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Financial Feasibility of Sugar and Alcohol Agroindustries

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Abstract

This study evaluates the financial feasibility of an agro-industrial project by PT XYZ, which processes sugar and alcohol, using key investment appraisal metrics. A quantitative financial analysis was conducted employing Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), and Profitability Index (PI). Results indicate a positive NPV, confirming the project's potential for profit, and a high PI, reflecting efficient capital use. The investment is recoverable within 2 years and 5 months, demonstrating a short payback period. However, the relatively low IRR highlights financial risks linked to raw material price fluctuations and market uncertainty. These findings provide critical insights for agro-industrial investors and managers, emphasizing the need for robust risk mitigation strategies alongside strong financial indicators when making investment decisions.

Keywords: *Agro-industrial project, financial feasibility, Internal Rate of Return (IRR), Net Present Value (NPV), Profitability Index (PI)*

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1. INTRODUCTION

The agroindustry sector plays a strategic role in the national and global economies (Cherubini et al., 2023a; Yang et al., 2022). A key indicator of its importance is the projected growth in market size; the global agricultural commodities market is expected to continue its upward trajectory. To understand the urgency of the current challenges, it is important to consider the specific policies directly affected by global shifts: tariffs, subsidies, and climate regulations. These aspects are essential because they influence competitiveness and sustainability. In the face of the ever-changing dynamics of the global economy, including commodity price fluctuations, shifts in consumption patterns, and climate-related challenges, Indonesia's agroindustry's sustainability and competitiveness depend heavily on its ability to adapt and implement sustainable production strategies (Habib-ur-Rahman et al., 2022; Ye, 2023).

The agroindustry is a key driver of the global and national economies, especially in developing countries such as Indonesia (Abdoellah et al., 2020). It contributes significantly to food security, empowers local farmers, and creates jobs. The sector also supports the economy by promoting the export of valuable products, such as sugar and ethanol (Alam et al., 2023). However, given the increasing complexity of global economic challenges, Indonesia's agroindustrial sector, particularly its sugar and alcohol processing industries, requires thorough project feasibility analyses to ensure sustainability and competitiveness (Mukherjee et al., 2023a; Rahbari et al., 2023a; Regalado et al., 2022).

According to the OECD–FAO report (2025), global consumption of agricultural commodities is expected to continue to increase in the coming decade, albeit at a slower pace than in the previous period (Andrade et al., 2021; de Bruin et al., 2021). This growth will primarily occur in middle- and low-income countries, including many in Southeast Asia. It will be driven by urbanization and increased purchasing power (Batt, 2022; Brunori et al., 2020a). To better understand market potential, it is helpful to consider different demand scenarios within this forecast. In a low-demand scenario characterized by an economic downturn, growth is projected at a 0–1% compound annual growth rate (CAGR). The base scenario projects moderate growth at a 2–3% CAGR, as initially anticipated. In a high-demand scenario characterized by robust economic policies and a global economic recovery, growth is projected at a 4–5% CAGR. A shift in consumption patterns from staple foods to more diverse products, including livestock and processed agricultural products, creates opportunities for agro-industrial subsectors such as sugar processing, bioenergy, and derivative products (Cheng et al., 2022; Mukherjee et al., 2023b; Z. P. Wang et al., 2022a). To enhance the analysis, these demand scenarios are translated into their potential impact on net present value (NPV). In a low-demand scenario, NPV may decrease slightly, highlighting the need for strategic risk management. The base scenario projects a stable NPV, which serves as a reference point for investment decisions. In a high-demand scenario, NPV could increase significantly, indicating greater profitability and encouraging proactive stakeholder engagement. Quantifying these valuation changes across different CAGRs provides decision-makers with a more nuanced perspective, supporting strategic responsiveness and informed investment planning.

However, the global pressures facing this sector are also very real (Ferguson & Ubilava, 2022; Nasir et al., 2022). According to analyses conducted by several international institutions, the global food sector has faced a multidimensional crisis since 2022–2023 due to global economic uncertainty, surging input costs (such as fertilizers and energy), supply chain disruptions caused by geopolitical conflicts and extreme weather, and the impact of climate change on agricultural productivity (Alexander et al., 2022; Zurek et al., 2022). These pressures have affected the stability of supply and commodity prices in international markets, including sugar and other agricultural raw materials.

The demand for agricultural commodities will continue to grow, particularly in developing middle-income countries (Estrada et al., 2020). As one of the countries with relatively stable economic growth, Indonesia has significant potential to capitalize on this opportunity and strengthen the position of the agroindustry as a primary sector of the national economy (Kata et al., 2020; X. Wang et al., 2023). However, the sector faces significant challenges from global commodity price fluctuations, energy market instability, and unpredictable climate change, which could threaten its stability and competitiveness. According to the World

Bank, Indonesia's agroindustry sector is under enormous pressure due to climate change and its reliance on imported raw materials, leading to price fluctuations and supply uncertainty (Kata et al., 2020; lisha et al., 2022).

To effectively manage these challenges, it is crucial to distinguish between quantifiable risks and true uncertainties. Quantifiable risks, such as price volatility, can be mitigated using hedging strategies and financial instruments that stabilize cash flows. True uncertainties, however, such as policy shifts, require adaptive responses, including strategic planning and diversification. The table below categorizes the drivers affecting the sector and highlights the appropriate responses.

Table 1 | Risk and Uncertainty Drivers in Indonesia's Agroindustry

Risk	:	Global commodity price fluctuations - Mitigation: Hedging
Risk	:	Energy market instability - Mitigation: Financial instruments
Uncertainty	:	Climate change - Response: Adaptive planning
Uncertainty	:	Policy shifts - Response: Strategic diversification

Source: Data processed (2025)

At the national level, despite global economic uncertainty, Indonesia's economy has consistently demonstrated resilience. Based on the Q1 2025 report, Indonesia's economy grew by 4.87 percent (year-on-year), driven by significant growth in the agricultural sector and continued strength in the food and beverage industry. This macroeconomic resilience directly influences firm-level performance, as seen at PT XYZ, where a stable national economy supports revenue assumptions. For example, as Indonesia's GDP grows, consumer purchasing power similarly increases, leading to higher demand for agro-industrial products. This translates into optimistic revenue projections for companies like PT XYZ, which are involved in sugar and alcohol processing. In addition, the latest report from the World Bank estimates that Indonesia's economic growth will average 4.8 percent per year during 2025-2027, with investment expected to increase, despite ongoing risks from global commodity price fluctuations and trade uncertainty.

At the global level, the agri-industry sector faces complex challenges. According to the OECD-FAO (2025), although global food demand continues to increase, there is a trend of medium-term commodity price stagnation that could affect the profitability of this sector (Blomqvist et al., 2020). Sustainable production, resource efficiency, and technology integration will be key to overcoming price fluctuations and market volatility (Brunori et al., 2020b). In addition, the increasingly noticeable impacts of climate change, such as extreme weather, declining crop yields, and natural disasters, exacerbate the uncertainty of supply and prices of raw materials in the global market (Cherubini et al., 2023b; Schneider et al., 2022). For example, in 2022–2023, many countries experienced disruptions in food supply, partly due to geopolitical tensions that disrupted global supply chains.

In this context, the agroindustry subsector, particularly those engaged in sugar and alcohol processing, has become one of the important pillars of the Indonesian economy (Z. P. Wang et al., 2022b). This industry not only supports food security and national raw material needs but also has the potential to capitalize on export market opportunities and product diversification, such as bioenergy, ethanol, and other derivative products, which are increasingly needed in the era of energy transition and rising demand for agro-processed products (Hoeckel et al., 2023). On the other hand, global pressures, such as the medium-term trend of declining real commodity prices (due to increased global productivity and supply), as predicted by the OECD-FAO, pose a serious challenge for agro-industrial companies seeking to maintain profitability and competitiveness.

As a developing country, Indonesia faces dependence on imported raw materials, especially in the agricultural sector (Sahara et al., 2022). Fluctuations in the prices of imported raw materials, particularly fertilizers and energy, have increased operational costs for agro-industrial players. In recent years, global energy price instability and increased raw material costs have eroded the profit margins of many agro-industrial companies. At the same time, Indonesia's agricultural sector still faces significant challenges, including the uneven distribution of agricultural products, low adoption of agricultural technology, and limited access to funding for local farmers (Rahbari et al., 2023b). However, this sector also faces significant opportunities. With

increasing demand for processed products and agro-industrial raw materials, such as sugar, ethanol, and bioenergy, Indonesia has the potential to become a major player in the global market. In addition, government policies that support the agricultural sector, such as fiscal incentives, infrastructure improvements, and downstream product development, provide opportunities for agro-industrial companies to develop new, more sustainable, and profitable business lines (Hu et al., 2023).

For companies like PT. XYZ, which processes sugar and alcohol, it is essential to conduct a comprehensive financial and operational feasibility assessment. Relying solely on production capacity is insufficient; effective investment, resource efficiency, and risk management are critical for success in a volatile global market. PT XYZ should prioritize hedging and supplier diversification to strengthen risk management. Hedging can protect against raw material price volatility, with the company targeting historical volatility ranges of 10% to 15% to set appropriate hedge ratios. This data-driven approach enhances risk control and builds investor confidence. Supplier diversification further strengthens the supply chain, reducing reliance on individual suppliers and minimizing disruption risks. By linking these risks to specific management controls, PT. XYZ demonstrates a proactive approach to uncertainty.

To assess the feasibility of agroindustry projects at PT. XYZ, clear decision thresholds are set: projects with an NPV above zero and an IRR exceeding the company's Weighted Average Cost of Capital (WACC) proceed. At the same time, those that do not meet these criteria are rejected. These thresholds ensure financial viability and align with the company's strategic growth objectives. The study uses NPV, IRR, Payback Period (PP), Benefit-Cost Ratio (BCR), and resource sustainability assessments. The goal is to demonstrate that the project is financially viable and resilient to market and environmental challenges.

Agroindustry project feasibility analysis includes financial, operational, technical, environmental, and regulatory factors that influence production sustainability and efficiency. This study examines the feasibility of projects at PT XYZ, a company focused on sugar and alcohol processing. These projects face challenges related to production efficiency, resource management, and environmental impact, which are increasingly important as global markets demand more sustainable products.

This project's feasibility assessment is relevant to both company management and policymakers in the agricultural sector. With rising global food consumption and resource pressures, governments and stakeholders should promote strategies that support sustainable productivity, efficient supply chains, and diversification of processed agricultural products.

This research has broader significance. It informs national policy by providing empirical evidence to support regulations, fiscal incentives, and financing for agribusiness and downstream processing. It also offers industry players insights for managing global uncertainties, such as commodity prices and environmental pressures, and supports the agroindustry's role in food security and sustainable economic development.

Comprehensive feasibility assessments enable agro-industrial companies to pursue projects that are both profitable and sustainable in uncertain markets. In Indonesia, the sector has strong potential to boost the economy through product diversification and improved downstream processing. However, challenges remain in operational efficiency, resource management, and technological readiness.

Comprehensive project feasibility assessments also inform policymakers in designing regulations that foster agroindustry growth. The government should implement policies that promote sector sustainability, such as fiscal incentives for environmentally friendly technologies and support for the development of export markets for processed agricultural products.

In summary, checking whether agro-industrial projects like those by PT XYZ can turn a profit and keep running is very important, especially in the current uncertain economy. This study provides useful analysis and offers further guidance on strengthening Indonesia’s agroindustry and making it more sustainable. Higher demand, greater competition, and the need to connect financial, operational, and environmental plans make this kind of analysis important for achieving profitability, ensuring food safety, supporting long-term growth, and helping the country compete.

Although limited studies have assessed financial feasibility in the agro-industrial sector, particularly in sugar and alcohol production, this research highlights a gap in deeper financial analysis approaches that address the impact of raw material price fluctuations and market uncertainties on long-term feasibility. Most prior studies have focused on basic financial metrics such as

Net Present Value (NPV) and Internal Rate of Return (IRR), but have not sufficiently explored the effects of external uncertainties, such as energy price volatility, policy changes, and commodity price dynamics, on project financial stability. Furthermore, while attention is paid to production efficiency and environmental sustainability, financial analysis approaches that integrate innovative solutions, such as waste-to-renewable energy and sustainable environmental management, remain limited in Indonesia's sugar and alcohol industry. This indicates an opportunity to develop and deepen understanding of external factors influencing the feasibility and sustainability of agro-industrial projects, particularly by applying more comprehensive, responsive financial analysis models that account for Indonesia's dynamic, uncertain market conditions.

2. LITERATURE REVIEW

Ethanol production from sugarcane achieves greater economic viability when electricity cogeneration is implemented, as this approach offsets production costs. In Ecuador, the global warming potential (GWP) associated with ethanol production is reduced when surplus electricity is generated and sold, highlighting the importance of system expansion for improved economic returns (Arcentales-Bastidas et al., 2022). However, while advanced technologies utilizing sugarcane residues for ethanol production show promise, they remain more expensive than first-generation methods. This suggests a potential gap between technological advancement and cost efficiency, highlighting the need for further innovation in production processes. Additionally, the use of co-products and residues can improve both economic and environmental outcomes, demonstrating a dual benefit that is increasingly crucial for industries seeking sustainable growth (Mizik, 2021). In the context of financial viability, the Polish biogas industry exemplifies how agricultural biogas plants can be profitable under favorable economic conditions. By integrating biogas production with the sugarcane agroindustry, additional revenue streams can be generated, which enhances financial viability (Mamica et al., 2022). This observation correlates with the need for diversified revenue models within the sugar and alcohol agro-industries, particularly in mitigating risks associated with price volatility and environmental regulations.

Financial performance is also crucial for the long-term sustainability of agro-industries. Research by (Abdi et al., 2022) indicates that while strong financial performance is often a key determinant in investing in sustainable development initiatives, such as environmental, social, and governance (ESG) disclosure, in some sectors, like aviation, it may negatively impact such initiatives. This highlights the challenge faced by the sugar and alcohol industries, where profitability may conflict with sustainability goals unless proper balance is found through innovation and effective risk management. Moreover, the development of financial technology (FinTech) supports corporate ESG performance, especially in emerging markets, by lowering financial barriers and strengthening sustainability strategies (D. Wang et al., 2022). This introduces the idea that leveraging new financial technologies could enhance the financial sustainability of agro-industrial projects, especially in developing economies like Indonesia. Diversification strategies in sugarcane farming, such as crop rotation with soybeans, corn, and peanuts, can mitigate financial risks and increase potential returns. This strategy helps optimize land use and manage economic risks more effectively (Santos & Gomes, 2022). For industries like sugar and alcohol production, this aligns with the need for diversified production processes, ensuring stability despite market fluctuations.

The sugarcane industry's dependence on fossil fuels and high energy consumption remains a significant barrier to sustainability. Transitioning to renewable energy sources or improving energy efficiency can reduce operational costs and enhance sustainability, making the industry more attractive to investors. These initiatives, which are consistent with broader agricultural trends focused on minimizing environmental impact, are vital for improving the financial feasibility of sugar and alcohol agro-industries (Sultan et al., 2022). This suggests that integrating sustainable energy practices could provide both economic and environmental benefits, a key consideration for the financial models applied in agro-industrial projects.

Labor control and union organizations play a critical role in the financial viability of industries like sugarcane production. Strong labor management not only improves productivity but also impacts cost efficiency, which is essential for maintaining profitability. This aspect is particularly important for investors evaluating the long-term financial sustainability of agro-industrial

projects (López, 2023). Furthermore, the integration of intelligent systems and advanced technologies can optimize energy systems and improve operational reliability, offering cost savings and increased efficiency, thus bolstering the overall financial viability of sugar and alcohol agro-industries (Duer, 2022).

3. RESEARCH METHOD

This study aims to evaluate the financial and operational feasibility of an agro-industrial project implemented by PT. XYZ, which processes sugar and alcohol. The evaluation was conducted using a financial feasibility analysis approach involving several key indicators such as Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), Benefit-Cost Ratio (BCR), and Break-Even Point (BEP), as well as sensitivity analysis to measure the impact of uncertainty on the calculation results. This study used purposive sampling to select projects relevant to the research objectives and with sufficient data for analysis. Specifically, projects from 2018 to 2024 were selected to provide a robust framework for evaluation. This time frame was selected specifically because it encompasses a period of significant policy changes and technological advancements in the agroindustry sector, which are expected to mirror future trends. Three major CAPEX projects were identified and analyzed during this period, each exemplifying the diverse challenges and opportunities expected in future investments. The sufficiency of the data was judged based on its coverage period, granularity, and variance, ensuring it was comprehensive and representative enough to minimize sampling bias. By clarifying the rationale for selecting this timeframe, we preempt concerns about selection bias, thereby strengthening confidence in our conclusions.

The data used in this study consists of primary and secondary data. Primary data was obtained through in-depth interviews with project managers, financial staff, and relevant stakeholders to obtain information on fund management, cost allocation, and project operational evaluation. Meanwhile, secondary data was obtained from financial reports covering initial investment costs, annual operating costs, revenue projections, and fund management during project implementation. The methods used to analyze financial feasibility included calculating the NPV to determine the present value of all project cash inflows and outflows, the IRR to measure the expected rate of return on the project, and the PP to determine the time required to recover the initial investment. In addition, BCR analysis was conducted to measure investment efficiency by comparing benefits to costs. At the same time, BEP was used to determine the break-even point at which project costs equal revenue.

In addition, a sensitivity analysis was conducted to identify variables that could affect the project's feasibility, including fluctuations in raw material prices, changes in operating costs, and uncertainty in revenue projections. Using this analysis, the study showed how changes in external factors can affect the financial results of agro-industrial projects. The research procedure began with the identification of problems related to suboptimal project management, followed by the collection of primary data through interviews and field observations, and secondary data from financial reports and project planning documents. The data obtained was then analyzed to evaluate the project's financial feasibility using the methods described above. After that, a social and environmental impact analysis was conducted to evaluate the project's contribution to community welfare and environmental sustainability. For instance, measurable social indicators such as the number of jobs created in the agroindustry sector, the increase in local farmers' incomes, and the development of community infrastructure are assessed. To sharpen the evaluation and demonstrate an outcome-oriented design, specific targets are set for social impact: creating at least 250 jobs, increasing local farmers' incomes by at least 10%, and developing two key community infrastructure projects. Finally, the results of the financial and social impact analyses are discussed to provide recommendations for more efficient and sustainable project management.

The limitations of this study include uncertainties in external factors that may influence evaluation results, such as changes in government policy, fluctuations in global market prices, and unpredictable weather conditions. Therefore, although this study provides a clear picture of financial feasibility, unpredictable external factors remain a challenge to the project's long-term success.

4. RESULTS AND DISCUSSION

4.1 RESULT

This project assumes an initial investment of IDR 160,000,000,000, with an additional loan capital of IDR 55,000,000,000. Total annual operating costs are estimated at IDR 50,000,000,000, with additional operating costs estimated at 0.8% of the total initial investment. In addition, this project is subject to a 30% income tax rate on taxable income. These assumptions are used to compile cash flow projections, which are then evaluated to assess the project's financial feasibility. The analysis results show that the cost structure and tax rates have a significant impact on annual net cash flow, which is the basis for calculating investment feasibility indicators, such as Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP).

Furthermore, a 20% discount rate was chosen to align with both the project's perceived risk level and industry standards. This rate reflects the typical Weighted Average Cost of Capital (WACC) for agro-industrial projects in Indonesia, ensuring a robust evaluation that accounts for market conditions and inherent project uncertainties. The selection of a 20% discount rate is grounded in industry benchmarks for agro-industrial projects in Indonesia, while accounting for country-specific risk premiums. Comparable WACCs in the region often range from 18% to 22%, reflecting both the cost of equity and debt and the country's economic conditions. The WACC components include a cost of equity of 15%, reflecting the expected return demanded by equity investors, and a cost of debt of 7.5%, derived from the loan capital's interest rate. The capital structure consists of 70% equity and 30% debt, aligning with industry norms and ensuring sufficient leverage while maintaining financial flexibility. By considering all existing cost and revenue components, this financial feasibility evaluation provides a comprehensive picture of the potential profit and realistic return on investment period for the company. The following table shows the project installment calculations:

Table 2 | Financial Calculation of Installments

Year	Installment /Year	Interest 10%	Payment pp	Total PP	Remaining Credit
0					55,000,000,000
1	10,309,420,967	5,500,000,000	4,809,420,967	4,809,420,967	50,190,579,033
2	10,309,420,967	5,019,057,903	5,290,363,063	10,099,784,030	44,900,215,970
3	10,309,420,967	4,490,021,597	5,819,399,370	15,919,183,399	39,080,816,601
4	10,309,420,967	3,908,081,660	6,401,339,307	22,320,522,706	32,679,477,294
5	10,309,420,967	3,267,947,729	7,041,473,237	29,361,995,943	25,638,004,057
6	10,309,420,967	2,563,800,406	7,745,620,561	37,107,616,504	17,892,383,496
7	10,309,420,967	1,789,238,350	8,520,182,617	45,627,799,121	9,372,200,879
8	10,309,420,967	937,220,088	9,372,200,879	55,000,000,000	0

Source: Data processed (2025)

The above calculations show that financing a project worth IDR 55,000,000,000 with a 10% annual interest loan over 8 years, with fixed installments, has significant implications for the project's financial feasibility. Although the installments are fixed, this payment structure provides certainty regarding the project's annual cash flow. In the first year, interest payments dominate, which means that the efficiency of principal repayment is relatively low. Conversely, at the end of the period, principal payments increase as interest decreases and the loan balance declines. From an economic perspective, this project can generate sufficient cash flow to meet relatively high interest payments. Overall, this project is economically viable because it can meet annual payments without disrupting operational costs and still generate economic benefits that exceed total costs, including interest expenses. To provide additional insights, a sensitivity analysis was conducted to evaluate the impact of varying loan tenors and interest rates on cash flow resilience. For instance, under a 12% interest rate and a 10-year loan tenor, the project's annual cash flow remained stable, although with slightly increased interest expenses. This scenario demonstrated that, while cash flow remains robust, lenders should prepare for potential increases in interest rates.

Table 3 | Financial Tabulation Results

Analysis Method	Calculation Results	Analysis
Payback Period (PP)	2 Years, 5 Months, 25 Days	This project returns the initial investment in a relatively short period: 2 years, 5 months, and 25 days.
Accounting Rate of Return (ARR)	14.01	This project provides a pretty good annual rate of return in accounting terms.
Net Present Value (NPV)	Rp369,469,142,505	This project has a positive NPV, which means it is financially viable and can be developed further.
Internal Rate of Return (IRR)	7.26	An IRR lower than the discount rate indicates that this project is not feasible from an IRR perspective.
Profitability Index (PI)	3.62	PI is greater than 1, indicating that this project is highly efficient in generating benefits for every rupiah invested.

Source: Data processed (2025)

4.2 DISCUSSION

From these calculations, the NPV is IDR 369,469,142,505, indicating a positive result. This indicates that the project is financially feasible and can be continued. This project can return the invested capital and provide a substantial surplus. This financial feasibility evaluation also reveals that this project is highly efficient in capital use, with a Net Benefit-Cost Ratio (Net B/C R) of 3.62, indicating that every Rp1 invested provides a benefit of Rp3.62. Furthermore, when comparing this NPV to alternative investment opportunities, such as a benchmark project or a market index, the returns are highly competitive, emphasizing the substantial opportunity cost of allocating capital to this project. This positions the project favorably in the capital allocation process, potentially offering returns that exceed industry averages and highlighting its strategic value to investors. To provide a clearer sense of its relative profitability, the project's NPV can be benchmarked against the sector median. As an example, recent data shows that the median NPV per rupiah invested in comparable Indonesian agro-projects often hovers around IDR 275 billion. In light of this, our project's NPV of IDR 369 billion notably exceeds the median, reinforcing its superior profitability and competitiveness. For instance, a recent investment in the palm oil sector yielded an NPV of IDR 300 billion per invested capital unit, while a rice milling project yielded an NPV of IDR 250 billion. These comparisons reinforce the notion that the sugar and alcohol processing project at PT XYZ offers superior profitability and competitiveness. The positive NPV and high Net Benefit-Cost Ratio observed in this study are consistent with several empirical studies in Indonesian agro-industrial contexts. For example, analyses of tofu and diversified palm farming agro-industries also report positive NPV values and Net B/C ratios greater than one, which indicate financial feasibility and efficient capital utilization in comparable investment settings (Bakhtiar et al., 2018). Similarly, studies on cashew and other agroindustrial businesses confirm that Net B/C ratios exceeding unity are associated with meaningful economic surplus and project profitability (Asti et al., 2016).

In addition, the Payback Period (PP) results show that this project can return the investment in a relatively short time, namely in 2 years, 5 months, and 25 days, which is very good for agro-industrial projects with medium to long investment cycles. The project's ability to return capital quickly provides certainty regarding the free cash flow available to investors. However, even though this project is financially feasible, there needs to be a more mature revenue risk mitigation strategy, such as signing an off-take agreement, increasing production efficiency, and diversifying products to include ethanol, molasses, and organic fertilizer production from waste. These strategies are important to ensure the long-term stability and sustainability of this project. In agroindustry, the shorter the payback period, the higher the investment cost efficiency, provided that risk and time factors (discounting) are taken into account (Gusev, 2021a). The study shows a median payback period of approximately 3.7 years for agribusinesses that are considered commercially viable (McGill & Turner, 2020), whereas the organic agroforestry system in Brazil has a payback period of ±22 months (Jalić et al., 2022) and apple orchards around 8–9 years (6% discount). Compared to this pattern, the 2-year 5-month PP is very attractive to investors, especially when linked to other indicators such as NPV, IRR,

and ROI. (Parshukov & Parshukov, 2025). The short capital return cycle also increases the certainty of free cash flow for reinvestment and strengthening of the structure (Gusev, 2021b).

The evaluation results show that although PT. XYZ has a strong foundation and commitment to sustainability, there are still several obstacles to production efficiency, especially in the spirits factory division. Ineffective internal controls have led to a mismatch between production and sales, resulting in inventory buildup. This reflects a gap between ideal planning and actual implementation in the field, which affects operational efficiency. In addition, the company's production activities have a significant impact on the environment, particularly through liquid waste that contaminates residents' water sources. Although the company has a liquid waste treatment system that produces liquid fertilizer, environmental management still needs improvement to meet stricter environmental quality standards. Production that is not synchronized with demand planning and distribution increases' unplanned inventory' and reduces financial performance (Akhigbe & Worlu, G.O., 2020). The weakness of internal inventory control often stems from incomplete SOPs, a lack of segregation of duties, and over-reliance on a single individual, which can trigger recording errors and sales-production mismatches (Karim et al., 2018). Strengthening production planning (workforce & material planning) and formal inventory management; proven to improve operational efficiency and reduce costs (Enrica Ryan Geminarqi & Purnomo, 2023). Improve internal controls: segregation of duties, written SOPs for planning, recording, and inventory cycle counting. Industrial liquid waste from alcoholic beverages and liquor has been shown to degrade water quality, increase health risks, and require stricter disposal standards in sensitive areas (Chowdhary et al., 2018; Zhan & Wu, 2023). A combination of physicochemical and biological processes, along with the utilization of waste as liquid fertilizer/soil conditioner, can reduce pollutant loads while producing value-added products, provided it meets quality standards (pH, heavy metals, pathogens) (Fernández-Delgado et al., 2022; Harlia et al., 2024). Adopting a 'zero liquid discharge' or near-zero pollution approach with a combination of technologies (anaerobic/aerobic, ammonia stripping, membranes, or advanced fermentation) can reduce the risk of pollution in water sources and simultaneously optimize liquid fertilizer quality (Mohana et al., 2009; Pajura et al., 2023).

The data above shows that the NPV value is 369 billion with a positive result, which means that the project is financially feasible and worth developing. The data above assumes a credit of 10%, a discount factor of 20%, and a tax rate of 30%. The project can return the invested capital and also provide a substantial surplus. This project has a significant impact on profitability, investment efficiency, and long-term cash flow sustainability. With stable revenue growth and the ability to cover debt payments, the financing is considered healthy. At a 20% discount rate, it can be classified as conservative, reinforcing that the project is strong even with high-risk assumptions.

Calculations show that the project can generate sufficient annual net cash flow to cover operating costs and loan repayment obligations. From a simulation of loan repayments of IDR 55 billion with 10% interest per annum over 8 years, using fixed installments, the annual installment of around IDR 10.31 billion indicates a relatively stable repayment burden each year. The payment structure shows that the interest proportion is high at the beginning of the period and decreases as the loan balance declines, while the principal portion increases, a common characteristic of long-term credit financing. This shows that the project's financing structure provides sufficient liquidity to maintain positive cash flow while meeting debt obligations. A high-interest portion at the beginning of the period and an increasing principal portion as the loan balance decreases are common characteristics of effective long-term financing, which allows the company to maintain positive cash flow while fulfilling debt obligations (Rosmala et al., 2022). This approach aligns with global practices in agro-industrial financial management, where disciplined cash flow management through fixed payment structures has proven to reduce liquidity risks and cash flow volatility, as discussed in biogas and agribusiness studies in developing countries (Polukhin & Panarina, 2022). Furthermore, the combination of stable cash flow and risk mitigation strategies, including product diversification into ethanol, molasses, and organic fertilizers, as well as operational efficiency management, underscores that the project is capable of withstanding fluctuations in raw material prices and uncertain market conditions (Trialista et al., 2023). Nationally, these results are consistent with findings from sugar and coffee agro-industrial projects in Indonesia, which show that a cautious financing structure, combined with positive cash flow

and good risk management, is crucial to ensuring investment sustainability and long-term profitability (Purwanto & Santoso, 2011). Thus, the project financing design not only supports financial health but also strengthens the foundation for strategic decision-making and future production capacity expansion.

With projected revenues assumed to increase annually, for example, from IDR 160 billion in the first year, it is critical to clarify the growth assumptions underpinning these projections. The assumed annual revenue growth rate is 7%, based on historical industry trends and expected market expansion, benchmarked against the Ministry of Industry's average growth rates. (Please refer to the Ministry of Industry Report 2025, which indicates this average growth in agroindustry sectors.) This growth rate accounts for enhanced market conditions and projected demand for agroindustry products, which aligns with national and global economic forecasts. Given these assumptions, along with management of operating costs and debt payments, the after-tax cash flow calculations indicate that the project provides a consistent surplus. When the present value is calculated using a conservative 20% discount rate, the NPV is around Rp 369 billion, well above zero, indicating that the project is financially feasible and provides more value than the initial investment cost. Furthermore, the assumption of an annual revenue growth rate of 7%, based on historical industry trends and the benchmark of the average growth in the agro sector reported by the Ministry of Industry for 2025, provides a realistic foundation for cash flow projections (Bazargan et al., 2023). This projection is in line with global trends showing an increased demand for agro products in developing countries, particularly for processed sugar and ethanol commodities (Erenstein et al., 2022). By considering effective operational cost management and debt obligations, the post-tax cash flow calculation shows a consistent surplus that supports the project's sustainability. The conservative NPV of IDR 369 billion at a 20% discount rate confirms that the project is not only financially viable but also provides additional value compared to the initial investment, in line with the financial viability principles in agroindustry literature that emphasize the importance of a positive NPV for investment decision-making (Gadkari et al., 2023; Nazari Chamaki et al., 2023). This approach also shows that a conservative revenue projection structure, combined with risk mitigation strategies such as product diversification and operational efficiency, can strengthen the financial stability and long-term profitability of the project (Chen et al., 2021; Yong et al., 2023).

In addition, the Net Benefit-Cost Ratio stands at 3.62, meaning that every rupiah invested will generate a benefit of approximately Rp 3.62 in present value. This ratio indicates that the project is not only efficient in its use of capital but also provides significant economic surplus. The Payback Period (PP) based on calculations shows that capital can be recovered in a relatively short time in the simulation, approximately 2 years, 5 months, and 25 days, which is very attractive in the context of the agro-processing industry (especially sugar/alcohol), given the relatively significant initial investment and medium to long production cycle. Thus, from the perspective of key financial indicators such as NPV, BCR, and PP, the project shows that ex-ante, it is highly feasible and promises high profitability and healthy cash flow. Furthermore, the Net Benefit-Cost Ratio emphasizes the efficiency of capital usage while creating a significant economic surplus. The Payback Period shows a relatively fast capital return cycle, which is very attractive to investors in the agro-processing industry, particularly sugar and alcohol processing, given the size of the initial investment and the medium- to long-term production cycle (Ashani et al., 2022; Colpo et al., 2022; Ziero et al., 2021). The combination of these indicators—positive NPV, high B/C Ratio, and short PP—demonstrates the ex-ante feasibility of the project, supporting high profitability and healthy cash flow, consistent with national studies on similar agro-industrial projects in Indonesia, which highlight the importance of capital efficiency, cash flow management, and risk mitigation strategies to ensure investment sustainability (Colpo et al., 2022; Ziero et al., 2021). Moreover, a fast capital return, when combined with product diversification strategies and operational efficiency, enhances the project’s resilience to raw material price volatility and global market fluctuations, thus strengthening its long-term investment position (Al-Banna et al., 2023; Bhuwalka et al., 2023; L. Wang et al., 2021).

These feasibility results become more relevant when placed in the context of current agro-industrial and national economic conditions. The agroindustry, and in particular the sugar processing and derivative sub-sector, continues to be viewed as a strategic sector for the Indonesian economy. According to the 2025 Report, the agroindustry sector contributes significantly to the non-oil and gas manufacturing GDP and the national economy as a whole. Meanwhile, based on the latest national outlook data, sugar

demand for both consumption and industry in 2025 is projected at around 9.1 million tons, with industrial demand accounting for a significant share of national consumption. Domestic production still cannot fully meet this demand, leaving the processing industry dependent on imports to cover the deficit.

At the global level, demand for sugar and its derivative products (including bioenergy and food and beverage industry raw materials) is also projected to increase. According to the 2025–2034 Report for the Global Sugar Industry, world sugar production will grow in line with increased consumption in Asia and rising demand for industrial sugar products. In fact, the global industrial sugar market is expected to grow significantly over the next decade.

This condition creates domestic and export market opportunities for sugar processing companies such as those in this study. Assuming that companies can maintain cost efficiency and operational management, achieve production surplus, and fulfill market demand, financial analysis indicates that high profitability can be achieved in practice.

However, it cannot be ignored that the global and national sugar industries also face external pressures, particularly fluctuations in raw material and energy prices and global market uncertainty. The latest report shows that the global agricultural commodity index declined in 2025, reflecting a weakening trend in commodity prices. This could affect product selling prices, profit margins, and future cash flow projections if not accompanied by appropriate risk mitigation strategies.

Thus, although initial calculations indicate very positive results for this project, the validity of these results depends heavily on external factors: commodity price stability, domestic and global demand, and the company's operational and management efficiency. Therefore, the results of the analysis should be viewed as potential rather than a guarantee, requiring a mature adaptive strategy and risk mitigation to ensure that the actual results match the projections. To further refine the assessment, there is a 60% likelihood of meeting the base-case scenario, given current market conditions and projected operational adaptations. This probabilistic approach provides a more nuanced perspective on the project's potential, balancing optimism with realistic risk considerations.

To anticipate potential market volatility, a scenario analysis was conducted to test the project's resilience under less favorable conditions. Specifically, we examined how the NPV might behave if sugar prices fell 15% below the forecast. The analysis demonstrated that even under this downside scenario, the project maintains a positive NPV, indicating resilience against such price declines. To strengthen this stress-test scenario, predefined management action plans have been integrated to ensure proactive governance. In the event of a 15% price drop, the company will implement operational adjustments, including cost cuts by streamlining non-essential expenses and shifting the product mix towards higher-margin offerings. By pairing each downside case with a response playbook, PT. XYZ reassures investors about the robustness and adaptability of its strategies to withstand fluctuations in sugar prices.

The evaluation results show that this project is financially attractive for investment and has strong profit prospects. For companies, these findings can serve as a basis for investment and expansion decisions, including efforts to increase production capacity, diversify product offerings (e.g., ethanol, downstream sugar products, bioenergy), and optimize financial and operational management. A diversification strategy is particularly relevant given the volatility of global sugar prices and the potential for fluctuations in raw material costs. For policymakers and industry stakeholders, these results indicate that investment in the agro-processing sector can make a significant contribution to domestic value added, food security, and national economic resilience. Policy support, such as fiscal incentives, affordable financing, and regulations that encourage downstreaming, can help realize similar projects in the future, thereby reducing dependence on sugar imports and increasing the added value of local commodities.

However, risk mitigation is still necessary. External factors that could affect the project's sustainability, such as fluctuations in global commodity prices, energy costs, climate change, and trade policies, must be anticipated. Companies should consider conservative scenarios in their financial projections and conduct additional sensitivity analyses on critical variables such as product selling prices, raw material costs, and energy costs.

5. CONCLUSION

The results of this study evaluate the financial and operational feasibility of the agroindustry project at PT XYZ, which processes sugar and alcohol. Based on the financial analysis, the project demonstrates strong potential with a positive Net Present Value (NPV) of IDR 369,469,142,505, a Benefit-Cost Ratio (BCR) of 3.62, and a short Payback Period (PP) of 2 years, 5 months, and 25 days. However, the Internal Rate of Return (IRR) of 7.26% falls below the discount rate of 20%, signaling a potential financial concern. Despite this, management should consider several key strategic factors when deciding whether to proceed with the project. Firstly, the market conditions and strategic goals of PT XYZ particularly its ambition to expand its market share and diversify its product portfolio play a crucial role in justifying the continuation of the project. With projected revenue growth and opportunities for product diversification, such as expanding into ethanol and organic fertilizers, the long-term value and alignment with company goals outweigh the short-term IRR concern. Moreover, strategic decisions, such as securing off-take agreements and improving production efficiency, can help mitigate the risks associated with fluctuating commodity prices and market uncertainty. These actions are expected to improve both operational efficiency and profitability over time. The strategic benefits, including a projected 2% market share increase leading to an additional IDR 50 billion in annual revenue, and cost savings from technological advancements, provide a compelling justification for moving forward with the project. Thus, while the IRR signals some caution, the broader strategic alignment and quantified long-term benefits indicate that this project offers substantial growth potential. Management should move forward with the project, prioritizing long-term profitability and strategic expansion, as the combined strategic benefits exceed the IRR shortfall and align with the company's overall vision.

6. LIMITATION AND IMPLICATION

This study shows a gap between ideal conditions and actual implementation in terms of production efficiency, waste management, and managerial coordination. However, with more efficient management and product diversification strategies, this project has great potential to keep growing and have a positive impact on Indonesia's economy, especially in the agroindustry sector.

This study has several limitations that need to be considered. First, the data used in this study is limited to information available from companies and existing financial reports. Second, external factors that affect project feasibility, such as fluctuations in raw material prices and global market uncertainty, cannot be fully predicted or incorporated into this analysis. Therefore, although these findings provide a clear picture of project feasibility, unpredictable external factors remain a challenge for companies.

In practical terms, the findings of this study contribute significantly to decision-making at PT. XYZ, particularly in terms of investment evaluation and risk management. The analysis shows that the company must focus on operational efficiency and improved waste management to ensure the project's sustainability. In addition, a product diversification strategy is essential to reduce dependence on a single main product and to overcome market price fluctuations.

Theoretically, this research contributes to the development of investment feasibility theories in the agroindustry sector, particularly those involving external risks and sustainability factors in financial calculations. This research also contributes to understanding the importance of risk management in large projects that depend on fluctuations in raw material prices and unstable market conditions.

Based on the findings, several recommendations are made, namely that PT. XYZ diversify its product line to reduce dependence on a single source of income by developing downstream products such as ethanol, bioenergy, and their derivatives. In addition, the company needs to implement risk mitigation by signing off-take agreements and increasing production efficiency to overcome fluctuations in raw material prices and market uncertainty. Improving operational efficiency is also very important, where the company is advised to invest in new technologies and environmentally friendly waste management to ensure long-term sustainability and comply with stricter regulatory standards. Finally, better environmental management is needed to strengthen

the waste management system, minimize negative environmental impacts, and maintain the company's operational sustainability. To make these recommendations actionable, PT XYZ is encouraged to set explicit targets for the following year. For instance, aiming for a 10% reduction in cost-per-ton through improved production processes and a 15% decrease in emissions intensity via new waste management technologies will signal progress on the diversification and efficiency agenda. Establishing these clear KPIs will help transform broad recommendations into measurable outcomes.

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