Assessing the Viability of a Small Micro-Enterprise of an Urban Farming Group in Bausasran Village, Yogyakarta, in Developing a Vegetable-based Noodle Products

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Abstract. Gemah Ripah Farmer Group, located in Bausasran Village, Danurejan District, Yogyakarta City, is one of the small farmer groups that have successfully practiced urban farming. The group grows vegetables and fruits. The harvest is then sold directly to consumers or distributors. To increase the economic value, the group plans to start a small micro-scale dry noodle product business by utilizing their cultivation results. In business planning, an economic feasibility analysis is required. This study aims to determine the business feasibility with the indicators of Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), and Added value analysis with Hayami Method. This study simulates two business scenarios for dry noodle production, namely own production and third-party production with three variables of production capacity analyzed, namely 760, 950, and 1140 units/month. The results of this study show that self production scenario with a production capacity of 1140 pieces/month produces a higher level of feasibility with a value of NPV, IRR and payback period of IDR 42,038,344, 59% and 1.88 years respectively. Value-added analysis provides added value in the self-production scenario of IDR 55,527/kg at the production rate of 1140 units/month.

1 Introduction

According to data from the Horticulture Statistics Sub-directorate of the BPS, Indonesia experienced a 1.2 million hectare decrease in harvested area for vegetable crops between 2018-2022 [1]. Simultaneously, the country's population increased by 11 million individuals during this timeframe [2]. As the population grows, additional land is required for housing developments, with agricultural land being one of the proportions that must be sacrificed. In this way, the agricultural land area will decrease, disrupting food security. Therefore, innovation and creativity are necessary to utilize increasingly limited urban areas as micro-farming and urban farming land.

Urban farming involves cultivating crops within cities or urban areas to produce food locally in densely populated regions [3]. Urban farming can be accomplished through various methods, including vertical farming, rooftop gardening, urban parks operating as agricultural land, and utilizing modern technology, such as hydroponics or aquaponics [3]. Urban farming also offers a solution to improve food sustainability in urban areas, reduce dependence on imported food, and ensure access to fresh food for urban communities [4]. Furthermore, urban farming has substantial economic potential, including creating new business opportunities such as selling produce such as fruits, vegetables, and processed goods and reducing costs associated with food transportation and distribution [5].

One area that has successfully piloted the transformation of a narrow urban area into a vegetable cultivation village is Bausasran Village, located in Danurejan District of Yogyakarta City. Administratively, Bausasran Village spans an area of 470,000 square meters, of which 400 square meters can be utilized for vegetable cultivation [6]. Among the farmer groups operating in Bausasran Village, the Gemah Ripah Farmer Group is one of them. The farmer groups in Bausasran Village utilize the materials around them to build farms with soilless farming techniques such as hydroponics and aquaponics, as well as planting with soil in pots and verticulture. They garden either at the household scale (Home Farming) or at the community scale (Community Farming) to farm on narrow vacant lands. The cultivated plants are diverse, including vegetables, fruits, ornamental plants, and herbs. The crop yields are sold in the market, and the profits earned are reinvested into the agricultural business capital [12].

The agricultural crops of the Bausasran Village Farmers Group which are sold directly to consumers without undergoing processing into ready-to-eat food

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have a relatively low economic value. To increase the economic value of their crops, a dry noodle production business is planned with one of the ingredients sourced from cultivated agricultural products. To determine whether a business is feasible to run, an economic feasibility analysis is needed so that the risk of loss and bankruptcy can be minimized.

2 Method

This research aims to investigate the economic analysis of expanding the dry noodle manufacturing business within the Gemah Ripah Farmers Group. Key indicators to consider include the Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP). The NPV indicator calculates the ratio of present cash inflows to outflows over a set period, assessing the benefits of a production process [7]. The NPV can be calculated as follows:

$$NPV = \sum_{t=1}^{N} \frac{R_t}{(1+i)^t} \quad (1)$$

where *N* represents number of periods, *i* is rate of return and *t* is cash period.

The IRR indicator is utilized to calculate the interest rate at which the NPV equals 0. It serves as a representation of the percentage rate of return-on-investment capital, compared to the Minimum Acceptable Rate of Return (MARR) [10]. For a business to be feasible, the IRR value must exceed the MARR value [10]. The IRR value is derived using the following equation:

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2}(i_1 - i_2) \quad (2)$$

Where i_1 represents the interest rate that produces positive NPV values, and i_2 is interest rate that produces negative NPV values. NPV_1 on the other hand, represents a positive NPV, while NPV_2 represents a negative NPV.

The Payback Period indicator shows how long the business process takes to return investment capital from the annual cash inflow generated [11]. The equation for calculating PP is:

$$PP = t_i + \frac{M_t}{C_t} \quad (3)$$

t_i = the year right before the initial investment is fully returned
M_t = initial capital that is still not covered
C_t = cash flow in period t

In this study, the authors analyze the economic feasibility of two applicable scenarios. First, the business scenario for dry noodle production by procuring its own production equipment, starting from raw material processing, packaging, to sales. Second, the dry noodle business scenario involves dry noodle manufacturing services so that farmer groups only need to do packaging and sales. Figure 1 shows the schematic of scenario 1 (a) and scenario of scenario 2 (b).

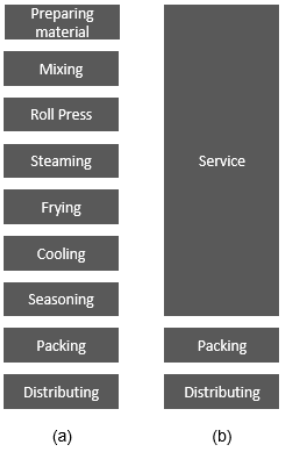

Fig. 1. Scenario 1 (a) and Scenario 2 (b) Scheme

To determine business feasibility in both scenarios, the authors create three production capacity variables in each scenario with NPV, IRR, and Payback Period indicators. The research flowchart is presented in Figure 2.

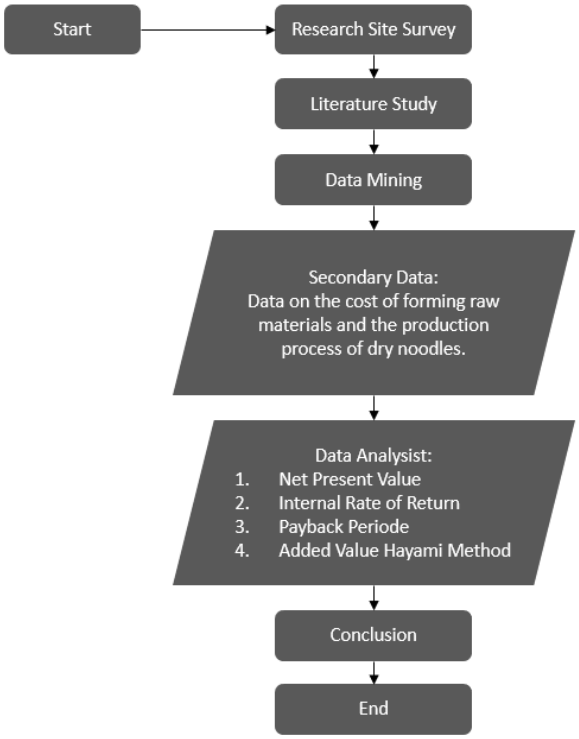

Fig. 2. Research methodology flowchart

3 Result and Discussion

3.1 Investment

Tool	Qty	Investment Cost (Rp)
Digital Balance	1	200,000
Horizontal Dough Mixer HMX-H02	1	2,700,000
Noddle Maker NOD1503	1	1,800,000

Food Dehydrator DHY-10H	1	3,200,000
FOMAC Electric Steamer STM-JEZ5	1	4,500,000
Gallon	1	32,000
Vaccum Sealer	1	300,000
Total		12,732,000

Table 1. Investment Cost of Scenario 1

The Bausasran Farmers Group plans to invest in processing the crops into processed dry noodle products. The Farmer Group plans to invest Rp 20,000,000 which will come from community service grants as well as profits from the sale of previous agricultural products. The amount of initial investment capital considers the price of production equipment and production costs for the next 3 months. The first scenario requires three workers working in production, packaging, and distribution. The production equipment investment cost component for scenario one is shown in table 1.

Cost Component	760 per month (Rp)	950 per month (Rp)	1140 per month (Rp)
Fixed Cost	2,148,224	2,148,224	2,148,224
Variable Cost	2,268,915	2,982,015	3,755,115
Semi-Variable Cost	780,000	900,000	1,000,000
Total Operational Cost	5,197,139	6,030,239	6,903,340
Sales Projection	5,737,388	7,177,994	8,522,011
BEP	6,740	6,142	5,797

Table 2. Cost Component per month of Scenario 1

The price per pack of 80 grams noodles is planned to be at a profit margin of 12-39% and is tested on production capacity variables of 760 per month, 950 per month and 1140 per month. The cost-forming components of scenario I are shown in table 2.

Then for the second scenario, namely the sale of dry noodles by involving the services of making dry noodles or in another sense it does not require production equipment as in the first scenario, except for a vacuum sealer. The workforce needed in the second scenario is only one person to communicate with service providers as well as carry out packaging and distribution. In this second scenario it is considered for analysis because of the large initial capital required by farmer groups in running a business. In this scenario, farmer groups only carry out packaging and sales activities without the production process. The amount of noodle making services is IDR 4,500/80-gram packaging. The cost-forming components of scenario II are shown in table 3. Table 4 presents the details of the fixed cost, variable cost, semi-variable cost components as a comparison between scenario I (self production) and scenario II (third party production) at a production rate of 760 per month.

Cost Component	760 per month (Rp)	950 per month (Rp)	1140 per month (Rp)
Fixed Cost	449,500	449,500	449,500
Variable Cost	3,724,000	4,730,000	5,756,000
Semi-Variable Cost	780,000	900,000	1,000,000
Total Operational Cost	4,953,500	6,079,500	7,025,500
Sales Projection	5,701,980	7,217,910	8,551,420
BEP	6,413	6,347	6,277

Table 3. Cost Component per month of Scenario 2

In scenarios I and II, the selling price is targeted at IDR 7,500/package. The projected sales target is expected to increase from the assumption of 60% capacity in the first year and then increase 5%/year until the 10th year.

Cost Component	Self Production of 760/month (Rp)	Third Party Production of 760/month (Rp)
Fixed Cost		
Maintenance Cost	539,280	42,000
Depreciation Cost	108,944	7,500
Salary Cost	1,200,000	400,000
Building Rent Cost	300,000	-
Variable Cost		
Materials/ Services Cost	1,689,400	3,420,000
Packaging Cost	304,000	304,000
Overhead Cost	275,515	-
Semi Variable Cost		
Marketing Cost	750,000	750,000
Administration Cost	30,000	30,000

Table 4. Detail of componen cost Self production Vs Third Party Production on 760 per month

3.2 Investment Valuation

To calculate the economic feasibility analysis, the authors assume a business age of 10 years, equipment maintenance costs of 4%/month, and a discount rate of 18%.

3.2.1 Scenario 1: Self Production

1. Net Present Value

To calculate the NPV for each production capacity scenario per month, annual net cash flow data is needed.

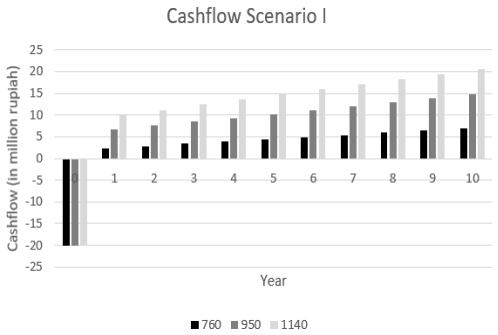

Fig. 3. *Scenario I cash flow graph*

The data in Figure 3 is entered into equation 1 so that the NPV value for each production capacity scenario is obtained and presented in table 5. Production of 760 per month produces a negative NPV which indicates business feasibility, whereas in the production capacity scenario 950 per month and 1140 per month generates a positive NPV value of IDR 22,745,376 and IDR 42,038,344 respectively. The greater the NPV, the higher and more profitable the return on capital.

	760 per month (Rp)	950 per month (Rp)	1140 per month (Rp)
NPV	-2,143,490	22,745,376	42,038,344

Table 5. NPV of Scenario 1

2. Internal Rate of Return

The IRR calculation is an iterative calculation, in helping the author determine the IRR for each scenario, the help of Microsoft Excel software is used with the formula "=IRR (cash flow array along with initial capital, initial IRR guess)". From the calculations carried out, the IRR for each production capacity scenario is summarized in table 6. In the production capacity scenario of 760 per month, the IRR is 15% <18%, so this scenario is not feasible, while the production capacity scenario is 950 per month and 1140 per month produces an IRR value of 41% and 59% respectively. The greater the IRR, the greater and more profitable the percentage return on investment.

	760 per month	950 per month	1140 per month
IRR	15%	41%	59%

Table 6. IRR of Scenario 1

3. Payback Period

To calculate the payback period, we can observe the cumulative cash flow from each scenario and see in what year the cumulative cash flow value is greater than the initial investment cost. Figure 4 shows the cumulative cash flow for each production capacity scenario.

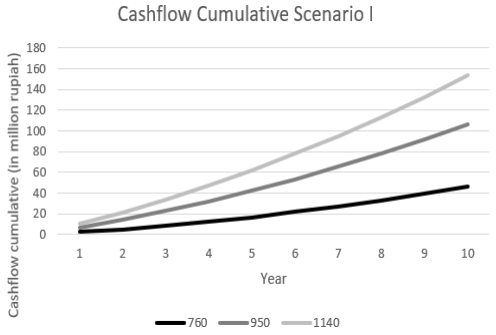

Fig. 4. Scenario 1 cash flow cumulative graph

At the production capacity of 760 per month, the amount of the initial investment will be returned in the year between the 5th and 6th year. Then at a production capacity of 950 per month, the amount of the initial investment will return between the 2nd and 3rd years. Then at a production capacity of 1140 per month, the amount of the initial investment will return between the 1st and 2nd years.

$$PP_{760} = 5 + \frac{20.000.000 - 16.750.410}{21.666.938 - 16.750.410} = 5{,}66\ years$$

$$PP_{950} = 2 + \frac{20.000.000 - 14.246.314}{22.699.450 - 14.246.314} = 2{,}68\ years$$

$$PP_{950} = 2 + \frac{20.000.000 - 10.070.436}{21.310.076 - 10.070.436} = 1{,}88\ years$$

3.2.2 Scenario 2: Third Party Production

1. Net Present Value

As in the NPV calculation for scenario 1, Figure 5 presents the cash flow from scenario 2 for each production capacity. The NPV calculation results for scenario II are presented in table 7. Production of 760 per month produces a negative NPV which indicates business unfeasibility, while the production capacity scenario of 950 per month and 1140 per month produces a positive NPV value of IDR 10,071,883 and IDR 18,573,338 in succession.

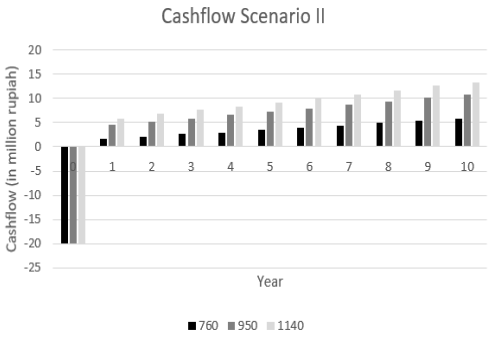

Fig. 5. Scenario 2 cash flow graph

	760 per month (Rp)	950 per month (Rp)	1140 per month (Rp)
NPV	-5,903,118	10,071,883	18,573,338

Table 7. NPV of Scenario 2

2. Internal Rate of Return

From the calculations carried out, the IRR for each production capacity scenario is summarized in table 8. In the production capacity scenario of 760 per month, the IRR is 11% <18%, so this scenario is not feasible, while the production capacity scenario is 950 per month and 1140 per month produces an IRR value of 29% and 37% respectively.

	760 per month	950 per month	1140 per month
IRR	11%	29%	37%

Table 8. IRR of Scenario 2

3. Payback Period

In Figure 6, the cumulative cash flow from scenario II for each production capacity scenario is attached.

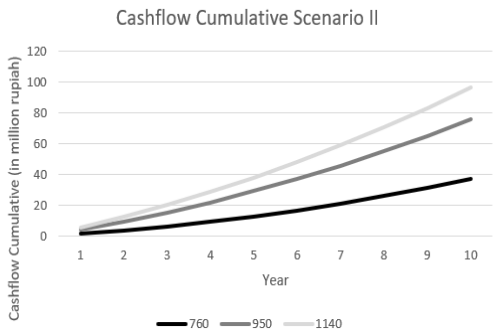

Fig. 6. *Scenario 2 cash flow cumulative graph*

As an example, consider the production capacity of 760 per month, the initial investment amount will be returned in the year between the 6th and 7th year. Then at a production capacity of 950 per month, the amount of the initial investment will return between the 3rd and 4th years. Then at a production capacity of 1140 per month, the amount of the initial investment will return between the 2nd and 3rd years.

$$PP_{760} = 6 + \frac{20.000.000 - 16.876.656}{21.324.240 - 16.876.656} = 6{,}70\ years$$

$$PP_{950} = 2 + \frac{20.000.000 - 15.460.794}{22.016.484 - 15.460.794} = 3{,}69\ years$$

$$PP_{1140} = 3 + \frac{20.000.000 - 12.718.800}{20.316.528 - 12.718.800} = 2{,}96\ years$$

3.3 Added Value Analysis

In addition to the business feasibility analysis, it is important to conduct a value-added analysis for the assessment of services obtained by business actors and measure the employment opportunities created. The higher the added value of a product will trigger tighter competition in the acquisition of raw materials and product marketing because it is more profitable [9]. Research on added value using the Hayami method. The Hayami method is presented in table 9.

No		Output, Input, and Price	Score
1		Output (Unit/production)	(1)
2		Input Materials (Kg/production process)	(2)
3		Input Workers (working day/production process)	(3)
4		Conversion Factors	(4) = (1)/(2)
5		Labor Coefficient	(5) = (3)/(2)
6		Output Price (IDR/unit)	(6)
7		Average wage for workers (IDR/working day)	(7)
		Revenue and Income	
8		Price of Raw materials (IDR/Kg)	(8)
9		Other input contributions (IDR/Kg)	(9)
10		Output price (IDR/unit)	(10) = (4) x (6)
11	a	Added Value (IDR/Kg)	(11a) = (10) - (9) - (8)
	b	Additional Value Ratio (%)	(11b) = (11a)/(10) x 100%
12	a	Workers' allowance (IDR/working day)	(12a) = (5) x (7)
	b	Workers' share (%)	(12b) = (12a)/(11a) x 100%
13	a	Income (IDR/Unit)	(13a) = (11a) - (12a)
	b	Income level (%)	(13b) = (13a)/(10) x 100%
		Remuneration for the Owner of production factors	
14		Margin	(14) = (10) - (8)
	a	Labor income (%)	(14a) = (12a)/(14) x 100%
	b	Other input contributions (%)	(14b) = (9)/(14) x 100%
	c	Company income (%)	(14c) = (13a)/(14) x 100%

Table 9. Variables and Score in Added Value Analysis using Hayami Method

Table 10 presents a table comparing the value of each sub-variable used in the Hayami Method calculation in the self-production vs third party production scenario. The added value of self-production is Rp 55,527 per kg. This implies that 1 kg of vegetable noodle material can produce an added value of Rp 55,527. This value is greater than the third-party production at the same production rate, which is Rp 32,800.

Variable	No.	Sub Variable	Self Production	Third Party Production
Output, Input, and Price	1	Output (Unit/production)	1140	1140
	2	Input Materials (Kg/production process)	90	90
	3	Input Workers (working day/production process)	20	20
	4	Conversion Factors	12.67	12.67
	5	Labor Coefficient	0.22	0.22
	6	Output Price (IDR/unit)	Rp 7,500	Rp 7,500
	7	Average wage for workers per working day (IDR/production hour)	Rp 85,500	Rp 28,500
Revenue and Income	8	Price of Raw materials (IDR/Kg)	Rp 27,473	Rp 57,000
	9	Other input contributions (IDR/Kg)	Rp 12,000	Rp 5,200
	10	Output price (IDR/unit)	Rp 95,000	Rp 95,000
	11 a	Added Value (IDR/Kg)	Rp 55,527	Rp 32,800
	b	Additional Value Ratio (%)	58.45	34.53
	12 a	Workers' allowance (IDR/working day)	Rp 19,000	Rp 6,333
	b	Workers' share (%)	34.22	19.31
	13 a	Income (IDR/Unit)	Rp 36,527	Rp 26,467
	b	Income level (%)	38.45	27.86
Remuneration for the Owner of production factors	14	Margin	Rp 67,527	Rp 38,000
	a	Labor income (%)	28.14	16.67
	b	Other input contributions (%)	17.77	13.68
	c	Company income (%)	54.09	69.65

Table 10. Added Value Analysis of Self production vs Third party production in production rate of 1140 per month

4 Conclusion

The results of this study can be concluded that building a dry noodle production business is more feasible by implementing scenario I, namely by buying production equipment and then carrying out the production process by members of farmer groups. This is based on the indicators NPV, IRR, Payback Period which show better results in scenario I. Then with the production capacity variable it is found that the production capacity of 760 packages per month is not feasible to run because the NPV value is negative, and the IRR value is smaller than the discount factor in both scenarios. A larger increase in production capacity provides greater profit because it can reduce production margin costs as seen in the production capacity scenario of 950 per month and 1140 per month in both scenarios which results in greater profits in the production capacity scenario of 1140 per month. The NPV, IRR, and PP at a production capacity of 1140 per month in scenario I is IDR 42,038,344; 59%; and 1.88 years respectively, while the NPV, IRR, and PP at a production capacity of 1140 per month in scenario II is IDR 18,573,338; 37%; and 2.96 years respectively. In scenario I, farmer groups require large initial investment capital to provide production equipment for the production, packaging, and distribution process, while in scenario II, farmer groups only need to carry out packaging and distribution. Then from the results of the added value analysis using the Hayami method, the added value obtained in self-production is Rp 55,527 which is greater than third party production of Rp 32,800 at the same production level of 1140 units/month.

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