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Article

Financial Feasibility Study of Crystalline Xylose

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Abstract: Xylose is a sugar obtained from breaking down hemicellulose. It is a polysaccharide found in the cellulose fibers of plant cell walls. One example of a plant containing hemicellulose is coffee, especially its waste called Coffee Cherry Processing Waste (CCPW). Its process's 10 L capacity production design was carried out to establish its mini factory. The financial feasibility study of each processing unit was designed. The research method used was quantitative methods. Apart from that, the approach used in this research is descriptive. The test results show that the crystalline xylose sugar processing unit is feasible to develop because the calculation results of the financial feasibility criteria are met with NPV > 0, B/C > 1, IRR 51%, PBP for two months < 5 years, which means the business owner could have returned his capital before the project period ends and BEP Q of IDR 15,565,013.54 while BEP Rp IDR 22,002479.88 was declared feasible because the BEP value was lower than the net income from xylose crystal sugar.

Keywords: Industrial design, NPV, B/C, IRR, PBP, BEP

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1. Introduction

People generally use food sweeteners as granulated sugar extracted from sugar cane plants. Granulated sugar is prevalent among people, so that it can become one of the basic needs of society, and it is continuously increasing. Granulated sugar or non-reducing sugar is sucrose sugar, which has a delightful taste and relatively high calories, so sucrose sweeteners can cause several health problems, such as obesity and diabetes (Setiawan et al., 2018). Efforts that need to be made to overcome this health problem include replacing sweeteners with xylose crystal sugar, which has a lower calorie content than sucrose sugar (Galvan et al., 2022).

Xylose is a sugar obtained from the process of breaking down hemicellulose. Hemicellulose is a polysaccharide found biochemically in the cellulose fibers of plant cell walls. Xylose is one of the most abundant carbohydrates on earth, second only to glucose(Huntley & Patience, 2018). According to Salam et al. (2023), Xylose is often called wood sugar and is found in birch trees and other wood rich in hemicellulose. Xylose is a white crystalline solid with a sweet taste but no aroma. Xylose is a sugar-free bulk sweetener that can be used as a substitute for sucrose and other fermentable carbohydrates. Although it has the same taste as sucrose, Xylose has a lower glycemic index and fewer calories. One example of a plant containing hemicellulose is coffee, especially fruit waste.

Coffee fruit waste is the remainder of the coffee processing process to obtain coffee beans. Coffee fruit waste contains lignocellulose consisting of 46.3% cellulose, 35% hemicellulose and 18.8% lignin (Zulnazri et al., 2022). Xylose belongs to the monosaccharide group, which has five carbon atoms and a free aldehyde or ketone group, so it is included in the group that reduces sugars (Sjarif,

2018). Reducing sugar is sugar that can reduce electron-accepting compounds. Reducing sugar also has a taste that is not too sweet, can bind water (hygroscopic), and is also low in calories.

In Indonesia, there is still no xylose crystal sugar processing unit for coffee waste, so a factory design was carried out for this research. Designing a factory or processing unit is the central aspect of the factory establishment plan, which includes determining production machines, production processes, layout, quality, and finances. Determining the design of a production unit can be influenced by the industrial environment, living environment, market aspects, techniques and technology, management, employment, and finance (Istianah, 2019). A business feasibility study is an activity that studies the business activities or business that will be carried out to determine whether the business is worth running. The objects studied are large businesses and simple businesses or ventures. Applied Feasibility means that in-depth research is carried out to determine whether the business will provide more significant benefits than the costs incurred (Siregar, 2012). In this case, all aspects must be considered so that designing plans for setting up a factory can follow wishes and minimize losses. The design of a xylose crystal sugar processing unit using coffee fruit waste can optimize the process so that it is not only used as animal feed and compost. Still, it can also become low-calorie sugar and reduce people's dependence on high-calorie sucrose sugar. If the entire process and all related aspects can run optimally, then the use of coffee waste can be developed continuously

The problem behind this research is that there is no xylose crystal sugar processing unit from coffee waste, so this research was carried out to determine several aspects, especially the financial needs and income from the processing unit that has been designed so that the business feasibility of producing xylose crystal sugar made from coffee can be determined—basic coffee fruit waste.

2. Materials and Methods

The type of research carried out uses quantitative methods. Apart from that, the approach used in this research is descriptive. This approach aims to provide an overview and summary of the various conditions, situations or variables that may arise.

2.1 Tools and Materials

2.1.1 Tools

Oven, grinder, autoclave, shaker incubator, centrifuge, rotary evaporator, refrigerator, Erlenmeyer, measuring cup, beaker glass, measuring pipette, ball pipette, spatula, aluminums tray and analytical balance.

2.1.2 Materials

The materials used in this research include coffee fruit waste from local coffee farmers, 0.05M acetate buffer pH 5, 4.016% xylanase enzyme and 7% xylose crystal seeds.

2.2 Research Procedures

Economic analysis determines the costs that must be incurred when using production equipment. This makes it possible to know the production costs so that you can calculate the profit from the equipment. Costs whose magnitude depends on the output produced are called variable costs. The materials used are positively correlated with the amount of product produced. However, fixed costs do not depend on how many products will be made (Tooy et al., 2023). The determinant of the success of the production unit design is the results of the financial feasibility test. This test goes through the stages of calculating several financial feasibility criteria, which are used as follows:

According to (Tooy et al., 2023), to prevent businesses from experiencing losses, cost analysis is based on economic calculations. Companies will experience inflation and shrinkage. Entrepreneurs should pay significant attention when investing in machinery or processing technology. One way is to determine and calculate the following things:

a. Cost Analysis

In cost analysis, it is necessary to calculate fixed costs or costs that do not depend on the number of products produced, variable costs or costs that depend on the number of products produced, depreciation costs or costs that are calculated depending on the economic life, building costs or costs. These are included in a production unit and are direct protection of the production unit, basic costs or costs incurred in a process, where fixed and variable costs are known, as well as total costs or operating costs by combining fixed and non-fixed costs. Not fixed. Meanwhile, according to (Hidayat, 2023), cost and income analysis is a calculation of production costs, which includes raw material costs, labour costs, operational costs and capital costs, which is the first step in economic analysis. Furthermore, the income obtained from product sales must be calculated by considering the sales volume and prevailing market prices. By comparing costs and income, gross profit ratios and net profit ratios can be generated to evaluate business profitability

b. Parameter

According to (Dewi et al., 2019), financial aspect parameters can be calculated using the following formula:

- NPV (Net Present Value)

The present value of money or money flows in the future, taking interest into account, is known as Net Present Value (NPV). states that assessing investment projects based on Net Present Value (NPV) is a method of assessing capital investment in investment projects using measurements: present value of net cash flow (proceeds) EAT + Depreciation after calculating the present value capital outlay (Ruminta, 2020)

$$\text{NPV} = \sum_{i=1}^{n} \frac{(NBi)}{(1+i)n}$$

- IRR (Internal Rate of Return)

IRR is a calculation used to determine the interest rate, which is proportional to the present value of expected cash flows in the future or cash receipts with the initial investment outlay.

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

- BCR (B/C Ratio)

The feasibility project was done to determine the business efficiency (B/C Ratio) calculation, which is carried out by comparing the revenue obtained with the costs incurred over five years. A business is considered feasible if the B/C ratio is > 1.

B/C (Ratio) = (Total Revenue)/(Total Cost)

- BEP (Break Even Point)

The break-even point (BEP) is when total production costs equal revenue. The break-even point is where the company makes no profit and suffers no losses. BEP, or break-even point, is essential for management to make decisions to withdraw products, develop products, or close unprofitable subsidiaries (Maruta, 2018).

Break Event Point (BEP)

BEP (Q) = FC/(P-VC)

BEP (RP) = FC/(1-VC/P)

- PP (Payback Period)

PP (Payback period) is the time required to return all expenses used for the initial investment. Net cash flow is the difference between income and expenses per year. The payback period is usually set at one year.

Payback period (PP) = $\frac{1}{A_b}$ x 1 year

3. Results and Discussion

The financial aspect is an aspect related to the economic condition of a business, including initial investment and profits from sales that have been made. (Afiyah et al., 2015) Understanding and analyzing finance involves assessments and determining the currency unit for certain aspects considered appropriate from the decisions made in the business analysis stages. So, the economic element is essential in establishing a business to determine the feasibility of the company being run from a financial or monetary perspective. Financial calculations require an analysis of investment costs and operational costs before calculating financial feasibility criteria.

Investment costs, namely costs invested to prepare business needs to be ready to operate well, in the form of preparation and construction of infrastructure and business facilities, including development and improvement of human resources. Operational costs are incurred to carry out the business activities accordingly. These costs are usually incurred regularly or periodically over a while (Wardana et al., 2021). The investment costs required to establish a xylose crystal sugar processing unit are IDR 15,564,928.78/year. On the other hand, operational costs of IDR 3,393,022,884/year are needed. There is a quick replacement equipment fee of IDR 1,518,000/year.

Table 1. Total Costs and Sales Price

Total cost	IDR 2.610.017.603		-	
Production/day	7.445,5	Gram	148,91	Packaging
1-year production	2.233.650	Gram	44.673	Packaging
Production Cost	IDR 1.168,498916	/gram	IDR 58.424,94579	/Packaging
Selling price	IDR 1.519,04859	/gram	IDR 75.952,42952	/Packaging
Total sales	IDR 3.393.022.884	/gram	IDR 3.393.022.884	/Packaging

Table 1 shows the total costs for one year, IDR 2,610,017,603, by adding up investment, operational, and quick replacement equipment costs. Total production/day is 7,445.5 grams or 148.91 50-gram packages. Production of xylose crystal sugar in 1 year is 2,233,650 grams or 44,673 50-gram packages. The production cost is IDR 1,168/gram, while Packaging is IDR 58,425. The selling price is IDR 1,519/gram and IDR 75,952/Packaging using a markup of 30%. Total sales proceeds amounted to IDR 3,393,022.88/year in 50-gram Packaging.

Table 2. Financial Feasibility Criteria

No.	Criteria	Result	Information
1	NPV	IDR 2.863.101.959	WORTHY
2	IRR	51%	WORTHY
3	R/C ratio	1,306	WORTHY
4	PBP	0,234	WORTHY
5	BEP Q	IDR 15.565.013,54	WORTHY

No.	Criteria	Result	Information
	BEP Rp	IDR 22.002.479,88	WORTHY

Based on Table 2, it can be seen that the xylose crystal sugar processing unit is feasible to develop because the calculation results of the financial feasibility criteria are met with NPV > 0, where according to (Evy Sulistianingsih, 2019), NPV can be said to be feasible if the results obtained are positive, B/C > 1 according to (Yuniarti et al., 2013) which states that a project is declared profitable or feasible if the Net B/C Ratio value is greater than 1, IRR 51%which is greater than the applicable interest rate, according to the statement(Prasetya, 2022) which says that investment is said to be feasible if the IRR value is greater than the applicable interest rate. Conversely, the project is not feasible if the IRR value is smaller than the relevant interest rate. According to (Kusuma & Mayasti, 2014), A business is feasible if the payback period value is less than or equal to the life of the business investment. This research obtained PBP results for two months < 5 years, meaning the invested capital can be returned before the project period ends. The BEP Q was IDR 15,565,013.54, while the BEP Rp IDR 22,002479.88 was declared feasible because the BEP value was lower than the net income from xylose crystal sugar according to research(Wahyuni et al., 2020) where business activities are worth pursuing if the BEP Q value and BEP Rp value are smaller than the research.

4. Conclusions

The results of the data and discussion above can be concluded that the feasibility of the xylose crystal sugar processing unit business is declared feasible for development because the results obtained are Net Present Value (NPV) IDR 2,863,101,959, Benefit/Cost Ratio (B/C Ratio) 1.34, Internal Rate of Return (IRR) 51%, Payback Period (PBP) 0.234, Break Event point (BEP Q) IDR 15,565,013.54 and Break Event point (BEP Rp) IDR 22,002,479.88.

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