Jurnal Teknik Industri: Jurnal Hasil Penelitian dan Karya Ilmiah dalam Bidang Teknik Industri

Vol. 10, No. 2, 2024

Evaluating Alternative Investment Options for Grinding Machines Using the Incremental Cost Method

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ABSTRACT

The increasing demand in the food processing industry poses operational challenges due to production capacity constraints. A key issue is the limited capacity of the grinding machine, which frequently overheats, leading to production delays and exceeding standard working hours. To address this problem, an investment in an additional grinding machine is proposed. A feasibility study was conducted by analyzing market, technical, and financial aspects using Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PBP). The results showed an NPV of IDR 4,824,298,738, an IRR of 34.72%, and a PBP of 3.85 years, indicating the investment's feasibility. Additionally, an incremental cost analysis was performed to compare the existing condition with the proposed alternative, yielding a ΔROR of 98%, which exceeds the Minimum Attractive Rate of Return (MARR) of 11.01%. These findings confirm that adding a grinding machine is the most viable alternative to enhance production capacity, accommodate growing demand, and improve operational efficiency. By implementing this investment, the company can optimize its production process, reduce overtime costs, and ensure a stable supply to meet market needs. The feasibility study provides valuable insights for decision-making in similar industries facing production limitations due to equipment constraints.

Keywords: *Feasibility Analysis, Incremental Cost Analysis, NPV, IRR, PBP*

Introduction

Indonesia is a developing country with a diverse industrial sector. One of the industrial sectors that is growing rapidly in Indonesia is the food and beverage industry sector [1]. The Central Statistics Agency explained that the food and beverage industry sector in Indonesia experienced an increase of 4.9% from 2021 to 2022, reaching IDR 813.06 trillion compared to the previous year, which was IDR 775.1 trillion [1]. This increase shows that demand in several areas of the food and beverage industry has also increased. One area of the food and beverage industry is the food processing industry. The processing industry is an industrial sector with economic activities that convert basic goods of low value into finished/semi-finished goods of higher value [2]. The large contribution of this processing industry is because the scope of this business field is fairly broad, including agricultural raw material products such as the soybean processing industry into tofu products. PT XYZ is a company engaged in the food processing industry with tofu production located in Tangerang Regency, Banten. PT XYZ aims to increase sales and maintain customer satisfaction. In increasing sales, PT XYZ can realize this goal as evidenced by the increase in the number of tofu product sales. The increase in sales means an increase in customer demand for tofu products. However, the increase in demand for this product is a new challenge for the company's operations at PT XYZ. Based on the results of interviews with the head of production at PT XYZ, information was obtained regarding the company's constraints that could not meet customer demand. This constraint was caused by the increase in customer demand that was not balanced with an increase in production at the company, so production capacity did not increase.

In carrying out the production process, a process time is needed that can be used as a benchmark in determining the effectiveness of the production process [3]. However, the production process time that takes place at the company certainly has a working hour limit, where the working hours for the production process at PT XYZ start at 04.00 WIB and finish at 19.00 WIB. However, based on the results of interviews with the head of production at PT XYZ and observations at the company, overtime often occurs in the production process at PT XYZ. The production process time that exceeds the working hour limit is due to inadequate machine capacity. A comparison of the machine capacity used at PT XYZ can be seen in Table 1.

Table 1. Comparison of Machine Capacity

Machine	Machine Capacity (kg/hour)	Number of Existing Machines	Total Machine Capacity (kg/hr)
Grinding Machine	200	1	200
Cooking Machine (Water Addition)	300	2	600
Screening Machine	200	3	600
Boiling Machine	375	2	750

Based on Table 1, it can be seen that there is a gap in machine capacity between the grinding machine and other machines. The lack of grinding machine capacity in meeting the production process at PT XYZ is because the company only has 1 grinding machine with a machine condition that often overheats. After all, it is used for the grinding process for a long duration. From the problems that have been explained, the management of PT XYZ plans to increase machine capacity by purchasing a new grinding machine. Thus, an analytical study was conducted on the addition of grinding machines at PT XYZ, which was reviewed from market aspects, technical aspects, and financial aspects and then compared with the existing ones currently run by the company using the incremental cost method.

A business feasibility study refers to analysis from various perspectives, such as financial, social, legal, market and promotion perspectives, innovative and special perspectives, and executive and monotter perspectives [4]. So the purpose of a business feasibility study is to determine how likely a business will succeed in the future [5]. An investment project generally requires a lot of funds and has an impact on the company in the long term, therefore, so that the funds that have been invested are not wasted, it is necessary to conduct a business feasibility study [6].

The purpose of the market aspect analysis is to determine the market size and demand growth, the market share of the product in question, and the level of market absorption to prevent overproduction that can lower prices. Market analysis is very important because no business project is successful without knowing that there is demand for the goods and services produced. This is because if the target market is clear, the future business prospects are also clear, so the risk of business failure is smaller [7].

Demand forecasting is an important component of marketing strategy to control changes in demand [8]. Forecasting techniques are attempts to predict the long-term demand for goods and services in terms of quality, quantity, and other factors based on previous data [9]

Technical analysis is needed to ensure that the concept or idea that has been chosen is feasible to implement. This is indicated by the availability of location, materials, tools, technology (methods), human resource skills, and funds needed to support the production process so that the products produced are of high quality and can meet customer needs. This technical aspect relates to the technical process of building a business project and its operation after completion [7]. In addition, the technical aspect also examines the availability of technology and readiness to carry out investments [10]

The production process is one of the production factors that exist in a company to produce a product [11]. The process of converting raw materials into finished products or adding value to products (goods and services) to meet human needs is the definition of production [12]. The selection of this equipment and facilities can be adjusted according to various criteria, such as suitability for the raw materials used and the ability of the workforce to operate them. One of the alternative ways that companies can use to improve efficiency in running their operations is by organizing the layout of their operations [13]

The financial aspect includes all financial aspects used to assess the feasibility of a project in a company [7]. The financial aspect analyzes the amount of investment costs and working capital and the rate of return on investment from the business to be run. Investment costs are costs that must be incurred at the beginning of the business year or when the business takes place to obtain production factors used in the production process[14].

Depreciation cost is the decrease in the value or price of equipment over its economic life [15]. Production cost is the total cost incurred during the process of transforming raw materials into final products [16]. Factors of production are costs that are valued in money, so total costs reflect the number of factors of production sacrificed [17].

The income statement is a report of the company's financial performance generated by a business activity in it [18]. The statement of owner's equity is a statement that shows the changes in owner's equity over a specific period, such as a month or a year.

Cash flow is cash flow or cash flow in the company in a certain period that describes how much money comes in (cash in) to the company and the types of income and also describes how much money comes out (cash out) and the types of costs incurred [19].

A balance sheet shows the total assets, liabilities and equity of a company at a particular period [20].

Investment Assessment Criteria

1. *Net Present Value (NPV)*

   Net Present Value (NPV) is a method for calculating the difference between the current investment value and the future net cash receipt value [21].
2. *Internal Rate of Return (IRR)*

   Internal Rate of Return (IRR) is a method of measuring the rate of return [21].
3. *Payback Period (PBP)*

   Payback Period (PBP) is the time required to end the initial investment with cash [21].

Incremental cost is a method for comparing two or more alternatives for an investment project. In this process, the alternatives must have the same level of output revenue [22]. An efficient method for evaluating two alternatives using incremental analysis is with the PW benefit value with the PW cost. This is because, in multi-alternative incremental analysis, costs and benefits can be used to assess several alternatives[23]. The decision criteria for incremental cost analysis are if the ΔROR value ≥ MARR, the alternative chosen is the one with the higher investment. However, if the ΔROR value < MARR, then the alternative chosen is the one with the lowest investment.

The table shows the results of identifying the analysis that will be used in this research by comparing the results of previous researchers who used different analyses or methods.

Table 2. Framework Comparison Based on Previous Research

	Yunus etc, 2020 [7]	**Ambararum etc, 2020** [24]	**Farisi etc, 2019** [25]
Issue Topic	Feasibility Analysis of Opening a New Branch	Feasibility Analysis of Opening a New Business	Feasibility Analysis of Adding a Production Line
Analysis/Methods	Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), Sensitivity Analysis, Risk Analysis	Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), Sensitivity Analysis	Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), Incremental Cost Analysis, Sensitivity Analysis
Output	Analyze the opening of new branches with extensive analysis, such as risk analysis for COVID-19 conditions as well. This is because the topic of the problem is extensive, and the research was conducted during the COVID-19 pandemic.	Analyze the opening of a new business with a broad aspect analysis and calculate in detail due to the broad subject matter.	Analyze the addition of production lines by analyzing aspects that focus on factors for adding production lines such as business processes, sales projections, and financial factors. This is conducted because the topic of the problem with the solution is still within the company's environment.
Differences	There is a comparison of alternative company locations	There is a comparison of alternative company locations	There is a comparison of alternative solutions with existing conditions
Framework Selection	The chosen framework focuses on analyzing the selection of alternative machine investments by considering market aspects, technical aspects, and financial aspects. This research is conducted using the calculation of Net Present Value		

(NPV), Internal Rate of Return (IRR), Payback Period (PBP), incremental cost analysis, and sensitivity analysis because the purpose of this research is to help companies make decisions in adding machines and allow them to gain additional profits. In addition, incremental cost analysis is used because in this research, there is also a comparison of alternative solutions with existing conditions where the topic of the problem focuses on solutions that still exist in the company environment.

Research Methods

The final project research uses qualitative and quantitative methods. The data collected consists of two types of data, namely primary data and secondary data. Primary data is obtained directly from the production company of PT XYZ through observation and interviews, as well as from the company's historical data. While secondary data is complementary data obtained through the collection of statistical data needed to support the final project work process. Data collection carried out in this study includes market aspect data, technical aspects, and financial aspects. Market aspect data is used to determine market conditions on product demand and sales in the company. Technical aspect data to determine production volume, additional grinding machines, number of additional workers, facility needs, raw material procurement, and production layout. While financial aspect data is used to calculate investment costs, depreciation expense, operational and production costs, estimated income, EAIT, owner's equity statements, ending cash balance, and feasibility analysis. However, data collection on the aspects used in this research was limited by the amount and type of data required and data privacy. This study consists of several stages, namely, the preliminary stage, data collection stage, data processing stage, data analysis stage, and analysis results stage. These stages can be seen in Figure 1 and Figure 2.

Figure 1. Research Stage

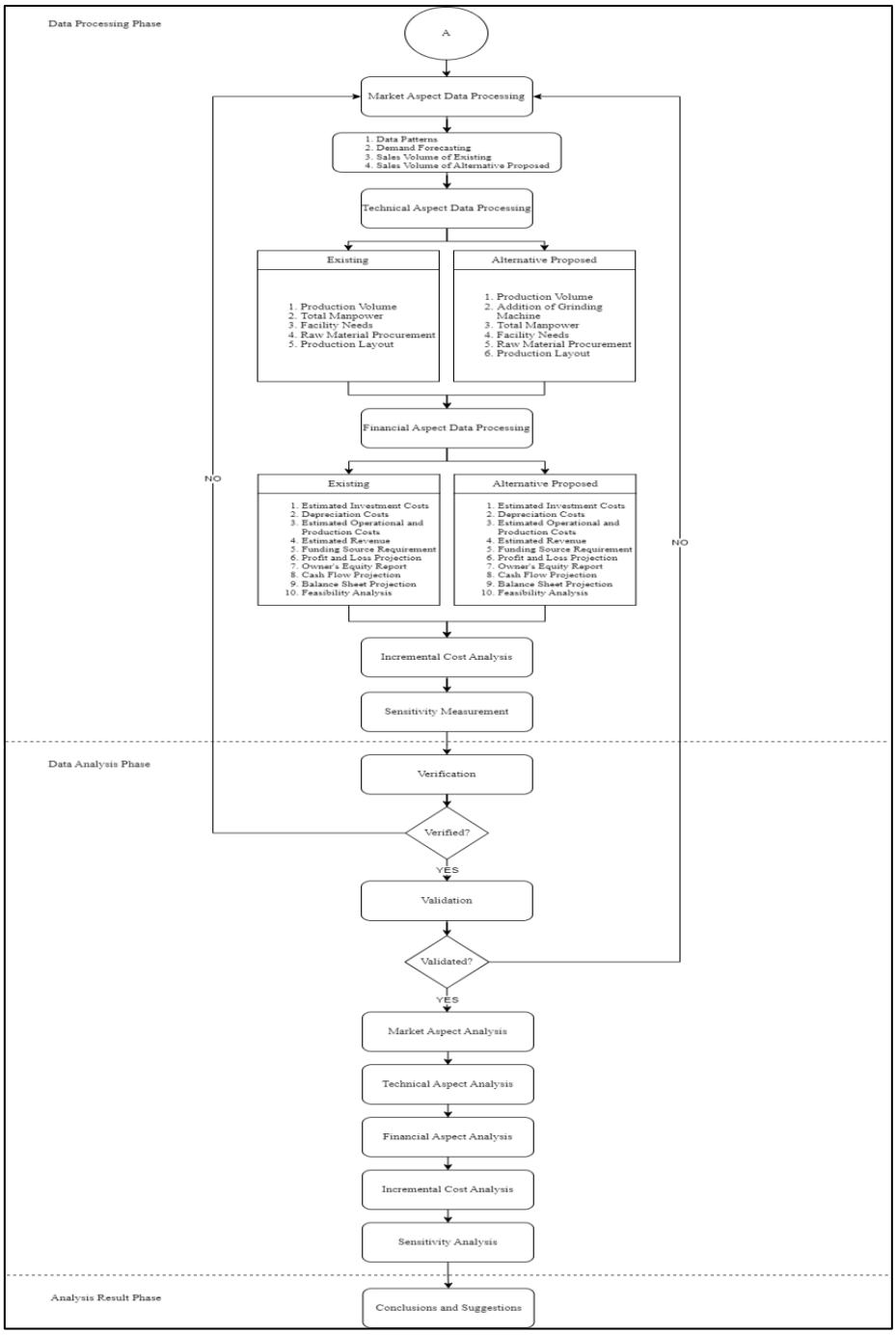

Figure 2. Advanced Research Stage

Results and Discussion

1. Market Aspect

The market aspect data aims to determine the marketing strategy of PT XYZ and the market demand based on historical sales data, which is then processed into a demand forecast. To determine the amount of demand in the future using historical sales data that will use sales data from July 2022 to December 2023. The historical sales data pattern has an upward trend data pattern, so future demand forecasting can use linear regression forecasting methods, single exponential smoothing, and double exponential smoothing. After the forecast calculation is carried out, the double exponential smoothing method is selected. The estimated demand forecast results are obtained as sales volume at PT XYZ, shown in Figure 3.

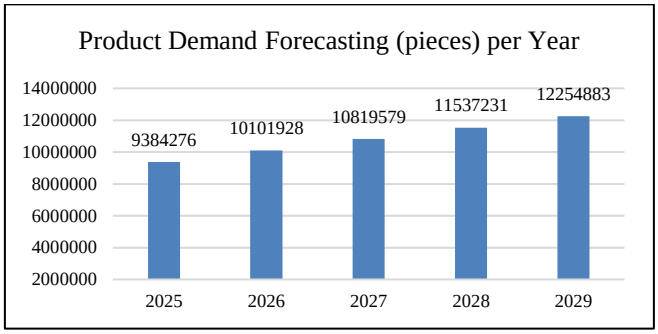

Figure 3. Demand Forecasting Results

Based on the demand forecasting results used as an estimate of the sales volume of the proposed alternative with the addition of a grinding machine, the following is a comparison of the sales volume of existing conditions and proposed alternatives at PT XYZ, which can be seen in Figure 4.

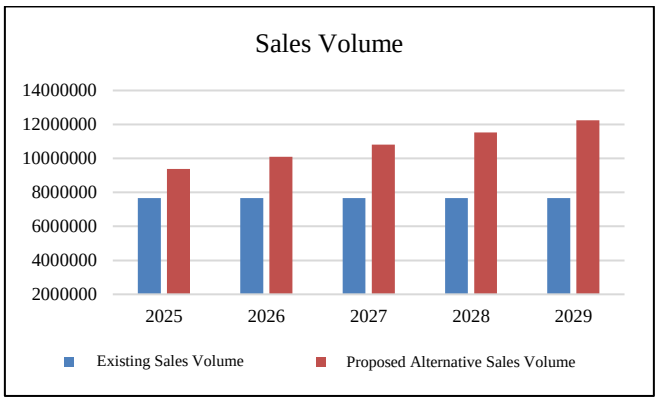

Figure 4. Sales Volume

Based on Figure 4, it can be seen that the sales volume in the existing condition has a constant amount for the next 5 years because there are no additional facilities or workforce at PT XYZ. The sales volume in the existing condition is 7657680 tofu products. Meanwhile, the sales volume in the proposed alternative is obtained from the results of demand forecasting as in Figure 3, where the sales volume increases every year.

2. Technical Aspect

In the technical aspect data, the technical requirements are calculated for each scenario, namely the estimated production volume, the estimated addition of grinding machines for the proposed alternative, the estimated number of workers, the estimated facility requirements, the estimated procurement of raw materials, and the production layout for the proposed alternative. Based on the sales volume in the processing of market aspect data, Figure 5 is a comparison of production volume for each scenario by adding an allowance of 0.5% of the sales volume.

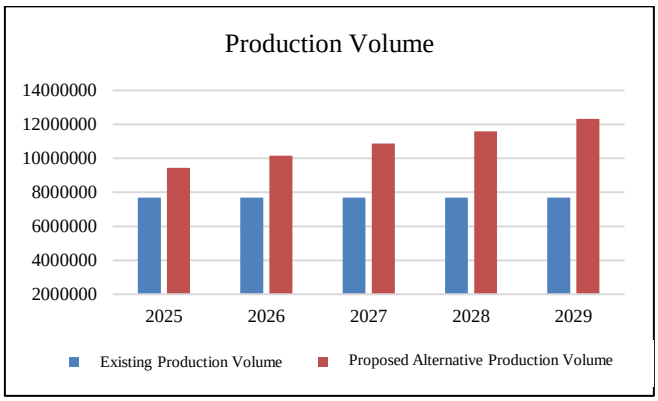

Figure 5. Production Volume

In Figure 5, it can be seen that the production volume in the existing condition has a constant amount of 7695969 tofu products. Meanwhile, the production volume in the proposed alternative increases every year. In 2025, the production volume at PT XYZ is 9431198 tofu products; in 2026, it is 10152438 tofu products; in 2027, it is 10873678 tofu products; in 2028, it is 11594918 tofu products; and in 2029, it is 12316158 tofu products.

Based on the production volume in Figure 5, the following is the calculation of the addition of grinding machines at PT XYZ, which can be seen in Table 3.

Table 3. Addition of Grinding Machines

Year	Existing Machine Capacity	Production Volume	Additional Engine Capacity	Addition of Grinding Machine
2025	4659307	9431198	4771891	2
2026	4659307	10152438	5493131	2
2027	4659307	10873678	6214371	2
2028	4659307	11594918	6935611	2
2029	4659307	12316158	7656851	2

Based on the addition of 2 grinding machines, the number of additional workers with the position of soybean grinding process staff in 2025 to 2029 is 4 workers. Where the need for facilities, procurement of raw materials, and production layout adjust to the addition of machines, additional workers, and production volume. The difference in the number of facility needs in existing conditions and alternative proposals can be seen in Table 4.

Table 4. Facility Needs

No	Item	Number of Existing Facilities	Number of Proposed Alternative Facilities
1	Grinding Machine	1	3
2	Soybean Soaking Container	2	3
3	Stainless Steel Scoop	7	8
4	Plastic Basin	2	6
5	Plastic Scoop	3	5
6	Machine Bearings (Casting)	1	3
7	Boiling Barrels, Adding Salt, Preservatives, and Coagulation	30	48
8	Printing Board	30	48
9	Pressing Tool	30	48
10	Packaging Container	50	80
11	Bag	50	61
12	Mitsubishi T120SS Pick Up Car	2	3

The research conducted a feasibility analysis for the next 5 years so that the need for facilities with an economic life of less than 5 years will be repurchased according to the number of machines, the number of workers, and the results of the production volume that have been calculated. A comparison of the repurchase of existing conditions and alternative proposals in 2026 can be seen in Table 5.

Table 5. Repurchase Facility Needs in 2026

No	Item	Number of Existing Facilities	Number of Proposed Alternative Facilities
1	Plastic Basin	2	6
2	Plastic Scoop	3	5
3	Filter Cloth	3	3
4	Bag	50	66

Table 6 is a comparison of existing and proposed alternative repurchase conditions in 2028.

Table 6. Repurchase Facility Needs in 2028

No	Item	Number of Existing Facilities	Number of Proposed Alternative Facilities
1	Plastic Basin	2	6
2	Plastic Scoop	3	5
3	Filter Cloth	3	3
4	Bag	50	75
5	*Storage*	1	1
6	Dispenser	1	1

Seeing the difference in production volume in each scenario, Table 7 is the procurement of raw materials in existing conditions.

Table 7. Procurement of Raw Materials in Existing Conditions

Soybean Raw Material Requirements (kg)					
	2025	**2026**	**2027**	**2028**	**2029**
Cut	255974	255974	255974	255974	255974
Jambi	559446	559446	559446	559446	559446
Super 36	211266	211266	211266	211266	211266
Jumbo	212920	212920	212920	212920	212920
Special	110453	110453	110453	110453	110453
Super 35	35678	35678	35678	35678	35678
Raw Material Requirements for Salt and Preservatives (kg)					
Salt	19187	19187	19187	19187	19187
Preservatives	12791	12791	12791	12791	12791

Table 8 shows the procurement of raw materials in the proposed alternative.

Table 8. Procurement of Raw Materials in the Proposed Alternative

Soybean Raw Material Requirements (kg)					
	2025	**2026**	**2027**	**2028**	**2029**
Cut	313688	337677	361666	385655	409644
Jambi	685585	738015	790444	842874	895303
Super 36	258901	278700	298499	318298	338098
Jumbo	260928	280882	300836	320791	340745
Special	135357	145709	156060	166411	176763
Super 35	43722	47066	50409	53753	57097
Raw Material Requirements for Salt and Preservatives (kg)					
Salt	23513	25311	27109	28907	30705
Preservatives	15675	16874	18073	19271	20470

Figure 6 is the proposed production layout for the proposed alternative with the addition of a grinding machine.

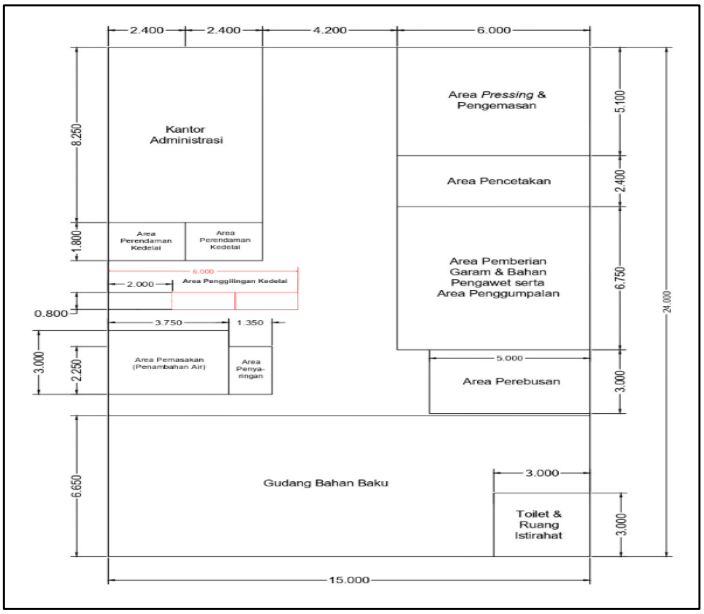

Figure 6. Alternative Production Layout Proposed

3. Financial Aspect

Based on the addition of 2 grinding machines and several facilities in the proposed alternative, Table 8 is a comparison table of investment costs incurred by PT XYZ for each scenario.

Table 9. Investment Costs

Existing	Alternative Proposal
IDR 1.127.177.770	IDR 1.240.276.770

Based on the investment costs incurred in each scenario, by looking at the economic life of each facility, Figure 7 is a comparison of depreciation costs in each scenario.

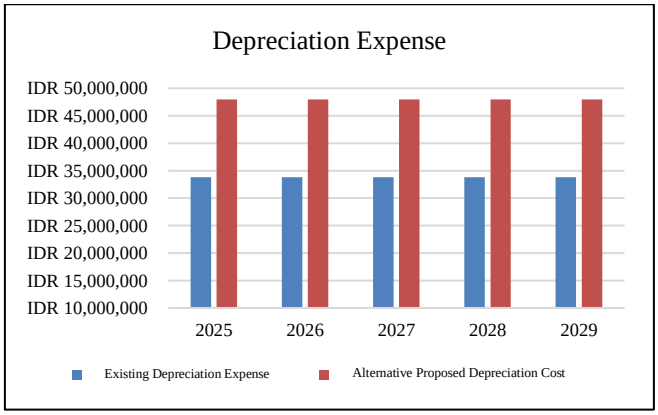

Figure 7. Depreciation Cost

The calculation of depreciation cost in Figure 7 uses the SLD (Straight Line Depreciation) method, where the total depreciation cost for the existing condition is IDR 33,800,785 for each year. Meanwhile, the total depreciation cost for the proposed alternative is different in each year, where in 2025 and 2026, it is IDR 47,944,357, in 2027 and 2028 it is IDR 47,951,857, and in 2029, it is IDR 47,965,357. Based on the calculation of depreciation cost, the salvage value is calculated for each scenario. The salvage value in the existing condition is IDR 279,193,213, and the proposed alternative is IDR 321,849,356.

In addition to investment costs, this study also calculates the company's operational and production costs for each scenario. The estimation of operational and production costs consists of direct costs and indirect costs. Direct costs include labor costs and raw material procurement costs. The

following is a comparison of labor costs for each scenario, which can be seen in Figure 8, while raw material procurement costs can be seen in Figure 9.

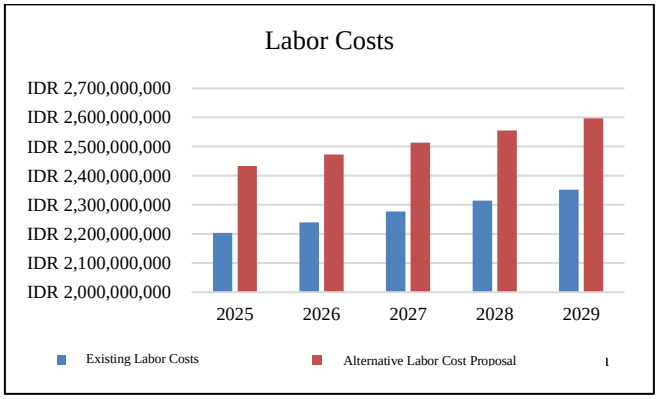

Figure 8. Labor Costs

Based on Figure 8, it can be seen that the labor costs that must be incurred by PT XYZ in existing conditions for 2025 are IDR 2,203,961,760, in 2026 IDR 2,240,106,733, in 2027 IDR 2,276,844,483, in 2028 IDR 2,314,184,733, and in 2029 IDR 2,352,137,362. Meanwhile, the labor costs in the proposed alternative for 2025 are IDR 2,433,261,600, in 2026 it is IDR 2,473,167,090, in 2027 it is IDR 2,513,727,031, in 2028 it is IDR 2,554,952,154, and in 2029 it is IDR 2,596,853,369.

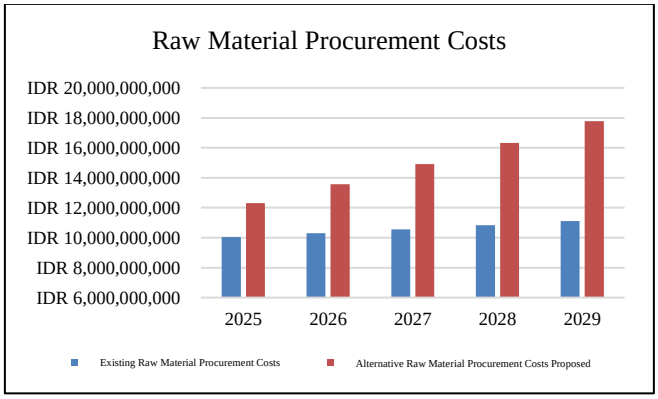

Figure 9. Raw Material Procurement Costs

The total cost of raw material procurement that needs to be spent by PT XYZ in the existing condition is IDR 10,035,208,023 for 2025, IDR 10,293,112,869 for 2026, IDR 10,557,645,870 for 2027, IDR 10,828,977,369 for 2028, and IDR 11,107,282,087 for 2029. Meanwhile, the cost of raw material procurement in the proposed alternative is IDR 12,297,870,981 for 2025, IDR 13,578,561,742 for 2026, IDR 14,916,957,387 for 2027, IDR 16,315,178,064 for 2028, and IDR 17,775,414,783 for 2029. In addition to direct costs consisting of labor costs and raw material procurement costs, there are indirect cost calculations that include electricity costs, water costs, transportation tax costs, fuel and other transportation needs, transportation maintenance costs, building maintenance costs, oil costs, machine maintenance costs, and other costs. Figure 10 is a comparison of indirect costs for each scenario at PT XYZ.

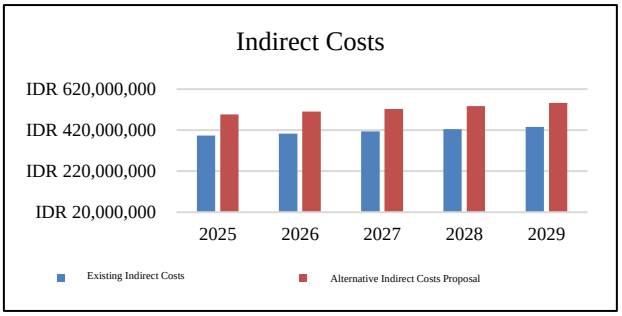

Figure 10. Indirect Costs

Based on Figure 10, it can be concluded that the total indirect costs of existing conditions for 2025 are IDR 393,413,574, in 2026 IDR 403,524,303, in 2027 IDR 413,894,877, in 2028 IDR 424,531,976, and in 2029 IDR 435,442,447. Meanwhile, the alternative indirect costs proposed for 2025 are IDR 496,911,032; in 2026, it is IDR 510,204,310; in 2027, it is IDR 523,818,994; in 2028, it is IDR 537,763,343; and in 2029, it is IDR 552,045,831. After knowing the costs that need to be incurred for each scenario, the next step is to calculate the estimated income. The estimated income at PT XYZ is obtained from the sales of tofu products, which is obtained from the results of multiplying the selling price of the product by the sales volume in each scenario. The selling price of the product is assumed to increase by 2.57% annually according to the increase in inflation.

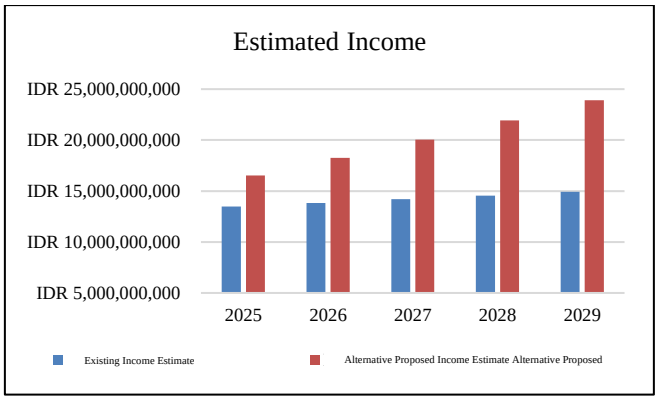

Figure 11. Estimated Revenue

Looking at Figure 11, there is an increase in estimated revenue each year. Where in the existing conditions, the estimated revenue obtained by PT XYZ in 2025 is IDR 13,495,083,718, in 2026 it is IDR 13,841,907,369, in 2027 it is IDR 14,197,644,388, in 2028 it is IDR 14,562,523,849, and in 2029 it is IDR 14,936,780,712. Meanwhile, the estimated income obtained by PT XYZ in the proposed alternative in 2025 is IDR 16,537,853,899, in 2026 it is IDR 18,260,093,013, in 2027 it is IDR 20,059,932,131, in 2028 it is IDR 21,940,222,371, and in 2029 it is IDR 23,903,910,144. Based on the estimated income and operational and production costs in each scenario consisting of direct costs and indirect costs, the EAIT (Earning After Interest and Tax) value is obtained, which can be seen in Figure 12.

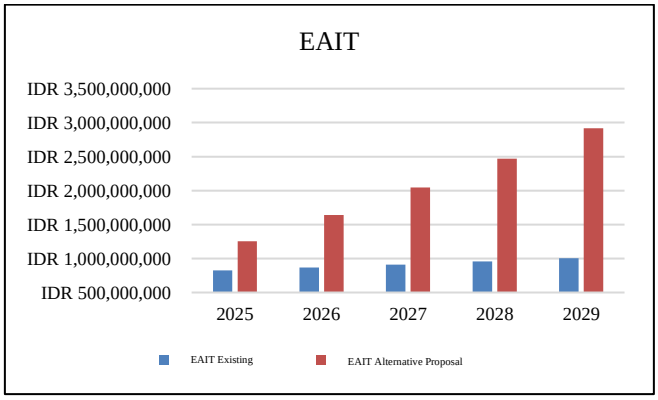

Figure 12. EAIT

EAIT in the existing condition is IDR 824,556,078 for 2025, IDR 867,005,866 for 2026, IDR 910,881,081 for 2027, IDR 956,223,842 for 2028, and IDR 1,003,077,440 for 2029. Meanwhile, EAIT in the proposed alternative is IDR 1,255,556,600 for 2025, IDR 1,641,964,437 for 2026, IDR 2,047,189,479 for 2027, IDR 2,471,955,068 for 2028, and IDR 2,916,972,650 for 2029.

Based on the initial capital to be disbursed and the EAIT received in each scenario, Figure 13 is a summary of the owner's equity costs in each scenario.

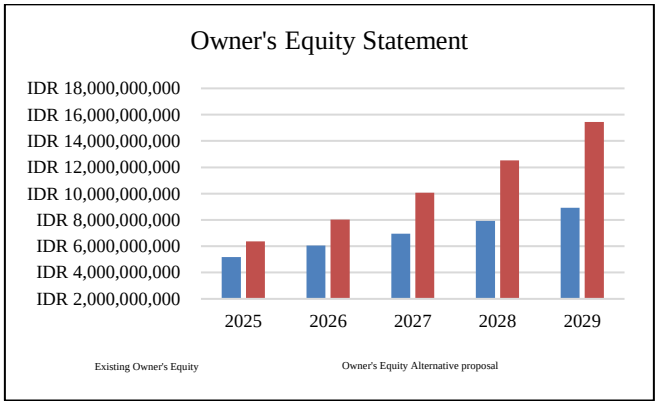

Figure 13. Owner's Equity Report

Total owner's equity in the existing condition for 2025 is IDR 5,182,639,687; in 2026, it is IDR 6,049,645,553; in 2027, it is IDR 6,960,526,634; in 2028, it is IDR 7,916,750,476; and in 2029, it is IDR 8,919,827,915. Meanwhile, the total equity of the proposed alternative owners for 2025 is IDR 6,375,604,273; in 2026, it is IDR 8,017,568,710; in 2027, it is IDR 10,064,758,189; in 2028, it is IDR 12,536,713,257; and in 2029, it is IDR 15,453,685,907.

The cash flow in this study was made in 6 years of implementation, starting from period 0 to period 5, namely in 2029. Figure 14 shows a comparison between the ending cash balances for each scenario.

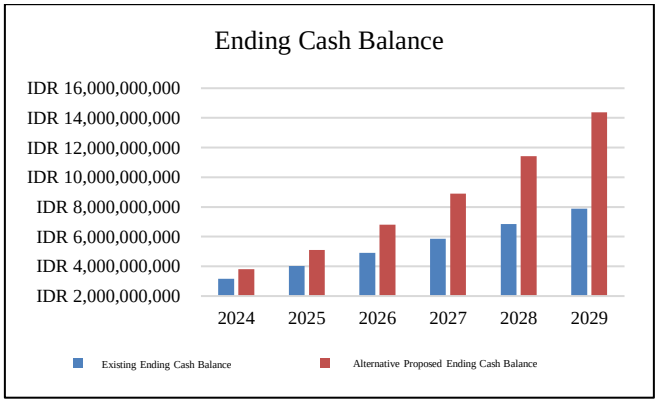

Figure 14. Ending Cash Balance

Based on Figure 14 above, it can be seen that the existing condition ending cash balance in 2024 is IDR 3,158,145,839, in 2025 it is IDR 4,016,502,702, in 2026 it is IDR 4,917,015,353, in 2027 it is IDR 5,861,697,220, in 2028 it is IDR 6,850,996,477, and in 2029 it is IDR 7,887,874,702. Meanwhile, the alternative final cash balance proposed in 2024 is IDR 3,807,010,903, in 2025 it is IDR 5,110,511,860, in 2026 it is IDR 6,799,984,653, in 2027 it is IDR 8,895,125,989, in 2028 it is IDR 11,414,138,544, and in 2029 it is IDR 14,379,076,551. The balance sheet is one of the financial reports that will show the financial position or condition in a certain period. The balance sheet consists of assets and liabilities. Assets consist of assets, current assets, fixed assets, and intangible assets. While liabilities consist of liabilities and equity. Assets and liabilities must be balanced or have the same value. In the existing condition and the proposed alternative, the value of assets and liabilities are the same, which means they are balanced.

After calculating the total cost, the next step is to conduct a feasibility analysis. Feasibility analysis is carried out to test whether the investment alternative is feasible or not. Feasibility analysis is carried out using 3 methods, namely NPV, IRR and PBP. These three methods will show whether the investment made is feasible or not with each different criteria. After the calculation, the NPV value for the existing condition is IDR 1,142,640,345 with an IRR value of 18.45% and a PBP of 4.57 years, while for the proposed alternative, the NPV value is IDR 4,824,298,738 with an IRR value of 34.72% and a PBP of 3.85 years.

Incremental Cost Analysis

After the calculation, the ΔROR value is obtained from the comparison of 98%. Where the result of the incremental cost analysis is the value of ΔROR≥MARR, then the selected alternative is the

alternative with the largest investment, namely the proposed alternative with an investment in adding a grinding machine.

Sensitivity Analysis

Sensitivity analysis is carried out to determine the impact that occurs if there is an increase in the cost of procuring raw materials or a decrease in the selling price of the product. The cost of procuring raw materials is sensitive to an increase of 8.42%, with a positive limit of 8% and a negative limit of 9%. The selling price of the product is sensitive to a decrease of 6.40% with a positive limit of 6% and a negative limit of 7%.

Conclusion

Based on the calculations and analysis conducted, the feasibility of adding a grinding machine has been evaluated from market, technical, and financial aspects. The market analysis shows that the existing sales volume remains constant at 7,657,680 tofu products annually, whereas the proposed investment in a grinding machine is projected to increase sales each year, reaching 12,254,883 tofu products by 2029. From a technical perspective, the existing condition relies on the current production setup without additional facilities or workforce, while the alternative includes purchasing two grinding machines, hiring four additional workers, and expanding production facilities to accommodate increased demand. Financially, the existing investment requires an initial capital of IDR 4,358,083,609, with an NPV of IDR 1,142,640,345, an IRR of 18.45%, and a PBP of 4.57 years, confirming its feasibility. In comparison, the alternative investment plan requires IDR 5,120,047,673 in initial capital, yielding a higher NPV of IDR 4,824,298,738, an IRR of 34.72%, and a shorter PBP of 3.85 years, indicating a more favorable return.

The incremental cost analysis further supports the investment decision, with a ΔROR of 98%, surpassing the Minimum Attractive Rate of Return (MARR) of 11.01%. This confirms that adding a grinding machine is the most viable alternative to improve production capacity, meet growing demand, and enhance operational efficiency. Implementing this investment will optimize the production process, reduce overtime, and ensure a stable supply. The study framework can also be applied to similar industries facing production constraints. Future research should consider potential risks such as market fluctuations and operational challenges to ensure long-term sustainability

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