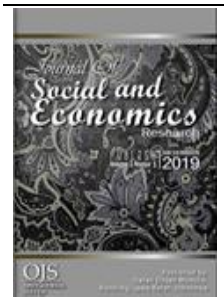


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## ASSESSING THE FINANCIAL FEASIBILITY OF MAGGOT FARMING: A CASE STUDY OF NYAMPIH


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**ABSTRACT**

The increasing amount of organic waste in Indonesia, which accounts for almost 50% of the total waste generated poses a significant challenge in waste management. This problem is worsened by the limitations of existing waste management models, particularly their real-world impact and economic benefits. The purpose of this study is to assess the financial feasibility of Black Soldier Fly (BSF) maggot farming as an innovative solution to Indonesia's organic waste problem. BSF maggots not only reduce organic waste but also generate economically valuable products such as animal feed and organic fertilizer. This study aims to assess the financial feasibility of a Black Soldier Fly (BSF) maggot farming project undertaken by Nyampih, a waste-management startup based in Sumedang, West Java. The study utilizes internal data from Nyampih's financial plan, company reports, and interviews, along with external data from government data, industry benchmarks, and relevant research. The analysis is limited to ten-year projections and focuses on financial feasibility. This study finds that the project is feasible and potentially profitable, with a net present value (NPV) of IDR 2,905,018,264.74, an internal rate of return (IRR) of 41.20%, a payback period of 3.88 years, a discounted payback period of 4.87 years, and profitability index of 5.77. However, the project has financial risks, particularly concerning the sales and price of maggot flour, which is projected to have the highest sales volume and price. Operating costs, COGS, and dried maggot sales and pricing also show sensitivity to NPV fluctuations. This emphasizes the importance of continuous monitoring and adjustment of marketing strategy, product proportions, pricing strategies, and cost structures to align with actual market conditions.

## INTRODUCTION

The world is facing the global challenge of rising municipal solid waste generation. The United Nations Environment Programme (2024) predicts a rise in municipal solid waste generation from 2.3 billion tonnes in 2023 to 3.8 billion tonnes by 2050, resulting in a global direct cost of $361 billion. Implementing waste prevention and management strategies could reduce annual costs to $270.2 billion. Thus, UNEP invites all the stakeholders to take action to prevent the worst scenarios. Recognizing this urgency, the Indonesian government, through Presidential Regulation No. 97 of 2017 concerning National Policy and Strategy regarding Waste Management, has set ambitious targets to address this issue, aiming to have 70% of waste appropriately managed by 2025.

According to data from the Indonesian Ministry of Environment's National Waste Information System (SIPSN), Indonesia generated 214.7 million tons of waste in 2023. Of this, only 51.16% were handled properly, leaving 32.28% untreated. Based on KLHK data from 2018, 55.56% of waste management in Indonesia still takes place at final disposal sites (TPA) using an open dumping system.

The gap between the current performance and the government target indicates significant room improvement for waste management in Indonesia. Despite its waste management statistics, there is another issue related to waste management in Indonesia, such as the impact of the existing waste management that has yet to be fully felt (Rahmawati et al., 2021). Another study by Pratama et al. (2023) examined the obstacles to implementing waste banks in Serang City and discovered that the waste banks did not provide a significant economic benefit to members and only reduced 0.03% of total municipal solid waste.

Existing limitations in waste management strategies, particularly regarding their real-world impact and economic benefits, highlight the need for innovative and more impactful solutions. Research suggests that inclusive waste management models, implemented at the village level, can offer significant socio-economic benefits. A successful example is Taro Village (Rahmawati et al., 2023), where such a model has drastically reduced waste sent to landfills leaving only 10% of waste remaining. Additionally, the village has witnessed a decrease in poverty and stunting rates. This success story demonstrates how inclusive waste management aligns perfectly with the principles of inclusive economic growth, promoting equity, lowering poverty, and fostering faster economic development.

Nyampih emerges as a promising solution aligned with these principles. This company focuses on developing inclusive waste management models in villages. By actively involving local communities such as local heroes and youth organizations in the process, Nyampih aim to fosters economic benefits for all stakeholders and promote a more sustainable future for villages and Indonesia.

Nyampih's initial operations focused on developing a mobile application to connect waste management service providers with various user groups, including households, businesses, and government agencies. This app encouraged and empowered households to take a more active role in waste management by sorting their garbage independently. Once sorted, Nyampih's team would collect the waste for further processing by local community members and small and medium-sized enterprises (UMKM) working in waste management. In addition, Nyampih was

directly involved in conducting community activities related to waste management, including introducing basic waste processing techniques through a workshop.

However, this initial business model faced challenges, particularly in educating the community about waste sorting which resulted in low customer acquisition. On the other side, the operational costs were high relative to the profits generated.

Along with its operational activities, Nyampih recognizes other opportunities to shift its operational focus to organic waste management by cultivating maggot BSF. This shift was recognized because the amount of organic waste dominates the waste percentage. According to the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry, organic waste accounts for almost 50% of total waste generated in Indonesia. This percentage is also similar in Bandung City, where the most extensive composition of waste in Bandung City is organic waste, around 40–60 percent (Diskominfo Bandung City, 2023).

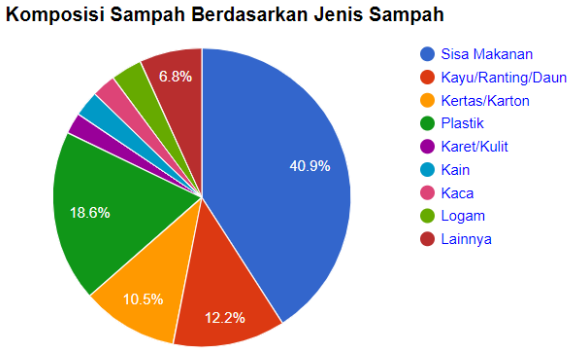


**Figure 1.** Waste composition by type (SIPSN, 2024)

The Black Soldier Fly (BSF) maggot is the larval stage of the Hermetia illucens fly. BSF flies are not disease carriers and do not produce foul odours due to natural antibiotics in their bodies, unlike common flies. According to Kementrian Lingkungan Hidup dan Kehutanan, BSF maggots offer various benefits, such as being rich in protein making them a valuable source of animal feed for fish, birds, and livestock. BSF maggot also generates organic fertilizer, a soil conditioner, and a revitalizer.

The high volume of organic waste and the potential applications of BSF maggots, have prompted Nyampih's team to consider maggot farming as their core business activity. However, a feasibility study is crucial before assessing the project's viability. Thus, this study aims to evaluate the financial feasibility of Maggot farming using several financial metrics: Net Present Value, Payback Period, Profitability Index, and Internal Rate of Return.

## METHODS

The figure below outlines the research design for this study, ensuring that it effectively addresses the research questions and objectives.

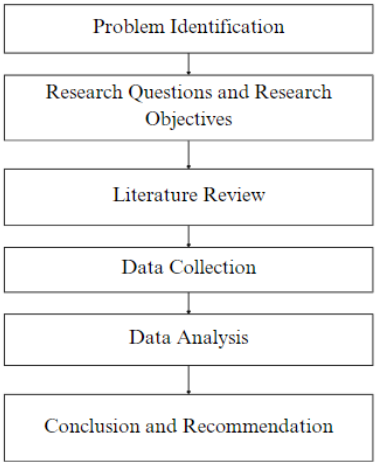


**Figure 2.** Research Design

The research will employ six steps as depicted in the figure above, with the following description of each step:

1. Problem Identification

   Conducting an interview with Nyampih's team to address the issue faced by Nyampih and identify their objective.

2. Research Questions and Objectives

   Formulate specific questions to guide the study and set clear objectives based on the problem identified.

3. Theoretical Foundations

   Establish a theoretical basis by reviewing relevant literature on the relevant theory needed for the study.

4. Data Collection

   Gather data from both primary sources (e.g., interviews, company's internal data) and secondary sources (e.g., government data, journals, books) to inform the analysis.

5. Data Analysis

   Analyze the collected data using relevant frameworks, which will incorporate six main stage analysis. The data analysis includes External Analysis, Internal Analysis, Product and Market Analysis, Business Model Analysis, Capital Budgeting Cashflow Construction, Capital Budgeting Analysis, and Capital Budgeting Risk Analysis.

6. Conclusion and Recommendation

   Draw conclusions based on the data analysis and provide recommendations for Nyampih regarding the feasibility and potential strategies for the maggot farming project.

This study will employ both primary and secondary data collection methods to gain a comprehensive understanding of the feasibility of Nyampih's BSF maggot farming project. Primary data is original and information that is gathered to solve a specific problem (Ajayi, 2017). For this study, the primary data was collected from the Nyampih financial plan, previous reports, and interviews with Nyampih's relevant personnel. Secondary data is data produced or gathered previously by others and

used for different objectives in the past (Ajayi, 2017). Secondary data collection was collected from external reliable sources such as government data, journals, books, company benchmarks, and other relevant sources to support the additional data needed for the analysis.

## RESULT

### Product and Market Analysis

This analysis will elaborate the product and market analysis of the project along with its pricing strategy, distribution place, and promotion strategy plan.

### 4Ps Marketing Analysis

The following table is the description of the product aimed to be produced by Nyampih and its plan for the price, distribution place, and promotion strategy.

**Table 1.** 4Ps Marketing Analysis

| Product | Price (Competitive Based Pricing) | Place | Promotion |
|---|---|---|---|
| **Fresh Maggot**: Fresh, moist, and used primarily for immediate feeding, have the shortest shelf life compared to dried maggot and maggot flour. | Rp35.000 | 1. Offline transaction in the farming place.<br>2. Online transactions through e-commerce.<br>3. Retail or distribution partnership. | 1. Social media promotion<br>2. Traditional marketing such as print advertising, direct sales, word of mouth marketing, etc.<br>3. Strategic partnership |
| **Dried Maggot**: Dehydrated, has a longer shelf life and often used directly or rehydrated as a convenient and protein-rich feed for poultry, fish, and other animals. | Rp45.000 | | |
| **Maggot Flour:** Powdered form, versatile use in various feed formulations, longer shelf life. | Rp60.000 | | |

To proceed with the maggot into dried maggot and maggot flour, it required further processing, which is drying and grinding. The conversion from fresh maggot into dried maggot is 3:1, which means that 3 kilograms of fresh maggot will turn into 1 kilogram of dried maggot after the drying process. The conversion from dried maggot into maggot flour is around 1:1 because it only needs to be grinded. However, for the purposes of this projection, it is assumed that there is a 0.2 percent reduction in weight from dried maggots to maggot flour to account for any potential errors or issues during the grinding process.

### TAM SAM SOM Analysis

Indonesia's agricultural sector is rapidly expanding and transforming. With a compound annual growth rate (CAGR) of 6.30% from 2024 to 2028, the industry is expected to reach a gross production value of US$121.80 billion by 2028 (Statista, 2023). However, the sector is facing challenges such as increased demand for food traceability and the effects of climate change. To ensure sustainable and efficient agricultural practices, these challenges require innovative solutions and the adoption

of emerging technologies. The government also plays its role in these matters, where the government is encouraging the use of organic fertilizers and sustainable farming practices (Kompas, 2023). Additionally, the government launched new initiatives to adjust its subsidy policies to encourage farmers to use more organic fertilizer (Menpan, 2023). Customers' demand for ecological and organic products, particularly organic fertilizer, will probably rise as people become more aware of the benefits of organic farming to the environment and their health (Exactitude Consultancy, 2023). Nyampih's maggot farming project can benefit from these market trends. The project's target market includes farmers in West Java, particularly those in Sumedang Regency, Bandung Barat Regency, and Bandung City, and the surrounding areas. Nyampih aims to capture a market share in the poultry and organic fertilizer segments by providing high-quality, sustainable products that meet the increasing demand for environmentally friendly agricultural solutions. To measure the targeted market size, here is the TAM, SAM, and SOM analysis of Nyampih's Maggot Farming.

**Table 2.** TAM, SAM, SOM Analysis

| **Animal Feed Segment** | | | | |
|---|---|---|---|---|
| **Parameter Description** | | **Data** | | **Source** |
| **TAM** | Calculated based on the value of animal feed consumed per year in Indonesia (in million) in 2022. | Poultry | 6,480,567.05 | BPS (2023) |
| | | Fish | 782,623.40 | BPS (2023) |
| **SAM** | The value of poultry feed consumed per year focused geographically on West Java and limited to the poultry feed segment (in million) year 2022. | 1,860,715.95 | | BPS (2023) |
| | Average price of poutry feed 2022 (per kg) | 8,200.00 | | TROBOS Livestock (2023) |
| | Poultry feed consumed per year focused geographically on West Java and limited to the poultry feed segment (in kg) year 2022. | 226,916,579.27 | | Value of poultry consumed/average price. |
| **SOM** | Percentage of Poultry Population in Sumedang Regency, Bandung Barat Regency, and Bandung City from the total poultry population in West Java in 2022. | 6.7% | | BPS Jawa Barat |
| | Poultry feed consumed per year focused geographically on Sumedang Regency, Bandung Barat Regency, and Bandung City and limited to the poultry feed segment (in kg) year 2022. | 15,203,410.81 | | 6.7% of SAM |
| Organic Fertilizer Segment | | | | |

| | | | |
|---|---|---|---|
| **TAM** | Organic Fertilizer Consumption on Domestic Market and Export Market, year 2022 (ton). | 302,362.00 | Asosiasi Pengusaha Pupuk Indonesia (2023) |
| **SAM** | Percentage of individual agricultural businesses in West Java that use fertilizer from the total number of individual agricultural businesses in Indonesia that use fertilizer in 2022. | 13.70% | BPS (2023) |
| | Organic Fertilizer Consumption in West Java, year 2022 (kg) | 41,423,594.00 | Organic fertilizer consumption x 13.70% x 1000 |
| **SOM** | Percentage of individual agricultural businesses in Sumedang Regency, Bandung Barat Regency, and Bandung City that use fertilizer from the total number of individual agricultural businesses in West Java that use fertilizer in 2022. | 13.92% | BPS Jawa Barat |
| | Organic Fertilizer Consumption in Sumedang Regency, Bandung Barat Regency, and Bandung City, year 2022 (kg) | 5,766,164.28 | 13.92% of SAM |

While TAM, SAM, and SOM analyses provide valuable insights into the overall market potential for maggot products, this study primarily relies on the company's production capacity, influenced by organic waste availability, to project sales. This approach ensures a realistic assessment based on internal capabilities. The subsequent table outlines a 10-year sales projection, incorporating planned capacity expansions and product distribution percentages. These products' percentages reflect the shelf life and versatility of use of each product, ensuring they cater to a broad customer base.

Maggot flour has the highest production percentage due to its long shelf life and versatility, which allows it to be combined with other ingredients or products. Dried maggots have a higher production percentage than fresh maggots because of their longer shelf life and easier storage. Meanwhile, fresh maggots will be produced in limited quantities due to their perishability. This percentage is based on the strategic plan and may change as the company discovers a pattern in demand.

**Table 3.** Year Sales Projections

| SOM breakdown | Target Capacity (waste/day) | Percentage of SOM | Total Maggot Produced (Kg) | Fresh Maggot (10%) | Dried Maggot (35%) | Maggot Flour (55%) |
|---|---|---|---|---|---|---|
| Y1 | 2.5 quintals | 0.037% | 7,782 | 778 | 2,724 | 4,280 |
| Y2 | 3 quintals | 0.045% | 9,392 | 939 | 3,287 | 5,166 |
| Y3 | 3.5 quintals | 0.052% | 11,002 | 1,100 | 3,851 | 6,051 |

| SOM breakdown | Target Capacity (waste/day) | Percentage of SOM | Total Maggot Produced (Kg) | Fresh Maggot (10%) | Dried Maggot (35%) | Maggot Flour (55%) |
|---|---|---|---|---|---|---|
| Y4 | 4 quintals | 0.059% | 12,344 | 1,234 | 4,320 | 6,789 |
| Y5 | 4.5 quintals | 0.067% | 13,954 | 1,395 | 4,884 | 7,675 |
| Y6 | 5 quintals | 0.074% | 15,564 | 1,556 | 5,447 | 8,560 |
| Y7 | 5.5 quintals | 0.082% | 17,174 | 1,717 | 6,011 | 9,446 |
| Y8 | 6 quintals | 0.090% | 18,784 | 1,878 | 6,574 | 10,331 |
| Y9 | 6.5 quintals | 0.097% | 20,394 | 2,039 | 7,138 | 11,217 |
| Y10 | 7 quintals | 0.104% | 21,736 | 2,174 | 7,607 | 11,955 |

**Business Model Canvas**

The business model of the Nyampih maggot farming is illustrated in the Business Model Canvas below.

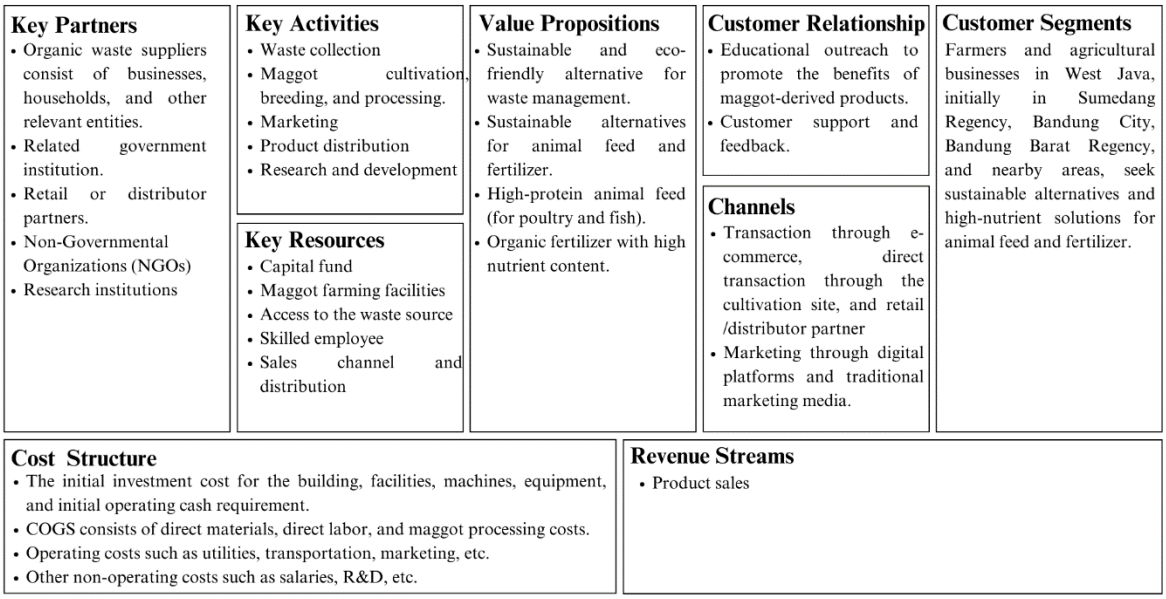


**Figure 3.** Nyampih's Maggot Farming Business Model Canvas

**External Analysis**

The external analysis below assesses the external environment of the Nyampih's Maggot Project

**PESTLE Analysis**

The following table is the PESTLE analysis of Nyampih's maggot farming, which aims to assess the politic, economy, social, technology, environment, and legal factors of the project.

**Tabel 4.** PESTLE Analysis of Nyampih's Maggot Farming Project

| Factors | Analysis |
|---|---|
| Politics | By addressing waste management challenges, Indonesia aims to achieve "Indonesia Bersih Sampah 2025" (Indonesia Free of Garbage by 2025). To support this initiative, the government has implemented strategies like JAKSTRADA (Kebijakan Strategi Daerah), a policy framework that requires regional governments to develop strategies for waste management (PPID KLHK, 2018). The Ministry of Environment and Forestry provides |

| Factors | Analysis |
|---|---|
| | technical assistance to regional governments in developing their JAKSTRADA plans. Some examples of local government initiatives for waste management, especially for maggot farming, are in Jakarta and Banyumas. According to KSBB Persampahan DKI Jakarta, the Jakarta government has implemented the Poli Inti-Plasma Model. With this partnership, the government provides breeding facilities for maggots while communities grow larvae using organic waste. The government also offers financial incentives to encourage the region's wider adoption of maggot farming. |
| Economics | Indonesia's GDP growth of 5.11% in Q1 2024 y-o-y (BPS-Statistik Indonesia, 2024). A projection by Statista (2024) shows that Indonesia's GDP is predicted to increase by 48.73 percent between 2024 and 2029, reaching 2.2 trillion U.S. dollars, marking the ninth consecutive year of growth. |
| | The Agriculture, Forestry, and Fishing industries experienced construction (-3.54%) y-o-y and slow growth compared to the previous quarter (0.01%) q-o-q (BPS-Statistik Indonesia, 2024). This indicates that there is potential for reduced organic waste generation and maggot demand from farmers. However, Indonesia is renowned for its vast and varied agricultural sector, which has long supported its economy. As reported by (Statista, 2023), Indonesia's agriculture industry is predicted to develop at a rate of 6.30% (CAGR 2024-20288) each year, with a gross production value of US$121.80 billion in 2028. |
| Social | According to a survey conducted by Illuminate Asia, which represents Iris in Indonesia, six out of ten Indonesians prioritize sustainability and environmental friendliness in product choices, but only 20% check for recyclables, and 60% have never checked (Illuminate Asia, 2021). Another survey by Standard Insight (2024), indicates that most respondents, regardless of age, are concerned about environmental issues, with the older generation showing the highest concern. Sustainable living is rated as Very Significant or Important, with older individuals valuing it the most. Those surveys reveal a positive trend regarding sustainability concerns among Indonesians, even though there is a potential lack of awareness about specific sustainable product attributes or the perceived inconvenience of actively verifying them. |
| Technology | The goal of reducing waste's negative environmental effects and improving the efficiency of waste management practices has led to the evolution of waste management technologies in recent years (Czekała et al., 2023). Modern technologies that may contribute to waste reduction and offer economic and environmental advantages include advanced software, sensor-based waste management, alternative waste transportation, etc. Elisabet et al. (2022) presented research projects demonstrating the potential of advanced technologies to address these challenges and improve maggot farming practices, involving IoT Sensors and Real-Time Monitoring, Vertical Biopond, and 3-in-1 stalls. |
| Environment | The National Waste Management Information System (SIPSN) shows that organic waste is nearly 50% of Indonesia's total waste. Bandung City also presents an extensive composition of organic waste, accounting for 40-60% (Diskominfo Bandung City, 2023). The maggot farming system can effectively reduce organic waste, thereby reducing the volume of waste (UNAIR NEWS, 2023). |
| | As stated in the research by Beesigamukama et al. (2020), sustainable use of black soldier fly frass fertilizer is expected to decrease overreliance on expensive mineral fertilizers, which can negatively impact soil and environmental health. |
| Legal | Currently, there are no regulations that directly regulate maggot farming. However, the government has established a regulation incorporating the national framework for managing household waste and waste generated from activities like households (e.g., small businesses, restaurants) through Presidential Regulation Number 97 of 2017 (PERPRES No. 97 of 2017), outlines specific policies and strategies for achieving this goal, including directions related to Jakstranas. It contains strategies, targets, and programs for |

| Factors | Analysis |
|---|---|
| | reducing waste. Regulations about waste management are also included in Minister of Environment and Forestry Regulation Number 14 of 2021 concerning Waste Management at Waste Banks, which contains regulations that support the development of waste management partnerships. |

PESTLE analysis highlights a supportive environment for Nyampih's maggot farming business in Indonesia. The government's focus on waste management, rising environmental awareness, and the potential for substantial market and technology advancement make Nyampih's project a promising solution with significant environmental and economic benefits.

**Porter's Five Forces Analysis**

This analysis delves into Porter's Five Forces framework to assess the competitive landscape and identify key factors influencing Nyampih's success. The analysis can be seen in the following table.

**Tabel 5.** Porter's Five Forces Analysis of Nyampih's Maggot Farming Project

| Force | Force factor | Degree of force |
|---|---|---|
| Bargaining Power of Buyer | Buyers are price sensitive and may choose between different feed and fertilizer options based on cost, quality, and availability. Established substitutes, such as soybean meal, fish meal, and conventional fertilizers, provide competitive alternatives, influencing buyer decisions based on cost and efficiency. | High |
| Bargaining Power of Supplier | Nyampih have a wide range of supplier options, from household waste collection, business and entities waste, and potentially partnerships with waste banks. Despite suppliers having alternatives such as composting or landfilling, supplying their waste to Nyampih holds potential for environmental benefits and cost savings in waste management. | Low |
| Threat of New Entrants | Even though the maggot farming industry in Indonesia is likely in its early stages, setting up a maggot farm does not necessitate advanced knowledge or infrastructure and a huge initial investment. It can be initiated on a small scale with basic tools and equipment, making it accessible to a wide range of potential entrants. The massive government support for maggot farming activities can also significantly lower the barriers to entry for new competitors. The increased government support can make starting a maggot farm more attractive, leading to a higher threat of new entrants shortly. | High |
| Threat of Substitute Product | Maggot products face competitive pressures from established substitutes in animal feed and fertilizer markets with well-established supply chains, widely available and acceptable, and a long history of use and trust in agricultural practices. The substitute of products includes fishmeal, soybean meal, compost, manure, etc. | High |

| Force | Force factor | Degree of force |
|---|---|---|
| Rivalry among Existing Firms | The waste management practice of organic waste treatment using Black Soldier Flies (BSF) has been widely spread, especially on a small scale (households, and local communities). However, there are relatively few established, large-scale maggot farming businesses like Nyampih. This suggests a less intense competitive environment currently. Nevertheless, the prevalence of small-scale operations indicates a growing interest in maggot farming. While not direct competitors in terms of scale, these smaller players could potentially expand and intensify competition in the future. Moreover, the high threat of new entrants and the rising awareness of the benefits of maggot farming may further contribute to heightened competition in the near future. | Moderate to High |

The Indonesian maggot farming industry presents a mixed landscape for Nyampih. While the company currently faces limited direct competition from large-scale players and have low supplier bargaining power, it must contend with significant threats from new entrants, readily available and well-established substitutes, and potentially intensifying rivalry due to the growing interest in the industry.

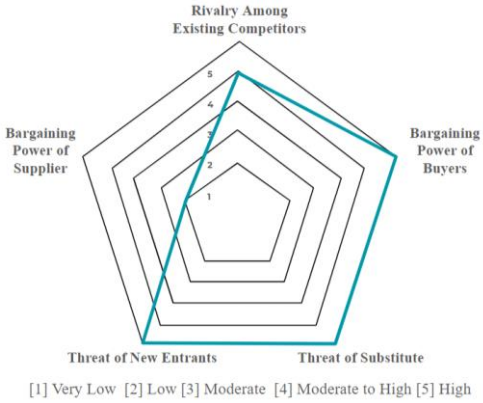


**Figure 4.** Porter's Five Forces Analysis Summary

**Internal Analysis**

**SWOT Analysis**

Below is the SWOT analysis that identifies the strengths and weaknesses along with the threats and opportunities. The SWOT analysis provides a comprehensive internal condition of the company while addressing the external conditions that were previously analyzed using PESTLE and Porter's Five Framework.

**Table 5.** SWOT Analysis of Nyampih's Maggot Farming Project

| | |
|---|---|
| **Strengths** | **S1: Circular economy and social impact value.** Nyampih's mission of addressing waste management challenges while creating social impact can attract environmentally conscious customers, partners, and investors who value their approach.<br>**S2: Strong community and individual network**, Nyampih established relationships with the local community, business incubator, and business experts that can help them to escalate and develop business with expert guidance and navigate challenges with informed decisions. |

| | |
|---|---|
| | **S3: A strong relationship with local stakeholders**, allows them to facilitate waste collection from villages, potentially providing a cost advantage, and building local support for the project. |
| **Weaknesses** | **W1: Lack of human resource experts for product research and development.** This weakness can hinder the opportunity to develop and optimize BSF maggot farming products to adapt to the rapidly evolving maggot industry and technology.<br>**W2: Limited capital**, can limit Nyampih's initiatives to invest in equipment, infrastructure, and research and development activities to upgrade their operational processes, scale up the business, and develop innovative and high-quality products.<br>**W3: Limited capacity** due to limited waste source at the beginning of the operating activities.<br>**W4: Limited Brand Recognition:** Relatively unknown brand compared to established players in animal feed and fertilizer markets. |
| **Opportunities** | **O1: Government and regulation support**. The management of waste, especially organic waste, is a major concern for the government. Many examples of government programs, including JAKSTRADA, partnerships, and financial incentives, indicate a strong likelihood of government support for maggot farming. Several waste management-related government regulations are in line with environmentally beneficial practices such as maggot farming.<br>**O2: Growing environmental awareness** presents opportunities to promote maggot as a sustainable waste management solution, a source of sustainable fertilizer, and other advantages that demonstrate maggot farming's economic circularity.<br>**O3: Advancements in waste management technologies** like IoT sensors and real-time monitoring could potentially enhance operational efficiency and optimize waste management processes. |
| **Threats** | **T1: Intense Competition.** Potential for increased competition from new entrants and existing players in the waste management, animal feed industries, and organic fertilizer industry.<br>**T2: The price sensitivity of buyers** could lead to challenges in maintaining customer loyalty due to the availability of alternative product substitute options and potential competitors offering lower prices. |

## TOWS Analysis

Given the SWOT analysis, here are the strategic actions Nyampih can take to leverage its strengths and opportunities while navigating its weaknesses and threats using the TOWS analysis. The analysis can be seen in table 6 below.

**Table 6.** TOWS Analysis of Nyampih's Maggot Farming Project

| | **Strengths** | **Weaknesses** |
|---|---|---|
| **Opportunities** | **S1, O1, O2:** Promote Nyampih's mission and the environmental benefits of maggot farming through marketing campaigns, targeting environmentally conscious customers and investors. This effort can increase sales and attract investment by highlighting the company's social impact and sustainability, leading to better financial viability.<br>**S2, O1, O2:** Use the strong community and individual network to secure grants and financial incentives to reduce capital constraints and enhance financial feasibility through government funding and support. | **W1, O1:** Partner with academic institutions and research organizations to leverage their expertise and resources for product development without significant capital outlay.<br>**W2, O1:** Actively search government funding and incentives designed specifically to help waste management and agricultural startups overcome capital constraints.<br>**W3, O3:** Gradually scale waste collection and processing capacity in alignment with advancements in waste management technologies to optimize investment.<br>**W4, O2:** Collaborate with environmental organizations or influential people to raise brand awareness and promote the advantages of maggot farming to a larger audience. |
| **Threats** | **S1, T1:** Differentiate Nyampih's products by emphasizing the circular economy | **W4, T1:** Invest in branding and marketing efforts to build brand recognition and loyalty, differentiate |

| | | |
|---|---|---|
| | model and social impact, creating a unique selling proposition, to maintain and potentially increase market share, mitigating the impact of competition on financial performance.<br>**S1, T2:** Emphasize the long-term environmental and economic benefits of maggot-based products to justify premium pricing and increase customer loyalty. | Nyampih from competitors, increase market presence and customer base, supporting revenue growth and financial stability.<br>**W2, W3, T2, T1**: Seek additional investment from investors who are interested in sustainable agriculture and waste management. Additional capital can be used to expand operational capacity, invest in advanced technologies, and develop cost-effective production techniques. This will help Nyampih compete effectively with other players and manage price sensitivity by offering high-quality products at competitive prices. |

Nyampih should implement a comprehensive strategy to enhance its financial viability and sustainability. By promoting its mission and environmental benefits, Nyampih can collaborate with government, investors, and relevant institutions to secure grants, incentives, and additional capital. This collaboration will enable the company to scale up operations and optimize production processes. Emphasizing the long-term benefits of maggot-based products and investing in branding and marketing will help build customer loyalty and support revenue growth. Through these strategic efforts, Nyampih can achieve financial stability and expand its market presence.

**Capital Budgeting Cash Flow Constructions**

**Initial Investment and Operating Expenditure**

At this stage, the initial investment required to start the project will be calculated. This initial investment encompasses capital expenditure (CAPEX), it includes the initial investment in assets such as land, buildings, equipment, and machinery. The initial investment also includes the initial cash balance to finance the beginning of the operating expenditure. Operating Expenditure (OPEX), on the other hand, consists of the cost of goods sold (COGS), operating expenses, and depreciation.

**Capital Expenditure**

The capital expenditure of the project consists of fixed asset investments as shown below.

**Table 7.** Capital Expenditure of Nyampih's Maggot Farming Project

| No | Item | Quantity & Capacity | Value |
|---|---|---|---|
| Land, Building, and Facilities | | | |
| 1 | Land | $800 m^2$ | IDR 180,000,000.00 |
| 2 | Building | 1 | IDR 40,000,000.00 |
| 3 | Biopond | 3 | IDR 3,000,000.00 |
| 4 | Containers | 30 | IDR 2,850,000.00 |
| 5 | Container Rack | 3 | IDR 4,800,000.00 |
| Machinery | | | |
| 6 | Organic Waste Chopping Machine | 1, 75kg/hour | IDR 4,000,000.00 |
| 7 | Drying Machine | 1, 30kg/hour | IDR 18,000,000.00 |
| 8 | Grinding Machine | 1,60kg/hour | IDR 2,000,000.00 |
| 9 | Sorting Machine | 1, 850kg/hour | IDR 18,500,000.00 |
| Equipment | | | |
| 10 | Hoes | 5 | IDR 375,000.00 |
| 11 | Small Shovels | 25 | IDR 625,000.00 |

| No | Item | Quantity & Capacity | Value |
|---|---|---|---|
| 12 | Large Shovels | 10 | IDR 1,200,000.00 |
| 13 | Digital Scales | 3 | IDR 750,000.00 |
| 14 | Large Scales | 2 | IDR 1,600,000.00 |
| 15 | Buckets | 30 | IDR 750,000.00 |
| 16 | Thermometer Hygrometer | 1 | IDR 125,000.00 |
| **Total Capital Expenditure** | | | **IDR 278,575,000.00** |

**Operating Expenditure**

The operating expenditure consists of the cost of goods sold, depreciation expense, and operating expense as shown below.

**Cost of Goods Sold**

Below are the details of the COGS component of the project.

**Table 8.** Cost of Goods Sold Component

| Item | Assumption | Number and Growth Rate |
|---|---|---|
| **Fixed Cost** | | |
| Direct Labor | The production team consists of one production officer with a salary of IDR 3,000,000.00 per month during the first year of operation, continuing through the fifth year. As the production capacity increases, the number of production officers will double to two persons for the period from year 5 to year 10. | The annual cost will be IDR 36,000,000.00 in the first year, increasing annually in line with the UMP growth and the addition of the second production officer. |
| **Variable Cost** | | |
| **Raw Materials** | | |
| Maggot Egg | Price estimation of maggot egg. | The cost is IDR 3,000 per gram, increasing annually with inflation. One gram of maggot eggs will become 3 kg of maggots. |
| Organic Waste Cost | Organic waste price estimation from waste suppliers (households, businesses, entities, etc). | The cost is estimated at IDR 500 per kg, increasing annually with inflation. Each kilogram of maggots requires up to 4 kg of organic waste during development. |
| Packaging | Price estimation of packaging. | The cost is IDR 800 per piece, with each piece used to package 1 kg of maggots. This cost will increase annually with inflation. |
| **Processing Cost** | | |
| Chopping cost/hour | Current market data of electricity cost per Kwh. | The current cost of electricity is IDR 1,444.2 per Kwh.The machine will use a power consumption of 75 watts. Hence, the machine cost per hour is IDR 1,083.53 and the production capacity of the machine is 75 kg/hour. |
| Strainer cost/hour | Current market data of electricity cost per Kwh. | The machine consumes 75 watts of power, resulting in an hourly cost of IDR 1,083.53 at the current electricity |

| Item | Assumption | Number and Growth Rate |
|---|---|---|
| | | rate of IDR 1,444.2 per kWh. The machine has a production capacity of 850 kg per hour. |
| **Additional Processing Cost for Dried Maggot and Maggot Flour** | | |
| Drying cost/hour | Current market data regarding LPG cost. A 5 kg LPG cylinder lasts for 8 hours. | The cost is IDR 11,250.00 per hour, with a production capacity of 30 kg per hour. This cost will increase with inflation. |
| Grinding Cost/hour | Current market data of electricity cost per Kwh. | The cost is IDR 1,083.53 per hour, with a production capacity of 55 kg per hour and a power consumption of 75 watts. This cost will increase with inflation. |

**Depreciation Expenses**

Below are the details of fixed assets that will be depreciated. The yearly depreciation expenses can be found in the appendix.

**Table 9.** Depreciation

| Item | Value | Lifespan (Years) | Salvage Value | Depreciation Method |
|---|---|---|---|---|
| Building | IDR 40,000,000.00 | 10 | 20% | Straight Line |
| Farming Facilities | IDR 10,650,000.00 | 10 | 5% | Double Declining Balance |
| Machine | IDR 42,500,000.00 | 10 | 10% | Double Declining Balance |
| Equipment | IDR 5,425,000.00 | 5 | 0% | Double Declining Balance |

**Operating Expenses**

Below are the details of operating expenses of the project.

**Table 10.** Operating Expense

| | Annual Expense at Year-1 | Assumption | Annual Growth |
|---|---|---|---|
| Marketing Expense | IDR 36,000,000.00 | Determined based on the company financial plan adjusted with the new marketing strategy plan. These costs consist of online advertising, social media content creation, traditional advertising, partnership costs, and any marketing-related costs. | Increase annually as the percentage of annual sales growth. |
| Utilities expense | IDR 18,000,000.00 | Determined based on the company financial plan adjusted with the new capacity plan. These cost, including electricity, water, and telecommunication costs. | Increase annually with the inflation rate. |
| Transportation Cost | IDR 27,375,000.00 | Determined based the company financial plan adjusted with the new capacity plan. These costs consist of the estimation of transportation costs for organic waste pickup. | Increase annually with the inflation rate and the organic waste capacity increase growth rate. |
| Salaries | IDR 126,000,000.00 | The company will employ 3 personnel, consisting of a marketing and salesperson, an operations person, and a treasury and administrative person, each with a salary of IDR 3,500,000. | Increase with the average UMP growth of Sumedang City. |
| Research and | IDR 24,000,000.00 | The RnD expense will occur during the | Increase |

| | Annual Expense at Year-1 | Assumption | Annual Growth |
|---|---|---|---|
| Development | | fifth-year projection period. This strategy is due to the strategic timing and focus of the company. RnD activities will occur as the company has improved its economic scale and financial condition, allowing them to expand into R&D activities. | annually as the percentage of annual sales growth. |
| Tax Rate | 0.5% annually, according to Government Regulation of The Republic of Indonesia Number 55 Of 2022 Concerning Adjustments to Arrangements in The Field Of Income Tax. | | |

**Initial Investment Calculation**

Below is the calculation of the initial investment needed to implement the project.

**Table 11**. Initial Investment

| Item | | Value |
|---|---|---|
| COGS | The initial cash balance is allocated to cover the cost of goods sold (COGS) and operating expenses for the first 12 months of business operations. The initial balance covering 12 months of operations is necessary to ensure the business's stability and success during its formative stages. Given the novelty of the product and the need to establish a strong market presence, sales are anticipated to exhibit some volatility during the initial period. Securing a 12-month coverage period provides the business with a solid foundation for building a sustainable operation. | IDR 123,457,372.05 |
| Operating expense | | IDR 207,375,000.00 |
| **Operating expenditure** | | **IDR 330,832,372.05** |
| **Capital expenditure** | | **IDR 278,575,000.00** |
| **Total initial investment requirement** | | **IDR 609,407,372.05** |

Therefore, the company requires IDR 609,407,372.05 to initiate the project.

**Financing Plan**

This maggot farming project will be entirely funded through equity financing, meaning that the required capital will come from the owner's investment and potentially other equity investors.

**Weighted Cost of Capital Calculation**

Since the project will be financed solely through equity, the weighted average cost of capital (WACC) calculation will only account for the cost of equity, or the cost of common stock. To calculate the cost of common stock, the Capital Asset Pricing Model (CAPM) approach will be used, as detailed below.

**Table 12.** Cost of Capital Calculation

| Capital Asset Pricing Model | | |
|---|---|---|
| Levered Beta | Levered beta from leading companies in the Indonesian animal feed and organic fertilizer markets: PT Japfa Indonesia Tbk, PT Charoen Pokphand Tbk, PT Malindo Feedmil Tbk, PT Saraswati Anugerah Makmur Tbk, and PT Indo Acidatama Tbk. | 0.76 |

| **Capital Asset Pricing Model** | | |
|---|---|---|
| Debt to Equity Ratio | Benchmark data from leading companies in the Indonesian animal feed and organic fertilizer markets: PT Japfa Indonesia Tbk, PT Charoen Pokphand Tbk, PT Malindo Feedmil Tbk, PT Saraswati Anugerah Makmur Tbk, and PT Indo Acidatama Tbk. | 60.23% |
| **Cost of Equity Calculation** | | |
| Unlevered Beta | Unlevered beta of companies' benchmark, calculated using formula:<br>Levered beta/ (1-Tax rate) x D/E ratio | 0.52 |
| Project Debt to Equity Ratio | The project will only finance by equity financing | - |
| Levered Beta | Unlevered beta/ (1-Tax rate) x D/E ratio | 0.52 |
| Risk-Free Rate | IBPA 10 Years Government Bond Yield | 7.26% |
| Risk Premium | Damodaran Cost of Equity for Indonesia | 7.38% |
| **Cost of Equity** | Risk free rate + (Levered beta x Risk Premium) | **11.06%** |

**Sales Projections**

The table below shows the revenue projections for year 1 to year 10, taken from the TAM SAM SOM analysis along with product and pricing strategy from 4Ps Marketing Analysis. The product price increases as much as the percentage of the inflation rate.

**Table 13.** Yearly Sales Projections

| **Y1** | **Y2** | **Y3** | **Y4** | **Y5** |
|---|---|---|---|---|
| IDR 406,602,447.54 | IDR 510,447,920.17 | IDR 621,983,200.29 | IDR 725,878,667.26 | IDR 853,534,241.92 |
| **Y6** | **Y7** | **Y8** | **Y9** | **Y10** |
| IDR 990,277,706.78 | IDR 1,136,633,328.47 | IDR 1,293,152,834.12 | IDR 1,460,416,771.77 | IDR 1,619,047,692.68 |

**Capital Budgeting Cash Flow**

Aside from the previous data regarding the initial investment, cost of capital, and sales projection, the additional general assumption will be employed for the capital budgeting cashflow as follows.

**Table 14.** General Assumption

| **Item** | **Number** | **Source** |
|---|---|---|
| Inflation rate | 4.02% | Average inflation growth rate from Jan 2013- June 2024. |
| UMP growth of Sumedang Regency | 5.60% | Average UMP growth of Sumedang Regency from 2016 - 2024. |
| Terminal growth rate | 0.43% | Average GDP contribution growth of the agriculture sector in Indonesia from 2010-2023. The average GDP contribution growth of the agriculture sector in Indonesia was chosen as a benchmark for the terminal growth rate because it reflects the long-term agriculture industry trend. |
| Terminal cash flow calculation | The terminal cash flow will be calculated using the perpetual growth method, with the formula: $CF_n$ x (1 - g)/ (WACC - g). Where $CF_n$ is the cash flow in the final year of the explicit forecast period, g is refer to the terminal growth rate, the rate at which the company is expected to grow indefinitely. And WACC is the Weighted Average Cost of Capital. | |

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net Sales | - | 406,602,447.54 | 510,447,920.17 | 621,983,200.29 | 725,878,667.26 | 853,534,241.92 | 990,277,706.78 | 1,136,633,328.47 | 1,293,152,834.12 | 1,460,416,771.77 | 1,619,047,692.68 |
| Cost of Goods Sold | - | 123,465,453.94 | 150,199,431.35 | 176,844,361.12 | 201,930,712.17 | 277,132,628.25 | 312,207,129.79 | 349,676,906.06 | 389,679,170.78 | 432,358,373.43 | 473,472,674.45 |
| **Gross Profit** | **-** | **283,136,993.60** | **360,248,488.82** | **445,138,839.17** | **523,947,955.09** | **576,401,613.67** | **678,070,576.99** | **786,956,422.42** | **903,473,663.34** | **1,028,058,398.34** | **1,145,575,018.23** |
| Marketing expense | - | 36,000,000.00 | 45,194,329.84 | 55,069,504.24 | 64,268,260.51 | 75,570,702.77 | 87,677,773.85 | 100,635,891.57 | 114,493,905.07 | 129,303,215.22 | 143,348,170.40 |
| Utilities expense | - | 18,000,000.00 | 18,723,365.22 | 19,475,800.28 | 20,258,473.42 | 21,072,599.81 | 21,919,443.46 | 22,800,319.18 | 23,716,594.62 | 24,669,692.38 | 25,661,092.23 |
| Transportation Cost | - | 27,375,000.00 | 34,138,911.04 | 41,363,234.72 | 48,069,794.15 | 56,271,546.03 | 65,025,798.90 | 74,365,794.64 | 84,326,122.84 | 94,942,886.46 | 105,004,594.64 |
| Research and Development | - | - | - | - | - | - | 24,000,000.00 | 27,547,020.09 | 31,340,368.27 | 35,394,114.48 | 39,238,634.13 |
| Salaries | - | 126,000,000.00 | 133,055,324.00 | 138,402,412.52 | 143,964,384.25 | 149,749,874.70 | 199,666,499.60 | 207,690,488.54 | 216,036,937.18 | 224,718,804.18 | 233,749,568.99 |
| Depreciation Expense | - | 13,976,833.33 | 11,347,368.33 | 9,386,011.68 | 7,895,389.40 | 7,166,195.20 | 7,845,043.96 | 6,332,480.54 | 5,284,479.08 | 4,540,779.73 | 4,000,571.39 |
| **Total Operating Cost** | **-** | 221,351,833.33 | 242,459,298.42 | 263,696,963.45 | 284,456,301.73 | 309,830,918.51 | 406,134,559.78 | 439,371,994.57 | 475,198,407.05 | 513,569,492.44 | 551,002,631.78 |
| **Total Operating Profit** | **-** | **61,785,160.27** | **117,789,190.40** | **181,441,875.72** | **239,491,653.36** | **266,570,695.16** | **271,936,017.21** | **347,584,427.85** | **428,275,256.29** | **514,488,905.90** | **594,572,386.44** |
| Interest Expenses | - | - | - | - | - | - | - | - | - | - | - |
| Tax Expenses | - | 308,925.80 | 588,945.95 | 907,209.38 | 1,197,458.27 | 1,332,853.48 | 1,359,680.09 | 1,737,922.14 | 2,141,376.28 | 2,572,444.53 | 2,972,861.93 |
| **Net Profit** | **-** | **61,476,234.47** | **117,200,244.44** | **180,534,666.35** | **238,294,195.09** | **265,237,841.68** | **270,576,337.13** | **345,846,505.71** | **426,133,880.01** | **511,916,461.37** | **591,599,524.51** |

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Earnings Before Interest and Taxes (EBIT) | - | 61,785,160.27 | 117,789,190.40 | 181,441,875.72 | 239,491,653.36 | 266,570,695.16 | 271,936,017.21 | 347,584,427.85 | 428,275,256.29 | 514,488,905.90 | 594,572,386.44 |
| Tax of EBIT | - | 308,925.80 | 588,945.95 | 907,209.38 | 1,197,458.27 | 1,332,853.48 | 1,359,680.09 | 1,737,922.14 | 2,141,376.28 | 2,572,444.53 | 2,972,861.93 |
| **Net Operating Profit After Tax** | **-** | **61,476,234.47** | **117,200,244.44** | **180,534,666.35** | **238,294,195.09** | **265,237,841.68** | **270,576,337.13** | **345,846,505.71** | **426,133,880.01** | **511,916,461.37** | **591,599,524.51** |
| Depreciation | - | 13,976,833.33 | 11,347,368.33 | 9,386,011.68 | 7,895,389.40 | 7,166,195.20 | 7,845,043.96 | 6,332,480.54 | 5,284,479.08 | 4,540,779.73 | 4,000,571.39 |
| **Operating Cash Flow** | **-** | **75,453,067.80** | **128,547,612.78** | **189,920,678.03** | **246,189,584.49** | **272,404,036.88** | **278,421,381.08** | **352,178,986.25** | **431,418,359.09** | **516,457,241.10** | **595,600,095.90** |
| Investment in Land | 180,000,000.00 | - | - | - | - | - | - | - | - | - | - |
| Investment in Building | 40,000,000.00 | - | - | - | - | - | - | - | - | - | - |
| Investment in Cultivation Facilities | 10,650,000.00 | - | - | - | - | - | - | - | - | - | - |
| Investment in Machinery | 42,500,000.00 | - | - | - | - | - | - | - | - | - | - |
| Investment in Equipment | 5,425,000.00 | - | - | - | - | 5,425,000.00 | - | - | - | - | - |
| Operational Expenditure | 330,832,372.05 | - | - | - | - | - | - | - | - | - | - |
| **Free Cash Flow to the Firm** | **(609,407,372.05)** | **75,453,067.80** | **128,547,612.78** | **189,920,678.03** | **246,189,584.49** | **266,979,036.88** | **278,421,381.08** | **352,178,986.25** | **431,418,359.09** | **516,457,241.10** | **595,600,095.90** |
| **Terminal Cash Flow** | | | | | | | | | | | **5,626,115,238.45** |
| **Total Cash Flow** | **(609,407,372.05)** | **75,453,067.80** | **128,547,612.78** | **189,920,678.03** | **246,189,584.49** | **266,979,036.88** | **278,421,381.08** | **352,178,986.25** | **431,418,359.09** | **516,457,241.10** | **6,221,715,334.34** |

The following figures present the income statement and capital budgeting cash flows.

**Figure 5.** Income Statement

**Figure 6**. Capital Budgeting Cash Flow

### Capital Budgeting Analysis

Based on the financial projections and the cost of capital calculations, below is the capital budgeting analysis result of Nyampih's Maggot Farming.

**Table 15.** Capital Budgeting Analysis

| Metrics | Result | Decision Criteria | Decision |
|---|---|---|---|
| Net Present Value | IDR 2,905,018,264.74 | NPV > 0 | Accepted |
| IRR | 41.20% | IRR > WACC | Accepted |
| Payback Period | 3.88 | Payback period less than 5 year | Accepted |
| Discounted Payback Period | 4.87 | Payback period less than 5 year | Accepted |
| Profitability Index | 5.77 | PI > 1 | Accepted |

The analysis shows that the maggot farming project is financially feasible as it fullfill all the criteria, wich are:

1. Internal Rate of Return

   An IRR of 41.20% is significantly higher than the weighted average cost of capital (WACC), indicating that the project is expected to generate returns well above the cost of financing.

2. Net present value

   The substantial positive NPV of IDR 2,905,018,264.74 indicates that the project will generate significant value more than the initial investment and capital costs.

3. Payback period.

Both the payback period and the discounted payback period indicate that the initial investment cost will be recovered in less than five years. This is a positive indicator of the project's ability to generate returns faster than intended.

4. Profitability Index

   A Profitability Index (PI) of 5.77 indicates that for every rupiah invested, the project is expected to return IDR 5.77 in terms of present value.

**Capital Budgeting Risk Analysis**

While the financial feasibility analysis provides a positive outlook for the maggot farming project, it is important to note that these projections are based on certain assumptions about future market conditions, costs, and operational efficiency. A risk analysis is required to gain a more in-depth understanding of the project's vulnerabilities and financial variability. Hence this section will incorporate sensitivity analysis to assess the financial risk of the maggot farming project investment.

**Sensitivity Analysis**

This risk analysis will employ sensitivity analysis to examine how changes in key input variables can affect the project's Net Present Value (NPV). This analysis will consider two scenarios: a 5% change and a 10% change in each key variable. The key variables included in this analysis are the quantity sold and price of each product, operating costs, cost of goods sold (COGS), inflation rate, and salary growth rate.

**Table 16.** Sensitivity Analysis

| Input Variable | 5% Change in Input Variable | | 10% Change in Input Variable | |
|---|---|---|---|---|
| | **Change to NPV when Input Variable change +5%** | **Change to NPV when Input Variable change -5%** | **Change to NPV when Input Variable change +10%** | **Change to NPV when Input Variable change -10%** |
| Salary Growth Rate | -0.61% | 0.60% | -1.23% | 1.20% |
| Quantity Sold of Fresh Maggot | 1.14% | -2.18% | 2.27% | -3.31% |
| Price for Fresh Maggot | 1.14% | -2.18% | 2.27% | -3.31% |
| Inflation Rate | 1.99% | -1.96% | 4.00% | -3.90% |
| Quantity Sold of Dried Maggot | 5.11% | -6.16% | 10.23% | -11.27% |
| Price for Dried Maggot | 5.11% | -6.16% | 10.23% | -11.27% |
| COGS | -6.17% | 5.11% | -12.61% | 12.61% |
| Operating Cost | -6.30% | 6.30% | -12.61% | 12.61% |
| Price for Maggot Flour | 10.72% | -11.76% | 21.43% | -23.51% |
| Quantity Sold of Maggot Flour | 10.72% | -11.76% | 21.43% | -23.51% |

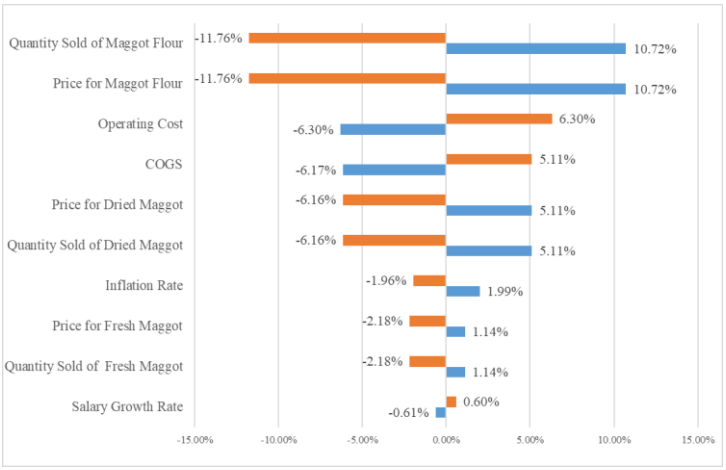


**Figure 7.** Tornado Chart of the Sensitivity Analysis with the 5% Change in Input Variable

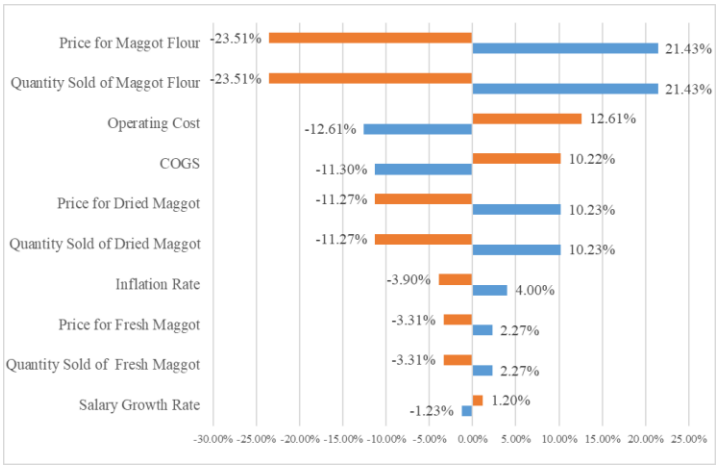


**Figure 8.** Tornado Chart of the Sensitivity Analysis with the 10% Change in Input Variable

The sensitivity analysis reveals key insights into the financial risk profile of the maggot farming project, which are:

1. Quantity Sold and Price of the Maggot Flour
   Changes in the quantity sold and price of maggot flour significantly impact the Net Present Value (NPV) of the project. A 10% decrease in sales volume can lead to an NPV reduction of over 20%, and vice versa. Even smaller changes, such as 5%, result in notable differences in NPV, suggesting that this product has the most significant influence on the project's financial performance. The high volume and high price of maggot flour compared to other products likely contribute to its substantial impact on NPV.
2. Operating Costs and COGS
   Changes in operating costs and costs of goods sold (COGS) also affect NPV, with a 10% change resulting in a larger NPV impact than a 5% change. This non-proportional relationship emphasizes the need for diligent cost management and efficiency to maintain profitability.
3. Quantity Sold and Price of the Dried Maggot

Dried maggot sales volume and price also significantly influence NPV, where the percentage change in key input variable is greater than the change in the NPV.

4. Inflation
   The analysis suggests that moderate inflation could benefit the project. This is likely because the increase in product prices may outpace the increase in costs, leading to higher revenue and profitability.
5. Quantity Sold and Price of the Fresh Maggot
   Fresh maggot demonstrates the least sensitivity to changes in sales volume and price. This is likely due to its lower production volume and price compared to other products. While not a primary driver of financial risk, maintaining consistent demand for fresh maggots remains important for overall profitability.
6. Salary Growth Rate
   The project seems relatively insensitive to changes in the salary growth rate, indicating that labor costs are not a major driver of financial risk.
   The project's financial success is heavily influenced by the proportion of product sales and their respective pricing strategies, with maggot flour being the most influential factor. This highlights the need for ongoing monitoring of market trends and demand for each product, adjusting product mix and pricing strategies to align with real-time market conditions. Deviations from initial sales volume assumptions could significantly impact the project's financial outcomes. Operating costs and the cost of goods sold (COGS) also play a significant role in determining profitability. If sales volumes or product mix change unexpectedly, adjustments to the cost structure may be necessary to maintain financial viability. Therefore, a flexible and responsive approach to cost management will be crucial for the project's long-term success.
   In conclusion, this analysis emphasizes the importance of adapting strategies in response to market fluctuations. By staying connected to market trends, adjusting product offerings, optimizing pricing, and maintaining consistent cost controls, the project can navigate potential risks and maximize its chances of achieving its financial objectives.

## CONCLUSION AND RECOMMENDATION

This study evaluates the financial feasibility of a maggot farming project undertaken by Nyampih, a waste-management startup based in Sumedang, West Java. Nyampih aims to produce maggot flour, dried maggot, and fresh maggot, targeting farmers in West Java, particularly those in Bandung City, Bandung Barat Regency, Sumedang Regency, and surrounding areas. The products serve as animal feed and organic fertilizer. Based on the financial feasibility and risk analysis, the study concludes the following:

1. The financial feasibility analysis demonstrates that the project is feasible and potentially profitable. Key financial metrics include a net present value (NPV) of IDR 2,905,018,264.74, an internal rate of return (IRR) of 41.20%, a payback period of 3.88 years, a discounted payback period of 4.87 years, and a profitability index of 5.77.
2. Despite the positive financial outlook, the project carries a financial risk, especially related to the quantity sold and pricing of maggot flour, which is projected to have the highest sales volume and price. Additionally, operating costs, cost of goods sold (COGS), and the sales and pricing of dried maggot show

sensitivity to NPV fluctuations. This highlights the importance of continuous monitoring and adjustment of product proportions, pricing strategies, and cost structures to align with real-time market conditions.

In conclusion, the Nyampih maggot farming project is financially feasible. While there are risks, proactive management of product mix, pricing, and costs, coupled with ongoing market assessment, can contribute significantly to the project's success

**Recommendation**

From the study, here are the recommendation for the company:

1. Based on the financial feasibility study, the Nyampih maggot farming project is financially feasible, and its implementation is recommended.
2. However, to ensure the project's success and mitigate potential financial risks, the following strategic actions are recommended:
   a. Prioritizing production and marketing effort for a product that has high contribution to the NPV, which in this case, is the maggot Flour. This could involve expanding production capacity and developing targeted marketing campaigns for this product.
   b. Continuously monitor market trends and customer preferences, as deviations from the projected sales mix could significantly impact financial outcomes. Regular assessment and adjustments to pricing and cost structures are crucial to maintain and optimize the company's financial performance.
   c. Develop a detailed risk management plan that has not been added in this study, such as supply chain disruptions, price volatility, and regulatory changes. This plan should include contingency measures, insurance coverage, and financial reserves to mitigate risks and ensure business continuity.

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