Bumi Farm is feasible to run because it meets all financial feasibility indicators.

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### 1. INTRODUCTION

Waste is one of the crucial issues that needs to be addressed, considering that based on data from the National Waste Management Information System in 2024, Indonesia produces 38,170,795.60 tons of waste per year from 343 regencies and cities in Indonesia (SIPSN, 2025). This amount is created from high daily waste generation and poor waste management, as only 33.74% of waste is managed annually. This indicates that waste management in Indonesia is not yet optimal (Gandhy, et al., 2025).

Based on waste generation data, West Java is the second largest contributor after East Java, with West Java producing 6,350,466.76 tons of waste per year (SIPSN, 2025). The city of Bogor itself is one of the contributors to the high daily waste generation in West Java, with a daily generation of 755.36 tons of waste. Based on its composition,

waste in the city of Bogor is dominated by food waste, amounting to 40%. If this type of waste is not managed and is left to accumulate, it will produce methane gas that has the potential to explode, pollute the environment, and endanger public health. Therefore, a solution is needed to overcome the problem of food waste, one of which is through maggot cultivation (Prasetyo & Gumilang, 2025). Maggots are the larvae of the Black Soldier Fly (BSF), which have the ability to reduce 90% of food waste and are highly nutritious, making them valuable. They also address the problem of food waste accumulation through the concept of a circular economy and create added value from worthless food waste (Gandhy et al., 2024). The creation of economic value from food waste through the circular economy concept occurs through a shift in the production cost structure. Food waste, which previously had no economic value and required processing costs, is now converted into one of the raw materials in BSF maggot cultivation.

Along with increasing awareness of sustainable waste management, BSF maggot farming businesses have begun to develop in various regions, including in the city of Bogor (A. S. P. Gumilang et al., 2025). One of the businesses involved in BSF maggot farming is Bumi Farm, located in Cipaku Village, South Bogor District, Bogor City. Based on initial observations, Bumi Farm processes 500 kg of food waste per day sourced from three hotels in Bogor City. The products produced by Bumi Farm consist of fresh maggots and maggot eggs. Bumi Farm has been operating BSF maggot cultivation since 2020 and producing various products with commercial value from waste that previously had no economic value. Unfortunately, to date, the business has not conducted a systematic financial feasibility assessment, so it is not yet known whether this business is truly financially profitable. This situation has led to uncertainty as to whether the business is truly profitable, breaking even, or facing the risk of long-term losses (A. S. Gumilang & Patra, 2024). Financial feasibility evaluation is very important to prevent waste of resources due to businesses that do not provide economic benefits (Yuniati et al., 2021).

Financial feasibility analysis is one of the analyses in a business feasibility study (Sunardi et al., 2022). A business feasibility study is an evaluation process conducted to review whether the business is feasible and profitable, or whether it could be detrimental. A business feasibility study consists of various aspects, one of which is the financial aspect, or financial feasibility (Wilistanti et al., 2025). Financial feasibility analysis is defined as an analysis conducted to assess the financial condition of a business, including how much profit can be obtained, how long it will take to return the capital, and various other financial factors (Exzan et al., 2024). The stages in conducting a financial feasibility analysis begin with identifying production costs by calculating the cost components in cultivation, starting with identifying investment costs, fixed costs, variable costs, and overhead costs (Ermawati & Hidayanti, 2019). After that, revenue is identified and analyzed using financial feasibility indicators (Wardana et al., 2021). Therefore, it is an important tool for assessing the sustainability of a business in order to determine whether the business will be profitable or not and whether it is feasible or not to run (Ngatno, 2021).

Previous research about financial feasibility of BSF Maggot is conducted by (Gandhy, Koen, et al., 2025) in Bubulak Village, then (Prihartini et al., 2022), at Omah Maggot, and research conducted by (Setiawan, 2023) at Farm Republic Larva, this research show that the cultivation businesses carried out in these places have met the criteria for financial feasibility, so it can be stated that these businesses are feasible to run and have the potential to grow. The results of these studies also show the importance of analyzing the financial feasibility of a business, so that business actors do not simply waste resources but can accurately measure the benefits that can be obtained from the sacrifice of these resources, especially in the case of BSF maggots. Moreover, the results of the study by (Raman et al., 2022) show that BSF maggot cultivation can contribute to

Sustainable Development Goals or SDGs. Thus, this study can enrich the literature related to the BSF maggot cultivation business that contributes to sustainable development, as well as integrate financial feasibility with circular economy principles as the foundation of the business model. In addition, BSF maggot cultivation at Bumi Farm also has the potential to provide economic and environmental benefits. However, in order for it to continue to grow, an analysis is needed to evaluate the feasibility of this business, so this study aims to evaluate the financial feasibility of BSF maggot cultivation at Bumi Farm.

## 2. RESEARCH METHOD

This research is a quantitative descriptive study that aims to describe the evaluation of the financial feasibility of BSF maggot cultivation at Bumi Farm, whether it will be profitable or detrimental (Gandhy, Koen, et al., 2025). The object of this study is financial feasibility analysis using net present value, internal rate of return, payback period, and net benefit cost. The unit of analysis in this study is individuals within the organization. The location of this study is Bumi Farm, Cipaku Village, South Bogor District, Bogor City. This location was selected purposively, considering that this business is attractive because it has been operating for 5 years and has the opportunity to grow (A. S. P. Gumilang et al., 2024). The type and source of data used in this study are primary data obtained from observations and interviews with the owners and managers of Bumi Farm and secondary data obtained from related publications and reports (Wilistanti et al., 2025). The analysis method used in this study is financial feasibility analysis with indicators consisting of:

### 2.1 Net Present Value

Net Present Value (NPV) considers the time value of money in cash flows, which is calculated by determining the difference between the present value of cash inflows and investment expenditures (Nopianingsih et al., 2022). The interest rate of this research using BI rate with 5,75% (Wilistanti et al., 2025). The interest rate of 5.75% used in this study was chosen because this value was issued by Bank Indonesia as the central bank. In addition, the discount rate of 5.75% was chosen because it represents macroeconomic capital costs and serves as a neutral benchmark for evaluating the intrinsic financial feasibility of a business, regardless of specific financing arrangements. An investment is deemed feasible by NPV when the NPV value is greater than zero ( $NPV > 0$ ), an investment is deemed not feasible by NPV when the NPV value is greater than zero or negative ( $NPV < 0$ ) (Kailuhu et al., 2023). To calculate NPV, the following formula can be used:

$$NPV = \sum_{t=1}^n \frac{Bt - Ct}{(1+i)^t}$$

Description:

NPV : Net Present Value  
 N : Economic Life  
 t : Investment Year  
 i : Interest Rate  
 Bt : Revenue in Year t  
 Ct : Cost in Year t

### 2.2 Internal Rate of Return

Internal Rate of Return (IRR) is an analysis conducted to measure the discount rate or calculate the interest rate that produces a net present value (NPV) equal to zero (Prihartini et al., 2022). IRR Value indicates the level of efficiency or percentage of expected annual return on an investment, thereby visualizing the feasibility of an

investment by comparing it to the cost of capital (Lestari & Wahyudin, 2022). The accepted criterion based on IRR is when the IRR value is greater than the interest rate (IRR > Interest Rate) and rejected criterion if IRR value is lower than interest rate. The interest rate of this research using BI Rate with 5,75% (Bank SBI Indonesia, 2024). To calculate IRR, the following formula can be used:

$$IRR = i1 + \frac{NPV_1}{NPV_1 - NPV_2} \times (i2 - i1)$$

Description:

IRR : Internal Rate of Return

i1 : Interest Rate That Produces a Positive NPV

i2 : Interest Rate That Produces a Negative NPV

NPV1 : Present Value That Produces a Positive NPV

NPV2 : Present Value That Produces a Negative NPV

### 2.3 Payback Period

Payback Period (PP) is an analysis used to measure how long it takes to recover the initial investment (Silviani et al., 2024). Payback Period is used to determine the time required to recover the investment expenditure (initial cash investment) through the cash flow generated (Yuniati et al., 2021). Simply put, PP is a ratio that compares the initial investment with its cash inflow, the result of which is a unit of time. In this study, the economic life used is 5 years. Gandhi, Qodriah, et al., (2025) state that the criteria deemed feasible based on the Payback Period is when the Payback Period value is smaller than the economic life of the project (PP < Economic Life) and payback period was rejected if payback period value is greater than economic life. To calculate the Payback Period value, the following formula can be used:

$$Payback\ Period = \frac{Investment\ Value}{Net\ Cash\ Inflow} \times 1\ Year$$

### 2.4 Net Benefit Cost Ratio

Net Benefit Cost Ratio (Net B/C) is an analysis that describes the ratio between the costs incurred and the benefits to be obtained (Sumbodo et al., 2023). Net Benefit Cost ratio is a ratio that compares positive net benefits with negative net benefits (Fisu et al., 2020). The accepted criterion for NET B/C is when the NET B/C value is greater than 1 (NET B/C > 1), indicating that every rupiah spent will yield benefits greater than 1 rupiah, thus demonstrating a profit (Gandhy & Sutanto, 2017). The project is rejected by NET B/C criteria if NET B/C value is less than 1 (NET B/C < 1) (Sumbodo et al., 2023). The formula for calculating the NET B/C value is:

$$NET\ B/C\ Ratio = \frac{[\sum_{t=0}^n(NPV+)]}{[\sum_{t=0}^n(NPV-)]}$$

Description:

B/C : Cost-benefit ratio

I : Discount factor

t : Total analysis period (years)

n : Economic live value of the project

## 3. RESULTS AND DISCUSSIONS

Bumi Farm is a business engaged in the cultivation of Black Soldier Fly (BSF) maggots, focusing on processing food waste from hotels as a waste supplier. This business has

been operating since 2020 through a circular economy approach, transforming previously worthless organic waste into economically valuable and environmentally friendly products. In its operations, Bumi Farm processes 500 kg of food waste per day obtained through collaboration with several hotels in the city of Bogor. The production process involves daily waste collection, sorting, feeding BSF larvae, harvesting, and processing the cultivated products. The main products produced by Bumi Farm consist of fresh maggots and maggot eggs, which are marketed to various consumer segments such as fish and poultry farmers. In one month, Bumi Farm is capable of producing 3 tons of maggots and 2 kg of BSF maggot eggs, but only 2 tons of maggots and 1 kg of eggs are sold because the rest are used to continue the cycle so that they can lay eggs again. This business is operated on government-owned land with a 200-square-meter land use permit Hak Guna Usaha (HGU), so Bumi Farm does not incur any land/rental costs in running its BSF maggot cultivation business.

### 3.1 Production Cost Analysis of Bumi Farm

Production costs in BSF maggot cultivation can be classified into several types of costs, namely investment costs incurred at the beginning when starting to cultivate BSF maggots, fixed costs incurred on a daily basis, variable costs incurred under certain conditions, and fixed overhead costs, which are indirect costs that remain constant regardless of conditions (Exzan et al., 2024). Production costs are defined as costs incurred by investors or business owners in the early stages of establishing a business to prepare the necessary requirements for the business to be operational (Arfah & Zurlaini, 2023). The following are the investment costs for BSF maggot cultivation at Bumi Farm.

Table 1. Investment Cost at Bumi Farm

No	Item	Unit	Quantity	Unit Price	Economic Life (Month)	Total Cost	Depreciation
1	Buildings	Units	2	40,000,000	240	80,000,000	333,333.33
2	Maggot Breeding Cage	Units	1	2,000,000	60	2,000,000	33,333.33
3	Wooden Maggot Biopond	Units	15	750,000	60	11,250,000	187,500.00
4	Wall Maggot Biopond	Units	8	1,000,000	60	8,000,000	133,333.33
5	Maggot Rack	Units	5	750,000	60	3,750,000	62,500.00
6	Hatching Tray	Units	30	15,000	60	450,000	7,500.00
7	Round Blue Barrel	Units	20	120,000	60	2,400,000	40,000.00
8	Scales	Units	2	600,000	36	1,200,000	33,333.33
9	Electrical Installation	Units	1	1,500,000	60	1,500,000	25,000.00
10	Maggot Eggs	Gram	1000	5,000	60	5,000,000	83,333.33
Accumulated Investment Costs						15,550,000	939,167

Source: Data processed by researcher, 2025

Based on the cost identification results, it is known that in cultivating BSF maggots at Bumi Farm, the investment costs consist of costs for buildings for cages and employee rest areas, maggot breeding cages for flies to reproduce, bioponds for maggot growth, biopond racks, hatching tanks, round blue barrels for storing waste, scales, electrical installations, and initial maggot eggs. The total investment cost to run this business is IDR 115,550,000, with the largest cost component being the construction of a building on a 100 square meter plot of land at a total cost of IDR 80,000,000. This cost component does not include land costs, as Bumi Farm uses land under a Right to Cultivate (Hak Guna Usaha), which is not classified as an investment cost.

Table 2. Fixed Cost at Bumi Farm

No	Item	Units	Quantity	Unit price	Total cost
1	Labor costs	People	3	105,000	7,560,000
2	Management costs	Day	1	150,000	4,500,000
3	Asset depreciation	-	-	-	939,167
Accumulated fixed costs				255,000	12,999,167

Source: Data processed by researcher, 2025

Based on the table, it is known that the fixed costs in the maggot farming business at Bumi Farm amount to Idr 12,999,167 per month. These costs are used to pay the wages of three workers who work six days per week, followed by management costs used for transporting waste from hotels to the cultivation site every day, and finally, asset depreciation obtained from the investment depreciation listed in Table 1. The variable cost for the maggot farming business at Bumi Farm is Idr 750,000 per month for bran. This amount may change if Bumi Farm wants to increase its production capacity. Under normal conditions, Bumi Farm needs 150 kg of bran as initial feed for newly hatched BSF maggots. This amount is needed to achieve a production target of 3 tons.

Variable overhead costs consist of electricity costs of Idr 50,000 per month, which are used for lighting in the barn and other electrical equipment. These costs are categorized as overhead costs because the electricity bill is not always Idr 50,000 per month; it can be higher depending on labor requirements. Based on the cost identification results, it is known that when accumulated from fixed costs Idr 12,999,167, variable costs Idr 750,000, and variable overhead costs of Idr 50,000. Therefore, Bumi Farm's monthly production costs amount to Idr 13,799,167, and its annual production costs amount to Idr 165,590,000.

### 3.2 Bumi Farm Revenue

Based on the results of interviews that have been conducted, it is known that Bumi Farm has two products, namely fresh maggots and maggot eggs, which are sold for Rp. 7,000 and Rp. 5,000, respectively.

Table 3. Revenue at Bumi Farm

No	Item	Unit	Selling price	Quantity	Revenue
1	Fresh maggots	Kg	7,000	1300	9,100,000
2	Maggot eggs	Gram	5,000	1000	5,000,000
Monthly revenue accumulation					14,100,000
Annual revenue accumulation					169,200,000

Source: Data processed by researcher, 2025

Based on the table, it is known that every month Bumi Farm successfully sells 1,300 kg of fresh larvae and 1,000 grams of BSF larvae eggs. Based on these sales, fresh larvae provide regular and stable cash flow, while larvae eggs are a product with high strategic value, which has biological and economic added value, because part of the production is deliberately stored to maintain the sustainability of the production cycle so that it can be a source of income and biological capital for the business. Based on these sales results, it is known that every month Bumi Farm receives income from product sales of IDR 14,100,000, and in one year has a turnover of IDR 169,200,000. With this turnover, Bumi Farm earns a monthly profit of IDR 300,833 or IDR 3,610,000 per year. This value shows a slight difference between income and expenses, indicating that this business operates with low margins and high discipline. Small errors in cost management, disruptions in waste supply, or a decline in selling prices can have a direct impact on business profits, so management needs to have detailed planning, strict cost control, and proper risk management.

### 3.3 Financial Feasibility Analysis

Based on the results of cost identification in the BSF Maggot cultivation business at Bumi Farm, the following is a financial feasibility analysis using NPV, IRR, PP, and Net B/C, as follows:

### 3.4 Net Present Value

Net Present Value (NPV) is used to assess the financial feasibility of the BSF maggot cultivation business at Bumi Farm by taking into account the time value of money. Based on the results of the financial feasibility analysis using a Bi Rate of 5.75% and assuming the economic life of BSF maggot cultivation at Bumi Farm to be 5 years, the following NPV values were obtained:

Table 4. Net Present Value at Bumi Farm

YEAR	REVENUE	COST	VALUE YEAR	NPV
0	-	115,550,000	(115,550,000)	(115,550,000)
1	169,200,000	115,550,000	53,650,000	53,650,000
2	169,200,000	115,550,000	53,650,000	53,650,000
3	169,200,000	115,550,000	53,650,000	53,650,000
4	169,200,000	115,550,000	53,650,000	53,650,000
5	169,200,000	115,550,000	53,650,000	53,650,000

Source: Data processed by researcher, 2025

Based on the NPV analysis results at Bumi Farm, it is known that the NPV value is positive at Idr 152,700,000, which indicates that the BSF Maggot Cultivation business at Bumi Farm is feasible because it meets the criteria with an NPV value  $> 0$  (Nopianingsih et al., 2022). Thus, the present value of all benefits is greater than the present value of all costs incurred during the life of the business. A positive NPV value also indicates that the BSF maggot cultivation business at Bumi Farm is capable of generating net added value after considering the initial investment, operational costs, and the discount rate used. Thus, financially, this business is not only able to cover all costs, but also provides economic surplus for business actors.

### 3.5 Internal Rate of Return

Internal Rate of Return (IRR) is a financial feasibility indicator that shows the internal rate of return on an investment (Lestari & Wahyudin, 2022). Based on the results of the financial feasibility analysis, an IRR value of 36.71% was obtained, which is greater than the BI Rate of 5.75%, so the business is declared financially feasible based on the IRR criteria. An IRR value that is higher than the discount rate indicates that the profits generated by the BSF maggot cultivation business exceed the cost of capital, so that the capital invested in the Bumi Farm business provides a better rate of return. A high IRR value also reflects the business's ability to generate stable and consistent net cash flow.

This clean and stable cash flow is influenced by market demand for BSF maggots as an alternative feed, as well as the cost efficiency gained from utilizing organic waste as the main raw material. This is because research results from (Hardini & Gandhi, 2021) show that BSF maggots used as alternative feed for catfish can reduce feed costs by 25.1%, which is why BSF maggots are highly sought after by fish and poultry farmers.

### 3.6 Payback Period

As a financial feasibility indicator used to measure the period required for a business to recover its initial investment from the net cash flow generated (Sunardi et al., 2022). In the analysis of BSF maggot cultivation at Bumi Farm, where the economic life of BSF maggot cultivation is 5 years, with an investment value of IDR 115,550,000 and a net cash inflow value of IDR 17,070,000, the payback period calculation is as follows:

Table 5. Revenue at Bumi Farm

Year	Revenue	Cost	Value Year	Npv	Effect On Initial Investment
0	-	115,550,000	(115,550,000)	(115,550,000)	-
1	169,200,000	115,550,000	53,650,000	53,650,000	(61,900,000)
2	169,200,000	115,550,000	53,650,000	53,650,000	(8,250,000)
3	169,200,000	115,550,000	53,650,000	53,650,000	45,400,000
4	169,200,000	115,550,000	53,650,000	53,650,000	99,050,000
5	169,200,000	115,550,000	53,650,000	53,650,000	152,700,000

Source: Data processed by researcher, 2025

Based on the calculation results, it is known that the payback period as stated in Table 6 shows a positive investment value after the second year, so the calculation results indicate that the investment can be recovered in a relatively short time compared to the economic life of the assets used, which is 2 years and 10 months. Therefore, a Payback Period that is shorter than the economic life of the business, which is 5 years, indicates that Bumi Farm is able to recover its initial capital before the assets experience a significant decline in function. This is a positive indicator, so the Maggot BSF cultivation business at Bumi Farm is feasible based on the Payback Period indicator.

### 3.7 Net Benefit Cost

The Net Benefit Cost Ratio (Net B/C) is a ratio that compares the present value of benefits with the present value of costs incurred during the life of the project (Kailuhu et al., 2023). Based on the analysis results, a Net B/C value of 2.32 was obtained, indicating that this business is feasible because it has a Net B/C value  $> 1$ . This shows that Bumi Farm generates greater benefits than the costs incurred. A Net B/C value greater than one indicates that every 1 rupiah invested in the BSF maggot cultivation business at Bumi Farm is able to generate greater economic benefits of 2.32 Indonesian rupiah.

The results of this financial feasibility calculation show that the Maggot Cultivation Business carried out at Bumi Farm, based on the financial feasibility indicators of Net Present Value, Internal Rate of Return, Payback Period, and Net Benefit Cost, meets all of these criteria. Therefore, the financial feasibility evaluation results show that the BSF Maggot Farming business at Bumi Farm is financially feasible because the four indicators are met. This reinforces the research conducted by (Gandhy, Koen, et al., 2025; Prihartini et al., 2022; Setiawan, 2023) which states the same thing, namely that the maggot farming business is feasible. The results of this study can also serve as a model for integrating this business into regional waste management programs, particularly in the city of Bogor as a market-based solution. This can be used as material for study by the city and regency of Bogor, which are currently addressing the problem of waste accumulation at the Galuga landfill (Sekretariat Daerah Kabupaten Bogor, 2025). These recommendations not only reduce the burden on landfills but also create economic added value and local employment opportunities. Therefore, the required policies should be more facilitative in nature, such as providing land, streamlining permitting processes, and strengthening partnerships with waste sources.

## 4. CONCLUSION

Bumi Farm is one of the businesses located in Cipaku Village, South Bogor District, Bogor City, West Java, which operates a black soldier fly maggot farming business and is able to reduce 500 kg of food waste every day from three hotels in Bogor City. Bumi Farm sells 1.3 tons of fresh maggots and 1 kg of BSF maggot eggs monthly, generating an annual revenue of IDR 169,200,000 with annual production costs reaching IDR 165,590,000. This results in an annual profit of IDR 3,610,000.

The results of the financial feasibility evaluation using the Net Present Value indicator with a Bi Rate of 5.75% show a positive value of Rp. 152,700,000, which meets the NPV criteria. The Internal Rate of Return value from the analysis is 36.71%, which indicates that the IRR value meets the criteria. The Payback Period value also shows a positive result because this business can generate profits for 2 years and 10 months. The Net Benefit Cost analysis also shows a positive value because Bumi Farm has a Net B/C value of 2.32. Therefore, based on the financial feasibility analysis of the BSF Maggot Cultivation business, it is known that this business is feasible to run because it meets all financial feasibility indicators. The results of this study can also be used as a model for integrating this business into regional waste management programs, particularly in the city of Bogor as a market-based solution. This is because it can solve waste problems and create new jobs. Therefore, the policies required by the Bogor city government should be more facilitative in nature, such as providing land, simplifying the licensing process, and strengthening partnerships with waste sources. To reinforce these findings, further research is needed on business feasibility studies by analyzing market and marketing aspects, legal aspects, social and environmental aspects, and business sensitivity analysis in order to strengthen the results of this study.

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