

## ECO-FRIENDLY OPPORTUNITIES AND STRATEGIES OF THE BLACK SOLDIER FLY MAGGOT BUSINESS IN PARIAMAN, WEST SUMATERA

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### Abstract

**Background:** Food Loss and Food Waste (FLW) may have a significant impact on the global economy, environment, and food security. However, this problem also presents a business opportunity through the production and processing of Black Soldier Fly (BSF) maggots that utilize organic waste.

**Purpose:** This paper aims to create a business model with Bank Sampah Sahabat Alam (BSSA) serving as the primary unit of analysis, formulate strategies, and prioritize strategies of the BSF maggot business in Pariaman, West Sumatera, to seize opportunities and use local resources.

**Design/methodology/approach:** The data were analyzed using Business Model Canvas (BMC), Internal-External (IE), and SWOT matrices to formulate strategies, and Quantitative Strategic Planning Matrix (QSPM) to prioritize strategies.

**Findings/Result:** The results demonstrate that the BSF maggot business is in a growth position, with intensive and integrative strategies recommended. The QSPM suggests prioritizing the political support of the Mayor of Pariaman for the development of this business, support from local governments plays a crucial role in determining business success by influencing policy formulation and resource allocation, which is critical to ensuring effective business planning and driving sustainable growth. Modified the BMC of the BSF maggot business in Pariaman with improvements in all BMC segments to support more effective strategy execution.

**Conclusion:** Strategy formulation through the SWOT Matrix resulted in 10 alternative strategies classified into intensive and integrative strategies from the IE matrix results. Strategy priorities for the BSF maggot business in Pariaman have been determined through QSPM analysis. The implementation of these strategies brings an update to the BMC, which provides a comprehensive guide for business development and optimization in a sustainable and eco-friendly manner.

**Originality/value (State of the art):** This paper makes a new contribution in the application of strategies generated from a combination of internal and external environmental analysis, including VRIO, Porter's Five Forces, PESTEL, as well as Internal-External (IE) and SWOT matrices, into Business Model Canvas (BMC) elements for the BSF maggot business. This holistic approach provides a more comprehensive strategic guide to deal with the sustainable business dynamics in this sector.

**Keywords:** BSF maggot business, business strategies, business model canvas, food waste, opportunities

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## INTRODUCTION

Food Loss and Food Waste (FLW) is a challenging problem because it impacts the economy, environment, and food security nationally, regionally, and globally (Abiad, 2018). According to FAO (2014), FLW can cause losses of USD 936 billion. The Ministry of Environment and Forestry (KLHK) acknowledges that in 2020 the total national waste production reached 67.8 million tons. This means that there are around 185,753 tons of waste produced every day by 270 million people or each resident produces about 0.68 kg of waste per day. This figure has increased compared to previous years. In 2018, national waste production reached 64 million tons from 267 million people. The waste ultimately contributes greatly to the increase in landfills. Food waste is the type of waste with the largest proportion in landfills with a percentage of 41% compared to other types of waste seen from data from the Ministry of Environment and Forestry in 2022, this is a problem as well as an opportunity for businesses with food waste input.

West Sumatera Environment Department (2022) explained that the composition of waste is obtained from organic waste and can create impacts on the economy, society, environment, and health. Furthermore, according to BPS (2022), in 2020 it had a waste pile of 2,593.71 tons/day and in 2021 it had a waste pile of 2,077.17 tons/day. According to this data, it can be seen that there is a reduction in waste generation through the implementation of good methods. For example, Pariaman City has a program to reduce waste generation through BSF maggot culture (Nurdi et al. 2023). The impact of maggot culture on reducing waste generation is quite large because maggots can reduce the volume of organic waste by >50% (Pasymi, 2022).

Maggot BSF is one of the caterpillars (larvae) from the metamorphosis of the black soldier fly which is an environmentally friendly agricultural technology innovation (Rini & Wahidah. 2024). Maggot BSF plays a role as a bio-converter of waste processing and organic waste including food waste (Surendra et al. 2020). Maggot BSF has the ability to break down organic waste better than other insects (Raksasar et al. 2020). The existence of BSF maggot as a waste decomposer can reduce the amount of organic waste

released by households and markets (Agustin et al. 2023) so that it can reduce the impact of environmental pollution and has economic value to be developed into a business (Khalid et al. 2022), especially in the West Sumatera region. The novelty of BSF maggot lies in its role as an organic waste management solution and economic potential. BSF maggots have the ability to decompose organic waste quickly and efficiently, converting it into useful biomass (Sari et al. 2023). In addition, BSF maggots can be processed into a high protein source for animal feed, thus creating new economic opportunities for the community (Goca et al. 2023). The application of this technology can provide sustainable waste management solutions and create economic opportunities.

The maggot business opportunity in Pariaman City is very potential considering that there is only one active maggot farmer left, namely Bank Sampah Sahabat Alam (BSSA), while market demand for maggot products remains high, especially from the broiler farming sector. Based on data from the Central Bureau of Statistics (BPS) of Pariaman City, in 2022 there were 979,500 broilers which became a potential market for maggot products. In addition, the abundant availability of raw materials, with 79.71% of the total 39.79 tons of daily waste in the city being organic waste, provides a strong foundation for the development of a large-scale maggot business. The combination of low competition, high demand, and abundant raw materials creates promising opportunities for the growth and development of new maggot businesses in Pariaman. These conditions indicate significant market potential that has not been fully utilized for the development of BSF maggot production and processing businesses. Therefore, there is a need for strategic efforts to establish large-scale maggot production and processing businesses in order to optimize market opportunities and utilize available local resources.

This paper aims to (1) create a business model for the production and processing of BSF maggot in Pariaman, (2) formulate alternative business strategies recommended to be applied to the production and processing of BSF maggot in Pariaman, (3) to prioritize business strategies in the production and processing of BSF maggot in Pariaman.

## METHODS

The research locations included several areas relevant to the research objectives. The main research was conducted in Pariaman City, with supporting locations in Padang City (MinaGot Sumbar), Tangerang City (PT. Magalarva), and Jakarta City (KLHK and BARANTIN). The selection of these locations is based on a variety of characteristics that can provide a more comprehensive insight into the production and processing of black soldier fly (BSF) maggot. The data were gathered from February to August 2024.

The data source used in this research is primary data. This primary data was collected by in-depth interview method using questionnaires to respondents. The interview method helps to gain insights into BSF maggot production practices, processing, and challenges and opportunities (DiGiacomo, 2023). Respondents in this study were selected based on their expertise, knowledge, experience, capabilities, and insights in accordance with the functions/positions of the companies/agencies in the business environment of the black soldier fly maggot production and processing business in Pariaman, consisting of 3 (three) internal respondents and 3 (three) external respondents. The data used to understand the external environment was sourced from the Central Statistics Agency (BPS); the Office of Trade, Cooperatives, and SMEs of Pariaman City; Pariaman City Government, West Sumatera Environment Agency; and other relevant agencies.

The data were analyzed with the following steps outlined by David (2011): (1) input stage, (2) matching stage, and (3) decision stage. Research by Dzulfikar et al. (2022) conducted data processing through BMC, IFE/EFE, IE, SWOT, and QSPM analysis. In the input stage, Business Model Canvas (BMC) analysis is carried out to map the business model. IFE matrix to evaluate internal factors by combining the strengths and weaknesses of BMC and VRIO, and EFE matrix to evaluate external factors by combining opportunities and threats of BMC, Porter's Five Forces, and PESTEL. After identifying eight key factors from internal and external aspects through rating calculations, the evaluation proceeds by assigning weights to each factor. These weights are derived by summing respondents' answers for each factor and dividing them by the total responses for all external factors. Subsequently, the weighted score is calculated by multiplying the weight with the rating for each factor, and the total score is

computed using the following formula (David & David, 2014):

$$\text{Score IFE/IFE total} = \sum(\text{weight} \times \text{rating})$$

The BSF maggot business not only produces fresh and dried maggots but also various value-added derivative products. The production process requires specialized technology, efficient waste management, and high capital investment and expertise, creating significant barriers to competitors and strengthening competitive advantage. In the matching stage, alternative strategies are formulated through two stages. First, the key factors that have been identified are entered into the IE Matrix to determine the position of the BSF Maggot business in Pariaman, which helps in strategic analysis (Roechan, 2024). Second, alternative business strategies are formulated using SWOT analysis, which can identify external opportunities and threats and consider strengths and weaknesses in maggot production (Ningsih et al. 2024).

At the decision stage, strategy prioritization is determined using QSPM, which facilitates the simultaneous assessment of alternative strategies by considering internal and external factors (Li et al. 2023). QSPM calculations are performed by multiplying the weights of relevant factors by the strategy attractiveness scores and then summing the results to determine the strategy priorities. Once strategy prioritization is determined, strategy alternatives are integrated into the BMC to improve business effectiveness, as suggested by Gonzalez and Brown (2023).

The research framework for this study can be seen in Figure 1. Includes an evaluation of the production and processing maggot business model with the BMC, followed by an analysis of the business environment using VRIO, Porter's Five Forces, and PESTEL. The analysis results were classified in IFE and EFE matrices to identify strengths, weaknesses, opportunities, and threats. Strategies were formulated through a combination of the results of the IE matrix and SWOT matrix and optimized with the QSPM. Finally, the resulting strategies were incorporated into an updated BMC and verified through discussions with respondents to improve the business components of the BSF maggot enterprise in Pariaman. Therefore, the use of BMC and business environment analysis in this study is expected to generate effective strategies to improve the sustainability of BSF maggot

cultivation and processing businesses in Pariaman. A systematic approach in evaluating business models and environmental factors is expected to support the development of optimal strategies, minimize risks, and create added value for the local agricultural industry through the utilization of BSF maggot as an efficient and environmentally friendly source of animal feed.

## RESULTS

### Input Stage

*First*, in analyzing the BMC elements of the Maggot BSF business in Pariaman, the use of the Business Model Canvas in the Maggot business in Pariaman, especially when only one Maggot business remains,

namely BSSA, is very important. Currently, an industrial-scale maggot business in West Sumatra has yet to materialize, while major competitors have been operating outside the province, such as PT Biocycle in Riau and PT Magalarva in West Java.

In this paper, BMC is utilized as an evaluative framework to systematically assess the key components of the existing business model, rather than serving as a tool for direct strategy formulation. Figure 2 presents the BMC, which facilitates the identification of strengths, weaknesses, opportunities, and threats within the business model. This evaluation forms the foundation for subsequent analyses employing strategic tools, such as the SWOT analysis and IE matrix, to develop and prioritize strategic alternatives.

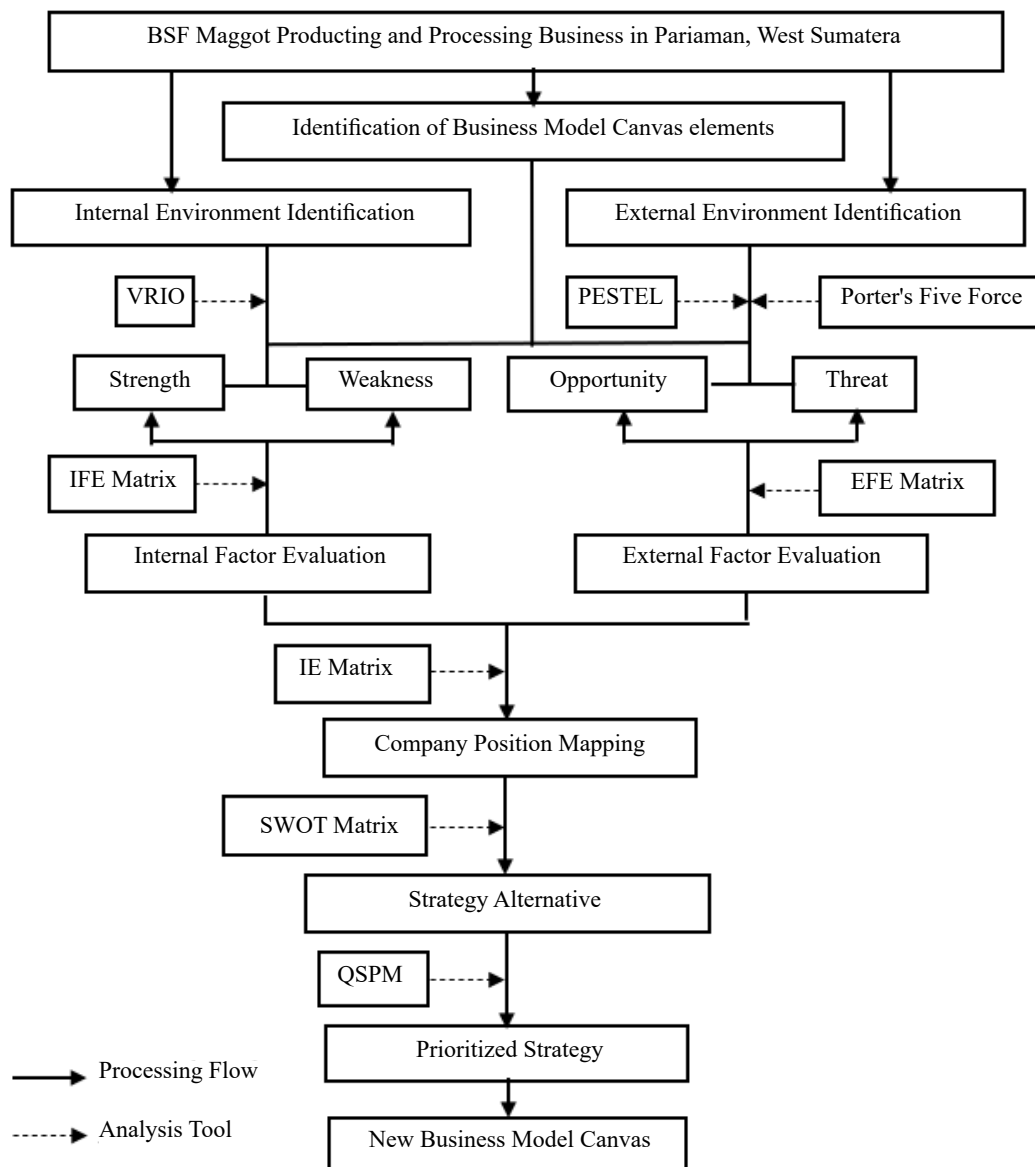


Figure 1. Research Framework

In the customer segment, B2C (Business-to-Customer) Segment, BSSA provides products and services to direct consumers, especially anglers. Fresh maggot is often used by anglers as an effective bait to attract fish. The moving and throbbing presence of fresh maggot naturally attracts fish, making it a popular choice of bait among anglers in Pariaman. By providing quality fresh maggot, BSSA helps fulfill the bait needs of anglers.

The value proposition of this business is diverse. First, BSSA offers BSF maggot as a high-quality alternative feed. BSF maggot meets all the criteria for animal feed ingredients, while BSF itself is an insect that does not carry harmful disease elements. This safety is very important in ensuring the health of livestock and agricultural products. In addition, the nutritional quality of BSF maggot is also very high.

The channel can be through social media to promote products by providing a direct channel to communicate with customers, social media is also used to join the maggot entrepreneur community and is used to understand market trends.

In the aspect of income flow, BSSA has a diverse source of income, which includes proceeds from the sale of products offered with revenues of more than IDR1,000,000/month. In 2020 BSSA received CSR assistance from PT Pertamina totaling IDR100,000,000 and the amount continues to increase every year, finally in 2023 BSSA received assistance from PT Pertamina worth IDR400,000,000.

In the main resources in managing the business at BSSA, several resources are the key to success. The first is quality human resources. Workers with the knowledge and skills to manage various aspects of the business, from production to marketing, are required. Skilled and experienced human resources will be a valuable asset in ensuring smooth and efficient operations.

To maintain the loyalty of customers who have purchased products from BSSA and encourage them to make future purchases, BSSA implements several strategies. One of the strategies used is the provision of discounts to loyal customers. These discounts provide an additional incentive for customers to keep choosing BSSA products so that they feel valued and get added value from their purchases.

<b>Main Partner</b> <ul style="list-style-type: none"><li>• CSR (Corporate Social Responsibility) Partner = PT Pertamina Patra Niaga DPPU Minangkabau</li><li>• Local government</li><li>• Neighboring Universities</li></ul>	<b>Main Activities</b> <ul style="list-style-type: none"><li>• Organic Waste Processing</li><li>• Production</li><li>• Education</li><li>• Research</li></ul>	<b>Value Proposition</b> <ul style="list-style-type: none"><li>• Alternative feed</li><li>• High nutrition</li><li>• Organic waste handling solution</li></ul>	<b>Customer Relationship</b> <ul style="list-style-type: none"><li>• Discount</li><li>• Educational outreach</li><li>• Souvenirs</li></ul>	<b>Customer Segment</b> <ul style="list-style-type: none"><li>• Agriculture office</li><li>• Farmers</li><li>• Fisher</li><li>• Maggot Breeder</li><li>• Catfish Farmer</li></ul>
	<b>Key Resources</b> <ul style="list-style-type: none"><li>• Building or land</li><li>• Vehicles &amp; Machinery HR</li><li>• Organic Waste</li></ul>		<b>Channel</b> <ul style="list-style-type: none"><li>• Social media</li><li>• Word of mouth</li></ul>	
<b>Cost Structure</b> <ul style="list-style-type: none"><li>• Fixed Cost</li><li>• Variable Cost</li></ul>			<b>Revenue Stream</b> <ul style="list-style-type: none"><li>• Product sales</li><li>• Training</li><li>• CSR Partner</li></ul>	

Figure 2. Business Model Canvas of BSF Maggot Business in Pariaman

An important partnership in BSSA's business involves a party committed to corporate social responsibility (CSR). BSSA's CSR partner is PT Pertamina Patra Niaga DPPU Minangkabau, which plays a significant role in supporting BSSA's initiatives in managing organic waste and promoting sustainable practices within its operational scope. In addition, cooperation with the local government is also an important aspect in helping to create an environment conducive to business growth.

The cost that must be borne by Bank Sampah Sahabat Alam (BSSA) in running its business in 2023 is IDR400,000,000, which is obtained from CSR assistance from PT Pertamina. Expenditures for BSSA's fixed costs in 2023 were IDR40,000,000 for public administration and operational costs of IDR40,000,000, which included various needs such as raw materials, infrastructure, and labor costs. The rest is used to purchase BSSA's research and development (R&D) equipment, such as machinery needed for research.

In the input stage, the first stage aims to answer the first research objective, which is to design a business model for the production and processing of BSF maggots in Pariaman using BMC.

**Second**, the identification of internal environmental factors is presented in Table 1. The strengths include (1) the availability of maggot feed in Pariaman is abundant, according to the Housing and Settlement and Environment Office of Pariaman City (2022), the waste generation is dominated by organic waste as much as 79.71%, or around 31.71 tons of organic waste is generated every day in Pariaman City; (2) high-nutrient

alternative feed produced in an environmentally friendly manner, the production process utilizes organic waste, such as food waste from the market, agricultural waste, and household waste, which is processed efficiently and sustainably; (3) local government assistance, assistance from the government can be obtained in several ways to build a maggot business in Pariaman, such as: the use of village funds, the Special Allocation Fund, and the Partnership and Community Development Program; (4) a structured organizational system, which reflects the collaboration between the local government, entrepreneurs, and the community, is able to provide comprehensive support for the progress of the business; (5) the ability to develop new products/services according to current market demands, BSSA decided to focus on the education business as the main source of income. Through training activities and workshops on BSF maggot production, BSSA is able to earn up to IDR2,000,000/session as a resource person; (6) Product differentiation, the BSF maggot business has great opportunities to expand in various market segments, from the animal feed industry to the agricultural and cosmetic sectors, and offers innovative solutions in organic waste management; (7) Dominant internal business conditions, as the only actor in Pariaman City, the maggot business has market control, production flexibility, freedom of marketing strategies, and extensive access to raw materials. (8) the maggot farming education center in Pariaman City, BSSA has received visits from various individuals and groups for study and cooperation purposes. In addition, BSSA actively conducts training to share knowledge and skills related to maggot farming.

Table 1. Results of Internal Factor Identification

No.	Strength	No.	Weaknesses
IF- D4	Availability of maggot feed in Pariaman City is abundant	BMC-B6	Production is still on a small scale
BMC-A2	Highly nutritious alternative feed produced in an environmentally friendly manner	IF-D1	The amount of production cannot meet consumer demand
IF-C1	Local government assistance	BMC-B1	No accept customers from large companies or farms
IF-A2	Structured organizational system	IF-B2	Prices charged to consumers are high
IF-E1	Ability to develop new products/services according to current market demand	BMC-B3	Lack of online marketing efforts
IF-E5	Product differentiation	BMC-B5	Limited land in urban areas
IF-B3	Dominant internal business conditions	IF-D5	Has not adopted the latest technology in production activities
BMC-A6	There is one of the maggot production education centers in Pariaman City.	IF-F1	The absence of a Database Management System that can be used to store, manage, and access company data

Weaknesses include (1) production is still on a small scale, the limited scale of production in Pariaman City significantly affects competitiveness, as the low production capacity makes it difficult for the company to compete with larger maggot producers, who are able to offer more competitive prices; (2) The amount of production cannot meet consumer demand, the production capacity is around 150-300 kg/month, BSSA is often unable to fulfill large orders, potentially leading to lost business opportunities and decreased customer satisfaction; (3) Not accepting customers from large Corporations or farms, BSSA's limited production capacity hinders the fulfillment of large demands, affecting its reputation and competitiveness against more reliable competitors; (4) the price charged to consumers is high, BSSA provides fresh maggot in 100gr doses at IDR10,000 while the average price of fresh maggot in the market ranges from IDR7,000 to IDR10,000/kg; (5) Lack of online marketing efforts, without effective efforts in digital marketing, BSSA may miss the opportunity to attract new customers, increase brand awareness, and compete with maggot producers in other regions who are more active in online marketing; (6) Most of the land in Pariaman City is customary land and densely populated residential areas, posing challenges for maggot business expansion, facility arrangement, and access to raw materials and logistics; (7) has not adopted the latest technology in production activities, The only machine used in the production process at BSSA is a waste shredder. The lack of use of modern technology can be seen in the use of manual sieves to sort maggots, as well as the method of drying maggots that still rely on sunlight. (8) The absence of a database management system to manage company data is a weakness of the maggot business in Pariaman City, making data recording and tracking manually, less efficient, and error-prone.

**Third**, the evaluation of internal environmental factors shows that the main strength of the BSF maggot business in Pariaman City is the abundant availability of maggot feed in Pariaman City, with a weighted score of 0.408. The strengths of the BSF maggot business in Pariaman City next are high-nutrient alternative feed produced in an environmentally friendly manner (0.372), the existence of local government assistance (0.372), its structured organizational system (0.341), the ability to develop new products/services according to current demand (3.341), and the existence of product differentiation (0.341), the dominant internal

conditions of the business (3.12), and there is one maggot production education center in Pariaman City (3.12).

The main weaknesses of the BSF maggot business in Pariaman City are that production is still on a small scale (0.025) and the amount of production cannot meet consumer demand (0.025). The next weakness is not receiving customers from large companies or farms (0.034) and the price charged to consumers is high (0.034). The next weaknesses are the lack of online marketing efforts (0.044), limited land in urban areas (0.044), not adopting the latest technology in production activities (0.044), and the absence of a database management system that can be used to store, manage, and access company data (0.044).

**Fourth**, the identification of external environmental factors using Porter's Five Forces analysis is used to analyze the industrial environment, which is a collection of similar companies producing the same goods in the West Sumatera region. In the aspect of Rivalry Among Competitive Firms, the maggot business in West Sumatera, which is SME-scale, faces obstacles in meeting increasing consumer demand. The small level of competition in West Sumatera provides a strategic advantage for the BSF maggot business in obtaining raw material supplies. With few competitors competing for suppliers, companies can more freely establish solid and sustainable partnerships, so that supply stability can be well maintained. However, in the BSF maggot industry in West Sumatera, even with limited competitors at the SME scale, it still has a significant influence on market dynamics, especially in terms of pricing. With only SME-scale competitors in West Sumatera, companies have the opportunity to focus on improving product quality and service without the pressure of intense competition.

In the Potential Entry of New Competitors aspect, increasing public awareness of the benefits of maggot as a profitable business source can pose a serious threat to existing businesses. In addition, the potential entry of new competitors can be an opportunity in the maggot industry. The presence of these new entrants not only opens up opportunities for collaboration in meeting consumer demand but also creates space for cooperation in research and technology development and business model innovation.

In the Potential Development of Substitute Product aspect, the openness of options for customers to switch to other products is one of the factors that show the potential development of substitute products in the market. In addition, substitute products tend to be easier to find because they are available in a wide variety of distribution channels in the market. The existence of substitute products is also a trigger for companies to continue to innovate and improve product quality to remain competitive.

The abundant availability of raw materials affects the bargaining power of suppliers. Competition among suppliers gives buyers more choices, increasing their ability to negotiate prices and procurement terms. Not only raw material suppliers, but suppliers also include financiers or investors. In planning for the development of a large-scale BSF maggot business in Pariaman City, it is important to consider opportunities for the involvement of financiers or investors who can act as suppliers. The potential for investor funding to build a maggot business in Pariaman City is very promising, driven by several key factors. The BSF maggot industry is also seen as an innovative and sustainable solution in organic waste management and alternative protein production, which is in line with the trend of green and sustainable investment.

In the Bargaining Power of Consumer aspect, the BSF maggot business in Pariaman City has several opportunities and threats that need to be considered carefully. One of the main opportunities is the presence of consumers from the business-to-business (B2B) sector, which offers significant market potential.

A macro external environment analysis using the PESTEL framework was conducted to evaluate the various factors affecting the business from each element. The process begins by identifying relevant factors from each PESTEL element, namely Political, Economic, Social, Technological, Environmental, and Legal, which is done through systematic interviews with resource persons who have expertise in the field.

On the political aspect, government policies that encourage partnerships between maggot businesses and the public sector in organic waste management such as organic waste management partnership programs, organic waste treatment projects, and education and awareness programs on the benefits of organic waste,

not only offer sustainable environmental solutions but also create opportunities for companies to engage in fruitful public-private collaborations.

On the economic aspect, exposing the increasing strength of the economy, people's purchasing power is expected to improve, expanding the market for maggot-based products, both as animal feed and other products. With stable economic growth, more investors and businesses will be attracted to participate in the sector, driving innovation and higher efficiency.

The social aspect explains that changes in social values or community trends can be both opportunities and threats for the BSF maggot business in Pariaman City. On the one hand, if people are increasingly concerned about environmental sustainability and the need for alternative protein sources, this could increase demand for maggot products.

Processing technologies, including oven drying and freeze drying, effectively reduce the moisture content of post-harvest maggots, maintaining product quality. The application of advanced technologies such as the Internet of Things (IoT), which is being developed at IPB, also has the potential to be applied in Pariaman City to monitor and control the BSF maggot production environment in real time.

Environmental aspects have a significant impact on the BSF maggot business in Pariaman City. Attention to environmental issues can be an opportunity to strengthen the company's reputation as a leader in responsible business practices. Conversely, excessive pollution or odor can pose a serious threat to the company's reputation. Table 2 describes the results of the assessment of external factors, namely:

*Fifth*, the evaluation of external environmental factors shows that the order of opportunities that must be maximized is the vast potential of customers, with a weighted score of 0.276, and maggot producers in West Sumatera are still MSEs (0.276), then the presence of new entrants can open up opportunities for collaboration in meeting consumer demand or collaboration in research and development, technology and business models. (0.231), creating more innovative and diverse products (0.231), utilizing e-commerce platforms for wider marketing (0.210), the existence of many organic waste suppliers in West Sumatera (0.210), investors



can be involved in the maggot business in Pariaman City (0.210), and changes in community trends that are increasingly concerned about the environment and sustainability (0.210).

External factors that are threats based on the order that must be minimized are low business growth rates (0.257), followed by online market competition causing greater price pressure (0.231), the emergence of new competitors in the same industry (0.231), the opening of options/alternatives for customers to replace/switch to other products (0.231), economic or environmental regulations that can increase operating costs. (0.231), the bargaining power of buyers remains strong despite the limited products produced by producers (0.210), the implementation of new technologies requires large investments in infrastructure, employee training, and changes to existing business processes. (0.210), environmental discomfort due to pollution or excessive odors (0.190).

### Matching Stage

The results of strategy formulation with the SWOT Matrix obtained SO strategy, ST strategy, WO strategy, and WT strategy with a total of ten alternative strategies. The SO strategy is prepared by referring to the internal strengths to take and take advantage of

existing external opportunities. SO strategies, namely (1) collaboration with the government, investors, educational institutions, and new entrants in the industry. Through collaboration with the government, it is expected to create policy support that supports industrial growth. Investors play an important role in providing capital. Collaboration with educational institutions will encourage research, development, and training of a qualified workforce. Meanwhile, the involvement of new entrants in the industry will open up opportunities for new and innovative ideas, which can accelerate growth and market diversification; (2) Integration with Integrated Waste Management Sites (TPST) throughout Pariaman City is a strategic step to optimally utilize organic waste as raw material in maggot production.

The ST strategy is prepared by referring to the internal strengths to overcome and reduce the impact of external threats. ST strategies, namely (1) Increasing the political will of the Mayor of Pariaman to support the development of a new BSF maggot business is a crucial step in ensuring the success of this initiative; (2) Optimizing the use of local government assets is a very important strategic step in the plan to develop a large-scale maggot business in Pariaman City; (3) Improving product quality and quantity as well as certification.

Table 2. Results of External Factor Identification

No.	Opportunities	No.	Threat
BMC-C1	Wide customer potential	BMC-D1	Low business growth rate
BMC-C3	Utilization of e-commerce platforms for broader marketing.	BMC-D3	Online market competition causes price pressure becomes greater.
EF1-A1	Maggot producers in West Sumatera are still on the MSE scale.	BMC-D6	The emergence of new competitors in the same industry.
EF1-B2	The presence of new entrants can open up opportunities for collaboration in meeting consumer demand or collaboration in research and development, technology, and business models.	EF1-C1	Open options/alternatives for customers to replace/switch to other products.
EF1-D1	The existence of many organic waste suppliers in West Sumatera.	EF1-E4	The bargaining power of buyers remains strong despite the limited products produced by producers.
EF1-D3	Investors can be involved in the maggot business in Pariaman City.	EF2-B2	Adjustments to changes in economic or environmental regulations that may increase operating costs.
EF2-C1	Changing trends in society that are increasingly concerned about the environment and sustainability.	EF2-D2	Implementing new technologies requires large investments in infrastructure, employee training, and business process changes.
EF2-D1	Technological developments make it possible to create innovative and diverse products.	EF2-E2	Environmental unfriendliness due to pollution or excessive odor.

The WO strategy is based on taking advantage of existing opportunities by minimizing weaknesses. The WO strategies are (1) Building a larger scale maggot production and processing business managed by BUMD; (2) Partnering with an environmentally-based e-commerce platform is a strategic step to expand market reach and increase the visibility of maggot products produced; (3) Adoption of modern production and processing technology and database management to increase business innovation and efficiency,

The WT strategy is defensive in nature by trying to minimize weaknesses and avoid existing threats. WT strategies, namely (1) Empowering the surrounding community as labor is a strategic step to support the sustainable development of the maggot business and avoid social problems; (2) Recruitment of newcomers as distribution and marketing agents.

### Decision Stage

The final stage is the prioritization of strategies using QSPM. Kadarusman (2013), in their research, utilized QSPM to prioritize the alternative strategies that had been formulated, and they chose market penetration as the strategy to prioritize, focusing on efforts to increase marketing to consumers. On the other hand, Amertha (2021) in his research also used QSPM to determine the priority strategies to be implemented. The Total Attractiveness Score (TAS) value is sorted based on the highest to lowest value to see priority strategies that can be implemented in the BSF maggot business in Pariaman City, the sequence of strategies is (1) increasing the political will of the Mayor of Pariaman to support the development of a new BSF maggot business. This strategy obtained the highest TAS value of 4.603, (2) building a larger scale maggot production and processing business managed by BUMD. The TAS value obtained was 4.588, (3) collaboration with the government, investors, educational institutions, and new entrants in the industry. The TAS value obtained is 4.557, (4) optimizing the use of local government assets. The TAS value obtained is 4.194, (5) integration with TPST in Pariaman City. The TAS value obtained is 4.158, (6) adoption of modern production and processing technology and database management to increase business innovation and efficiency. The TAS value obtained was 4.145, (7) improving product quality and quantity and certification. The TAS value obtained was 4.135, (8) partnering with environmentally-based e-commerce platforms. The TAS value obtained was

3.782, (9) recruitment of newcomers as distribution and marketing agents. The TAS value obtained is 3.655, (10) empowering the surrounding community as labor. The TAS value obtained was 3.228.

The new Business Model Canvas for the BSF maggot business in Pariaman City is the result of the implementation of strategies derived from the SWOT matrix analysis. The implementation of the SO, WO, ST, and WT strategies into the BMC of the maggot business in Pariaman City resulted in changes in the direction and development of this business. The BMC provides direction regarding the steps to be taken to expand and optimize business operations going forward.

In the customer segment, it has a wide market potential both at the national and international levels. At the domestic level, the potential customer segment includes poultry and fish farmers who require high protein feed at a lower cost. Farmers across Indonesia, who are looking for economical alternatives to conventional feed, are the main targets for this product. In addition, large animal feed manufacturers are also potential buyers of BSF maggot, given their need for a more sustainable protein source for their feed products.

BSF maggot products offer a sustainable value proposition in a large-scale business development plan in Pariaman City. The product helps reduce waste accumulation in landfills by processing organic waste into high-quality feed, an environmentally friendly solution that reduces waste volume and avoids the negative impacts of burning or landfilling. In addition, the business applies strict reporting transparency, ensuring the entire process, from waste collection to feed production, complies with applicable environmental regulations and standards.

For the large-scale BSF maggot business development plan in Pariaman City, the right B2B channel includes several strategic approaches. Distributors will play an important role in reaching a wider market by handling logistics and product storage. The use of B2B e-commerce platforms such as Alibaba or Tokopedia will simplify the purchasing process and increase product visibility in national and international markets. The revenue flow element in the BSF maggot business in Pariaman City, referring to the model implemented by PT Magalarva, consists of product sales as the main source of income. With 12 months of operation

in a year, the total annual revenue of the company can reach IDR7,020,000,000. The estimated annual revenue stream for the maggot business in Pariaman City obtained from product sales is estimated to reach around IDR7,000,000,000.

In the plan to establish a large-scale BSF maggot business in Pariaman City, customer relationships must be strategically built to ensure long-term success. Some of the types of customer relationships required include long-term partnerships with large poultry, fish, and animal feed producers through long-term supply contracts that provide sales stability.

For the planned development of a large-scale BSF maggot business in Pariaman City, key partners are needed that can effectively support business operations and development. Support from investors or financial institutions will be crucial in terms of initial financing, working capital, and business development.

It is important to identify the various cost structures required in the plan to develop a large-scale BSF maggot business in Pariaman City. Referring to PT Magalarva, which developed the business with an initial fund of IDR7,500,000,000, the costs include infrastructure, production facilities, technology, as well as raw material procurement, and initial operations.

### **Managerial Implication**

The production and processing of BSF maggots in Pariaman City necessitate the development of a formal strategic plan to maximize growth potential. Managerial implications include the importance of enhancing political support from local authorities, formulating strategic partnerships with various stakeholders, and optimizing regional assets while empowering local communities. There should also be a strong emphasis on improving product quality and adopting modern technologies to enhance operational efficiency. Finally, rigorous oversight is essential to ensure the effective implementation of strategies and integration with the city's waste management system.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

The conclusions drawn based on the explanation above are (1) Evaluation of the internal and external environment of the BSF maggot business in Pariaman City was carried out through BMC, VRIO, Porter's Five Forces, and PESTEL analysis. Identification of strengths and weaknesses using BMC and VRIO showed a strong internal position with an IFE score of 3.093. Meanwhile, external analysis through BMC, Porter's Five Forces, and PESTEL showed the business's ability to respond to opportunities and threats with an EFE score of 3.645. These results place the BSF maggot business in Pariaman City in a growth and development position (quadrant I of the IE Matrix). (2) The results of strategy formulation carried out using the SWOT Matrix, obtained ten alternative strategies which are grouped into intensive strategies and integrative strategies. Based on the results of QSPM, a priority strategy is obtained that can be implemented in the BSF maggot business in Pariaman City. (3) Implementation of strategies from the SWOT matrix analysis results to produce a new Business Model Canvas for the BSF maggot business in Pariaman City. The implementation of the SO, WO, ST, and WT strategies into the BMC of the maggot business in Pariaman City has resulted in a transformation in the direction and development of this business. The BMC provides guidance on the steps to be taken to develop and optimize business operations going forward.

### **Recommendations**

Through the results of the study, in the face of growing demand for maggot products in Pariaman, especially with only one small-scale producer in the City, an effective business strategy is needed to develop the BSF maggot business in Pariaman. The findings from this study can serve as a solid basis for directing strategies in developing the BSF maggot business in Pariaman. By implementing these strategies in an integrated and sustainable manner, it is expected that the BSF maggot business in Pariaman will not only survive but also excel in this highly potential industry. Thus, the contribution to the local economy and community welfare can be maximally improved.

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