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Financial Analysis of Business Feasibility and Maggot Black Souldier Fly Cultivation Development Strategy

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ABSTRACT: This study aims to analyze financial feasibility and develop strategies for developing Black Souldier Fly (BSF) maggot cultivation business. The research location in Omah Maggot Warna Warni, which is located in the village of Puntir Martopuro, Purwosari Pasuruan, was chosen with the consideration of having good prospects for BSF maggot cultivation. Respondents include 4 resource persons who are directly involved in maggot cultivation. The analysis used is a quantitative financial analysis by calculating the value (Net B/C, NPV, IRR, and Payback Period and BEP) with a discount factor (DF) of 11 percent. Sensitivity analysis was used to determine the sensitivity of BSF maggot cultivation to a decrease in production which was conditioned by a 10% to 40% decrease in production. Descriptive analysis with SWOT analysis is used to find strategies for developing Maggot Cultivation Business. The results showed that maggot cultivation was profitable to cultivate. This business is feasible because the NPV and Net B/C values are greater than 1, and the IRR value is higher than the interest rate. Based on the SWOT analysis, it shows that the position of the internal-external matrix of the Omah Maggot Warna Warni maggot cultivation business is in quadrant II or the growth and development strategy with the IFAS factor value of 2.39 and EFAS 3.03. This phase shows that the colorful Omah Maggot maggot cultivation business is undergoing a growth stage and must be developed because it has great potential to develop. The priority of the BSF maggot cultivation development strategy is to improve the quality of maggots, expand network marketing, and increase the use of cultivation technology and collaborate with the local government for the development of the Colorful Omah Maggot maggot cultivation business.

KEYWORDS: Black Souldier Fly, Financial feasibility, SWOT

I. INTRODUCTION

The corona pandemic has an impact on the weakening of the rupiah and the supply of feed raw materials, especially feed additives, is hampered. Increased logistics costs have an impact on adjusted feed prices. The livestock industry players, especially the poultry industry, such as feed mills, have also felt the impact. The need for fish feed for aquaculture production is still very dependent on factory production, most of which raw materials must be imported. The fish feed is sold by the factory at a high price to cover production costs. For small-scale fish farmers, the price of the manufacturer's feed is very burdensome for their production costs. For this reason, the development of independent fish feed using alternative raw materials continues to be encouraged, to be produced in many areas throughout Indonesia. Therefore, feed studies that are currently developing are aimed at finding alternative protein sources by utilizing insects. The use of insects as a protein source has been widely discussed by researchers around the world [1]. According to [2], protein sourced from insects plays an important role in naturally having economic value and being environmentally friendly. Insects are reported to have high feed conversion efficiency and can be reared and mass produced. Insect cultivation is known to reduce organic waste that can pollute the environment. Another advantage is that insect-based protein sources do not compete with humans so they are very suitable for use as animal feed ingredients, including poultry and fish [3]. One of the potential alternative raw materials is maggot which comes from insects that eat organic waste. The ability of the insect called Black Soldier Fly (BSF) is very unique because it can break down waste and produce high protein for fish feed needs. The advantages of maggot cultivation include maggot production technology that can be done easily by the community, and maggot can also be processed into maggot flour (mag meal) so as to reduce feed production costs. The infrastructure used in maggot cultivation is relatively simple, and maggot is able to degrade organic waste into other nutritional materials. Feed raw materials, insect-based products must also be safe from chemical contaminants.

II. REVIEW LITERATUR

Maggot is an organism derived from the Black Soldier Fly (BSF) egg, in the second phase of metamorphosis after the egg phase and before the pupa phase which will later become an adult BSF [4]. Maggot is able to live in tropical and sub-tropical climates so that these non-pest insects have the potential to be developed in Indonesia. As a non-pest insect, the ability of maggot larvae instars to decompose organic waste can be integrated into agriculture and animal husbandry. The life cycle of the Hermetia illucens fly has five stages. The five stages are the adult phase, the egg phase, the prepupa phase, and the pupal phase. Of the five stages, the prepupa stage is often used as fish food [5]. A normal BSF female fly is able to produce eggs ranging from 185-1235 eggs [6].

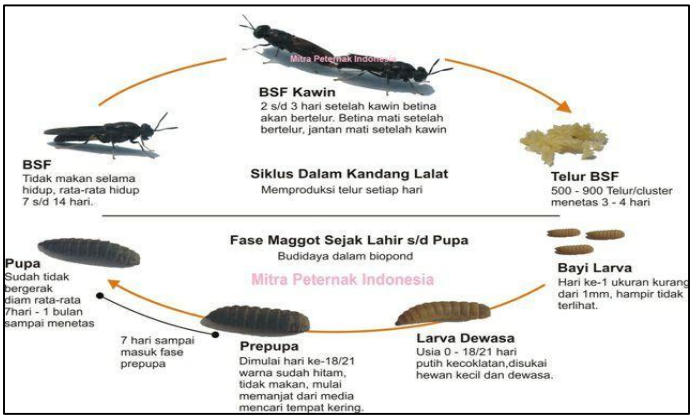

Figure 1. BSF life cycle.

A female takes 20-30 minutes to lay eggs with the number of egg production between 546-1,505 eggs in the form of egg mass [7]. Egg mass weight ranged from 15.8-19.8 mg with individual egg weight between 0.026-0.030 mg. The peak time for laying eggs is reported to be around 14.00-15.00. Female flies are reported to lay eggs only once during their lifetime, after which the female flies die [7]Within two to four days, the eggs will hatch into first instar larvae and develop up to the sixth instar within 22-24 days with an average of 18 days [8].

III. RESEARCH METHODS

This research was conducted in August 2021 at Omah Magot Warna Warni, which is a BSF maggot cultivation site owned by Mr. Kholis Akbar, located in the village of Puntir Martopuro, Purwosari, Pasuruan, East Java. Data collection is with primary and secondary data. The data analysis method, the first objective, was analyzed quantitatively using financial analysis with a business economic life of 3 years because it is the economic age of the maggot cultivation business [9]. Regional bank interest rates based on data from Bank Indonesia, the bank interest rate used as a reference is the loan interest rate for KUR of 11 percent. According to [10], the tools used to analyze business finances are Gross Benefit Cost Ratio (Gross B/C), Net Benefit Cost Ratio (Net B/C Ratio), Net Present Value (NPV), Internal Rate of Return (IRR).), Payback Period (PP) and BEP. The analysis used to answer the second objective is sensitivity analysis which is conditioned to a 10% to 40% decrease in production. For the third purpose, qualitative data was used which was analyzed using the SWOT analysis method.

IV. RESULTR AND DISCUSSION

Omah Magot Warna Warni is a BSF maggot cultivation site owned by Mr. Kholis Akbar, located in the village of Puntir Martopuro, Purwosari, Pasuruan, East Java. The area of cultivation is 650 m² with a total of 30 biopons with a size of 2x3 m and a fly cage with a size of 4 x 3 x 3 m. This cultivation was carried out starting in 2018 as an effort to find alternative feed for catfish when the price of factory feed soared due to the pandemic which forced farmers to look for feed substitutes to survive. Mr. Kholis Akbar was previously a catfish breeder with tarpaulin ponds with a total of 8 ponds with a diameter of 3 m containing 10 thousand seeds per pond.

A. Receipt Flow (Inflow)

The revenue stream for BSF maggot cultivation obtained by Omah Maggot Warna Warni occurred in the 1st year. Business revenue comes from the sale of egg phase maggot which is intended for seedlings and larval phase which is used for a mixture of fish feed and animal feed.

Table 1. Production and Sales Value of BSF Eggs in Grams.

Year	Total BSF egg production (grams)	Price per kilogram (Rp)	Sales value (Rp)
1	5490	5000	27.450.000
2	8100	5000	40.500.000
3	10800	5000	54.000.000
Total	**24390**		**121.950.000**

Source: primary data processed, 2021

Table 2. Production and Sales Value of BSF Maggot in Kilograms

Year	Total BSF egg production (grams)	Price per kilogram (Rp)	Sales value (Rp)
1	9250	7000	64.750.000
2	13500	7000	94.500.000
3	13200	7000	92.400.000
Total	**35950**		**251.650.000**

Source: primary data processed, 2021

B. Flow Expenditure (Outflow)

Outflow is the cost incurred or the flow of expenses used to finance the business being carried out or the business being run. In the BSF maggot cultivation business, the outflow includes investment costs, fixed costs and variable costs. The flow of costs or expenses reflects the expenses that occur during the life of the project.

C. Investment Fee

Table 3. Details of investment costs in maggot cultivation in Omah Maggot Warna Warni.

No	Type	Volume	Unit	Price	Total price
1	Building	1	unit	Rp 50.000.000	Rp 50.000.000
2	fly cage	4	unit	Rp 250.000	Rp 1.000.000
3	Seeds			Rp 1.000.000	Rp 1.000.000
4	Biopond	8	unit	Rp 187.500	Rp 1.500.000
5	Hatchery	10	unit	Rp 20.000	Rp 200.000
6	Stacking wood	10	unit	Rp 20.000	Rp 200.000
7	Light	5	unit	Rp 20.000	Rp 100.000
8	Electricity	1	unit	Rp 1.500.000	Rp 1.500.000
9	Water pump	1	unit	Rp 2.000.000	Rp 2.000.000
10	pellet machine	1	unit	Rp 2.500.000	Rp 2.500.000
11	Well	1	unit	Rp 1.200.000	Rp 1.200.000
12	Motorcycle	1	unit	Rp 14.000.000	Rp 14.000.000
13	Permissions	3	letter	Rp 500.000	Rp 1.500.000
14	Iron rack	5	unit	Rp 300.000	Rp 1.500.000
TOTAL					**Rp 78.200.000**

Source: primary data processed, 2021

D. Operating Costs

Costs are costs that are incurred periodically as long as the business is carried out. Operational costs consist of fixed costs and variable costs.

Fixed cost

Table 4. Fixed Costs in BSF Maggot Cultivation Business.

No	Component Name	Cost Per Year
1	Maintenance	Rp 2.400.000
2	BBM	Rp 6.000.000
3	Building Tax / UN	Rp 200.000
4	Electricity cost	Rp 6.000.000
	Total	**Rp 14.600.000**

Source: primary data processed, 2021

Variable Cost

Table 5. Variable Costs in Maggot.BSF Cultivation Business

No	Component Name	Cost Per Year
1	Feed cost	Rp 1.800.000
2	Hatching component cost	Rp 1.200.000
3	Employee salary	Rp 24.000.000
	Total	**Rp 27.000.000**

Source: primary data processed, 2021

Financial feasibility analysis is a method to determine the feasibility of maggot cultivation business. Financial feasibility criteria for maggot cultivation include NPV, Net B/C, IRR and Payback Period. The basic assumptions used in this research are:

1. The colorful Omah Maggot maggot cultivation business lasts for 3 years.
2. The capital used is own capital.
3. The land used for cultivation is private property.
4. The applicable interest rate from 2018 to 2021 is 11% based on bank interest rates.
5. Workers in the maggot cultivation business come from outside the family.
6. The initial year of business is in year 0, namely in 2018 breeders only invest and the production process begins in 2018.

The results of the Financial Feasibility Analysis of the Colorful Maggot Omah Maggot Cultivation Business in Pasuruan resulted in the following business feasibility criteria:

Table 6. Feasibility Criteria for Colorful Omah Maggot Business

No	Criteria	Value	Limitation	Description
1	NPV(DF 11%)	Rp 119.819.978	>0	Layak
2	GROS B/C (11%)	1.67	>1	Layak
3	NET B/C (11%)	2.53	>1	Layak
4	IRR	76%	>11%	Layak
5	PP	2 Year 1 Month	< 3 Year	Layak
6	BEP Unit	3.076 Kg		
7	BEP Rupiah	Rp 21.529.974		

Source: primary data processed, 2021

E. The Sensitivity of Maggot Cultivation in Colorful Omah Maggot

Production Decrease 10%

The production of BSF eggs and maggots has been carried out by creating conditions with a decrease in production of 10%, 20%, 30% and 40%. The next stage is to do a financial feasibility analysis with a DF of 11% and other variables are considered constant.

Table 7. Criteria for Financial Investment for Maggot Cultivation with 11% DF and 10% Production Decrease.

Criteria	Value	Limitation	Description
NPV	Rp 89.852.127	>0	Layak
Gross B/C	1,5	>1	Layak
Net B/C	2	>1	Layak
IRR	61%	>11%	Layak
PP	2,39	< 3 Tahun	Layak

Source: primary data processed in 2021

Production Decrease 20%

Table 8. Criteria for Financial Investment for Maggot Cultivation with 11% DF and 20% Production Decrease.

Criteria	Value	Limitation	Description
NPV	Rp 59.884.276	>0	Layak
Gross B/C	1,33	>1	Layak
Net B/C	1,77	>1	Layak
IRR	45%	>11%	Layak
PP	2,77	< 3 Tahun	Layak

Source: primary data processed in 2021

Production Decrease 30%

Table 9. Criteria for Financial Investment for Maggot Cultivation with 11% DF and 30% Production Decrease.

Criteria	Value	Limitation	Description
NPV	Rp 29.916.425	>0	Layak
Gtoss B/C	1.17	>1	Layak
Net B/C	1.38	>1	Layak
IRR	29%	>11%	Layak
PP	3.3	= 3 Tahun	Layak

Source: primary data processed in 2021

Production Decrease 40%

Table 10. Criteria for Financial Investment for Maggot Cultivation with 11% DF and 40% Production Decrease.

Criteria	Value	Limitation	Description
NPV	Rp 51.426.30	<0	Tidak Layak
Gtoss B/C	1	=1	BEP
Net B/C	1	=1	BEP
IRR	11%	=11%	BEP
PP	4.23	> 3 Tahun	Tidak Layak

Source: primary data processed in 2021

From the results of the sensitivity analysis with the creation of conditions for a 10% -30% decrease in the production of Colorful Omah Maggot cultivation, it is still feasible to cultivate but in the creation of conditions of 40% decline in production of Colorful Omah Maggot cultivation, it is not feasible to cultivate.

F. Maggot Cultivation Development Strategy in Colorful Omah Maggot Pasuruan

Development strategy is a way designed to make changes that can make a business develop better. The strategy for developing maggot cultivation uses a SWOT analysis. SWOT analysis is the identification of various factors systematically to formulate a strategy which includes internal factors consisting of opportunities and threats and external factors consisting of opportunities and threats Internal Factors for Cultivation of Colorful Maggot Omah Maggot (Hermanto, R. E. (2016).

Identification of Internal and External Factors

Table 10. Internal Factors of Colorful Maggot Omah Maggot Cultivation

No	Internal factors	Strenght	Weakness
1	The quality of the seeds produced	S1	
2	Competitive selling price	S2	
3	It's easy to get information on how to cultivate	S3	
4	Easy access to buy	S4	
5	Production capacity		W1
6	Cultivation Technology		W2
7	Limited marketing		W3
8	Simple promotion		W4

Table 11. External Factors of Colorful Maggot Omah Maggot Cultivation

No	Eksternal Faktors	Opportunity	Threats
1	Increasing interest in maggot cultivation	O1	
2	The level of consumer confidence in the seeds produced	O2	
3	Increased purchase demand	O3	
4	Promising market potential	O4	
5	Environmental Safety	O5	
6	Government support	O6	
7	Weather		T1
8	Other animal disturbance		T2
9	Business competition with other cultivators		T3
10	Fresh maggot can't be stored for long		T4

Table 12. Weighting, Rating and Score of Internal Factors

Internal Factors						
Strength		**Total**	**Average**	**Rating**	**Weight**	**Score**
1	The quality of the seeds produced	100	4	4	0.14	0.57
2	Competitive selling price	96	3.84	4	0.14	0.57
3	It's easy to get information on how to cultivate	77	3.08	3	0.10	0.32
4	Easy access to buy	79	3.16	3	0.10	0.32
	Total Strength			14	0.48	1.8
Weakness						
1	Production capacity	34	1.36	1	0.1	0.1
2	Cultivation Technology	61	2.44	2	0.2	0.4
3	Marketing	36	1.44	1	0.1	0.1
4	Promotion	33	1.32	1	0.1	0.1
	Total Weakness	164		5	0.5	0.7
	Total Strength + Weakness			19	0,98	2,5

Table 13. Value of Internal Factors and External Factors

Internal Factors	Value
Strength	1,8
Weakness	0,7
Total Strength + Weakness	2,5
Strengths - Weaknesses	1.1

External Factors	
Opportunity	2,2
Threat	0,8
Total Opportunities + Threats	3,0
Total Opportunity - Threat	1,4

Based on the total score of the internal and external factors of oyster mushroom farming, an IE matrix diagram can be made by looking for the X-axis and Y-axis intersection points. The X-axis intersection point (W–S axis) is obtained from the difference between the total strength and weakness factors, namely +1.07 and the point of intersection of the Y axis (O–T axis) is obtained from the difference between the total opportunity and threat factors, which is +1.43

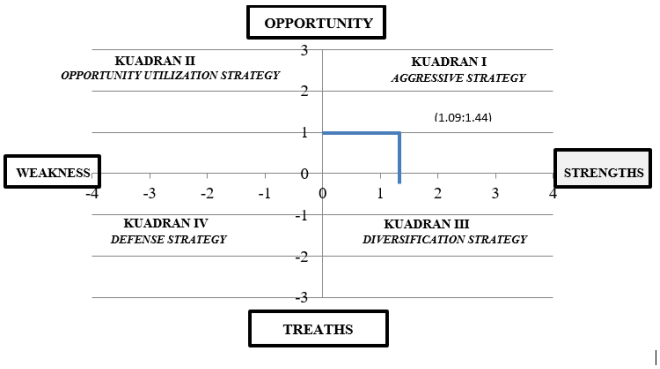

Figure 2. SWOT diagram

The results of the above calculation show that the position of the Colorful Omah Maggot cultivation business is in quadrant I. The existence of this position indicates the maggot cultivation business is in a growing, healthy and advanced condition. Quadrant I is a very profitable situation where the business has opportunities and strengths so that it can take advantage of existing opportunities. The strategy that must be applied in this condition is to support an aggressive growth policy. This allows business owners to expand their business and achieve the best.

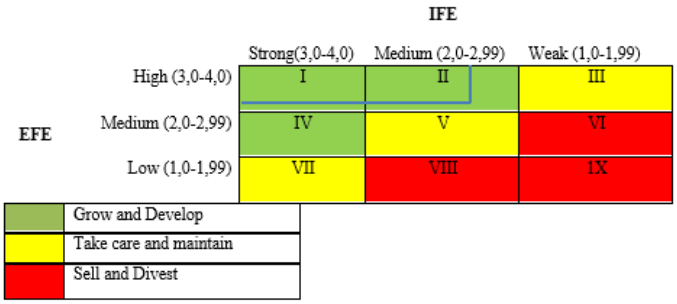

Figure 3. IFAS and EFAS. Diagrams

Based on the picture, it shows that the position of the external internal matrix of the Omah Maggot Warna Warni maggot cultivation business is in quadrant II or in the growth and development strategy with IFAS factor values of 2.39 and EFAS of 3.03. This phase shows that the colorful Omah Maggot maggot cultivation business is undergoing a growth stage and must be developed because it has great potential to develop.

G. Development Strategy

S-O Strategy (Strenghts-Opportunities)

The S-O strategy is a strategy that utilizes all strengths to seize and take advantage of the greatest opportunity. Strategies that can be run with the S-O strategy are:

1. Maintaining the quality of the resulting production to maintain consumer confidence.(S1O2). Good quality of BSF egg and maggot production, which are not easy to rot / die so that they are not good for seeds.
2. Increase education on how to cultivate maggot to increase the number of enthusiasts for maggot cultivation. (S3O1)
3. Maintaining competitive selling prices and increasing production to meet the increasing demand for purchases.(S2O3)
4. Increasing access to buying for consumers by utilizing information technology.(S4-O4)

W-O Strategy (Wekanesess-Opportunity)

W-O strategy is a strategy that can be applied by taking advantage of existing opportunities to minimize existing weaknesses. Strategies that can be run with the W-O strategy are:

1. Increase production capacity to meet increasing purchasing demand. (W1O1).
2. Participate in training related to technology for cultivation in order to increase production and produce better seeds and maggots. (W2-O2)
3. Participate in training related to technology for cultivation in order to increase production and produce better seeds and maggots. (W2-O2).
4. Increase promotion by utilizing technology to reach a wider market. (W4O4).
5. Establish relationships with local governments to be able to expand the market, not only local but also export markets. (W3O6).

S-T Strategy (Strenghts-Threats)

The ST strategy is a strategy that uses the strengths possessed to overcome threats. The following strategies can be executed with the ST strategy:

1. Anticipating extreme weather by placing fly cages according to temperature and humidity. (S1T1).
2. Install a device such as a wire cover that is placed above the biophone to prevent rats or snakes from entering so as not to interfere with production (S1T2).
3. Maintaining competitive prices to overcome business competition.(S2T3)
4. Improving the quality of production to be able to compete with other cultivators (S1T3).

W-T Strategy (Weknesses-Threaths)

The W-T strategy is a defensive strategy and tries to minimize existing weaknesses and avoid threats. The W-T strategy can be implemented in the following ways, namely:

1. Improve knowledge and technology to anticipate extreme weather so as not to interfere with the BSF breeding process. (W2T1).
2. Increase production capacity by adding fly cages that produce seeds to meet consumer demand so as not to switch to other producers. (W1T3).
3. Utilizing technology with machines that can convert fresh maggot into dry maggot, thereby reducing production shrinkage. (W2T4).
4. Promote maggot products more widely so that maggot is sold immediately. (W4T4).

H. Strategy Formulation

Based on the analysis of internal and external factors, Pasuruan's Colorful Omah Maggot maggot cultivation business with a value of 3.03 and 2.49 is in quadrant II with a growth and development strategy that has a large market opportunity, it means that the maggot cultivation business has a large market opportunity. And has the potential to be developed. The colorful Omah Maggot maggot cultivation business can be developed even better by using the formulation of short-term and long-term strategic plans. Efforts that can be made for the strategic formulation include:

a. Strategic Plans in the Short Term are:
    1. Maintaining the quality of the resulting production to maintain consumer confidence.
    2. Maintaining competitive selling prices and increasing production to meet increasing purchasing demands.
    3. Increase production capacity to meet increasing purchasing demand.
    4. Increasing access to buying for consumers by utilizing information technology.
    5. Increasing access to buying for consumers by utilizing information technology.
    6. Increase promotion by utilizing technology to reach a wider market.

b. Strategic Plans in the Long Term are:
    1. Anticipate extreme weather with tools that can monitor temperature and humidity
    2. Participate in training related to technology for cultivation in order to increase production and produce better seeds and maggots.
    3. Increase production capacity by adding fly cages that produce seeds to meet consumer demand so as not to switch to other cultivators.
    4. Utilizing technology with machines that can convert fresh maggot into dry maggot, thereby reducing production shrinkage.

5. Promote maggot products more widely so that maggot sells quickly.
6. Establishing relationships with local governments to be able to expand the market, not only local but also export markets.

I. CONCLUSION

1. Based on the results of the financial feasibility analysis with an interest rate of 11% that the Pasuruan Colorful Omah Maggot maggot cultivation is feasible because the NPV value> 0 is IDR 119,819,978, the Net B/C value> 1 is 2.53, the Gross value B/C>1 is 2.53, IRR is 67% and the payback period is <3 years, which is 2 years and 1 month.
2. The results of the sensitivity analysis on the maggot cultivation business of Colorful Omah maggot with the creation of conditions with a production decrease of 10% to 30% and other variables remain the same, the results show that the maggot cultivation business is still feasible, while the creation of conditions with a decrease in the production of 40% is obtained The results show that the maggot cultivation business is not feasible because the NPV <1 is –Rp.51,426.30, Net B/C<1, Gross B/C = 1 , IRR = DF is 11% and Payback Period > 3 years is 4 year 2 months. The conclusion for the sensitivity analysis is that the Omah Maggot Colorful maggot cultivation business is sensitive to a 40% decrease in production.
3. The conclusions obtained from the results of the study are that based on the IFAS-EFAS Matrix, the Colorful maggot cultivation business is in quadrant II (the company has positive internal strengths and has positive external threats) which means the maggot cultivation business must be able to maintain right and increase the internal strength that is owned and reduce the external threats that are being experienced for the achievement of company goals that are getting better
4. The results of the SWOT analysis show that the quail breeding business on the Gemini farm is in a white area position and in growth/stability conditions. The strategy implemented is the SO strategy by maintaining product quality to maintain consumer confidence, maintaining competitive selling prices and increasing production to meet demand, and expanding marketing reach to reach a broad market potential.

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