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Analysis of Factory Operational Scheme Using Decision Tree Method with C4.5 Algorithm

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Abstract

PT Pupuk Iskandar Muda (*PT PIM*) must optimize idle industrial assets in the *Arun Lhokseumawe SEZ* by selecting among three operational schemes: leasing, *operating cooperation (KSO)*, or self-management for the ex-*PT AAF H₂O₂* factory. This decision requires a data-driven approach to balance financial and risk factors. This study aims to determine the most feasible operational scheme based on economic indicators, including Net Present Value (*NPV*), Internal Rate of Return (*IRR*), and Payback Period (*PP*), as well as two primary risk dimensions: operational risk and market risk. The research method employs a descriptive-analytical quantitative approach. The data utilized are secondary, sourced from the project feasibility study and internal documents of *PT PIM*. Modeling was conducted by processing six main variables in categorical form to construct a decision tree structure using the *C4.5 algorithm*. The principal findings indicate that the self-management scheme is the most feasible option, delivering the strongest financial performance: an NPV of approximately Rp 38.77 billion, an IRR of 14.48%, and a Payback Period of 5.58 years. The established decision tree structure explicitly illustrates how the combination of risk and financial indicators can lead to different final decisions. This research makes a methodological contribution by applying the *C4.5 algorithm* for data-driven strategic decision-making. This approach has demonstrated improvements in accuracy, objectivity, and transparency when assessing the operational feasibility of industrial assets and can be replicated for similar cases in other sectors.

Keywords: *operational scheme, decision tree, C4.5 algorithm, NPV, IRR, market risk, factory reactivation, H₂O₂.*

INTRODUCTION

The reuse of idle industrial assets is one of the strategic issues in the management of asset-based companies, especially in the petrochemical industry sector where operational efficiency is a primary objective (Olanrewaju & Abdul-Aziz, 2015; Marimuthu & Khaliq, 2021). PT Asean Aceh Fertilizer (AAF) is a urea fertilizer company located in Krueng Geukueh, North Aceh, established in 1981 with a urea production capacity of 570,000 tons per year. This company is a joint venture among ASEAN member countries. In 1999, to diversify its product portfolio, PT Asean Aceh Fertilizer (AAF) established a hydrogen peroxide (H₂O₂) plant with a capacity of 12,000 tons per year (100% H₂O₂). The H₂O₂ factory, utilizing hydrogen feed gas obtained from PT AAF's ammonia plant, began its first production in July 2002 and underwent performance tests with satisfactory results (Al-Mashaqbeh & Gharaibeh, 2020). However, since December 2003, the AAF

plant has been shut down due to a lack of natural gas supply as a raw material. Consequently, with the cessation of operations at the ammonia and urea plants, the H₂O₂ plant—which had only been operating for a few months—was also stopped due to the unavailability of raw materials (Azmi et al., 2018; Ginting et al., 2022). The challenge of maintaining operational resilience in the face of input shortages is a critical issue for the long-term sustainability of petrochemical operations (Vera et al., 2020; Habib & Wenzel, 2016; Purba et al., 2023).

In the context of company development, PT Pupuk Iskandar Muda (PIM) undertook a corporate action in 2018 by purchasing the assets of the former PT AAF as development land and for several other industries as commercial land (Neupane et al., 2023). This strategic acquisition reflects a broader trend in brownfield redevelopment, where idle industrial assets are repurposed to support regional economic revitalization (Dixon et al., 2011; Loures et al., 2013). This area has since been inaugurated as the Iskandar Muda Industrial Area (IMIA), which includes the former PT AAF hydrogen peroxide (H₂O₂) factory. The transformation of such assets into integrated industrial estates has been shown to foster regional industrial clustering and investment attraction (Chung et al., 2017; Sun et al., 2019). Moreover, industrial redevelopment plays a key role in sustainable land use and long-term urban-industrial integration, particularly in emerging economies like Indonesia (Wei & Leung, 2005).

Following the acquisition of AAF assets by PIM in 2018, and to generate returns from these existing assets, PT Pupuk Iskandar Muda (PIM) seeks to re-operate the H₂O₂ factory using several operational schemes, including: H₂O₂ factory rental, operation cooperation (KSO), and self-management (swakelola). The H₂O₂ plant lease scheme involves PIM leasing the assets to a third party on an as is basis for an agreed period, with PIM earning income from asset leasing (Barlow et al., 2014; Campbell et al., 2012). The Operation Cooperation Scheme (KSO) is a collaborative operational model where raw materials and utilities are supplied from PIM factories, factory repair and operation are managed jointly with third parties, and product marketing is handled in collaboration with offtakers (Zhao et al., 2016; Mazzucchelli et al., 2021). Meanwhile, under the Self-Management scheme, the operation of the H₂O₂ factory is fully managed by PIM, including factory repairs, provision of raw and auxiliary materials, utilities, labor, and the search for partners or third parties as product offtakers (Liu et al., 2020; Gadde & Aitken, 2011; Tavakkoli-Moghaddam et al., 2020). These operational models are common strategic choices for firms optimizing underutilized assets in resource-intensive industries.

Each scheme presents different characteristics, challenges, and financial implications in terms of potential benefits and inherent risks. Therefore, a data-driven approach is required to evaluate the feasibility of each scheme objectively and systematically. This study analyzes economic indicators such as Net Present Value (*NPV*), Internal Rate of Return (*IRR*), and Payback Period (*PP*), as well as market and operational risks, which are the main determinants in investment decision-making.

Based on this urgency, the study is titled: “Analysis of Factory Operational Scheme Using Decision Tree Method and C4.5 Algorithm Approach (Case Study: Hydrogen Peroxide Plant PT PIM),” with the aim of providing scientific contributions and serving as a strategic consideration for PT *PIM* in selecting the most feasible, efficient, and adaptive operational scheme in response to market dynamics and internal company conditions.

RESEARCH METHODS

This research was conducted at PT Pupuk Iskandar Muda’s Hydrogen Peroxide (H_2O_2) Factory Reactivation Project from March to December 2024, encompassing an 18-month project timeline that included feasibility studies, risk assessments, procurement, and commissioning phases. The study employed a descriptive-analytical quantitative approach, utilizing the *C4.5 algorithm* to develop a decision tree model for evaluating the most feasible operational scheme among leasing, cooperative operation (*KSO*), or self-management. This method was chosen for its ability to systematically integrate financial and risk analysis, with secondary data from the company’s feasibility studies serving as the primary foundation due to its validated reliability and relevance to the project’s actual conditions.

The research relied on six key financial and risk variables—Net Present Value (*NPV*), Internal Rate of Return (*IRR*), payback period, discount rate, operational risk, and market risk—which were processed categorically to fit the *C4.5 algorithm*’s requirements. These variables were carefully selected for their critical role in investment decision-making, ensuring the model’s outputs would be both logically interpretable and practically applicable. To strengthen the analysis, the study followed a structured methodology, beginning with a literature review on investment feasibility and decision-making algorithms, followed by data collection, manual modeling in Excel for entropy and gain ratio calculations, and automated modeling in RapidMiner for efficiency and visual validation.

By comparing results from both manual and automated approaches, the research ensured methodological rigor while assessing the model’s accuracy and consistency. The *C4.5 algorithm*’s core components—entropy, information gain, and gain ratio—were applied to determine optimal decision nodes, ultimately generating a data-driven recommendation for the most viable operational scheme. This dual-modeling approach not only enhanced the reliability of the findings but also provided deeper insights into the classification logic, supporting PT *PIM* in making an informed, strategic decision for the factory’s reactivation. By combining manual and automated approaches, this research not only ensures the logical validity of the built model but also optimizes the effectiveness of the analysis through the application of data mining technology.

RESULTS AND DISCUSSION

Operational Scheme Based on Financial Aspects & Risk

The main data source comes from the feasibility study of the Hydrogen Peroxide plant project owned by PT Pupuk Iskandar Muda (PT PIM) which includes various technical documents, financial evaluation reports, as well as operational and market risk assessments. The use of secondary data allows this study to directly focus on the stages of analysis and development of classification models without having to go through a primary data collection process that requires a fairly long collection time. The data in this study is presented including:

1. Financial Feasibility Study

The calculation of NPV (Net Present Value), IRR (Internal Rate of Return), Discount Rate, and Payback Period are parameters used simultaneously in the study of the financial feasibility of a project to provide a comprehensive picture of the potential benefits and risks of an investment or long-term project decision-making and are also used to assess the extent to which an investment or project can provide economic benefits.

For the calculation results of each Scheme and the risks as explained in the following table:

Table 1. Data Results of Financial Feasibility Study Calculation

Indicators	Rent	KSO	Self-Managing
DR.	10.15%	7.13%	12.06%
IRR	13.61%	10.39%	14.48%
NPV (Rp.000)	23,262,908	7,088,639	38,774,042
PP	6.76	7.41	5.58

Source: PT PIM Final Report, 2022

2. Scheme Risk Mitigation

Scheme Risk Mitigation can be defined as a series of systematic measures designed to identify, analyse and mitigate potential risks that may occur in the implementation of a scheme or operational system. The main objective of this mitigation is to minimize the negative impact that can interfere with the continuity and effectiveness of the scheme. The risk mitigation process involves evaluating various uncertainty scenarios, determining appropriate countermeasures, and implementing controls or preventive measures so that risks can be controlled or diverted.

The risks managed include:

a. Operational Risk

Operational risk is the risk of loss arising from the inadequacy or failure of internal processes, human error, systems, or external events. The nature of this risk is endogenous and exogenous, meaning that it does not only originate within the organization but is also triggered by environmental factors beyond management's control [?].

To minimize the impact of the operational risks that have been identified, the implementation of a structured and sustainable mitigation strategy is required. Risk mitigation aims to reduce the likelihood of risk (likelihood) and reduce the magnitude of impact on factory operations. Operational risk mitigation strategies can be carried out through technical, managerial, and systemic approaches, as shown in the following table:

Table 2. Operational Risk Mitigation

Yes	Risk	Cause	Likelihood	Consequence	Risk Level	Risk Treatment
1	Factory repair delays	Inexperienced associates; Material delays; Partner default	3 (Medium)	4 (Weight)	12 (Medium Risk)	Recruit experts; Comprehensive tender; Contract guarantee
2	Work accidents	Lack of PPE, supervision, and unsafe working conditions	3 (Medium)	4 (Weight)	12 (Medium Risk)	SMK3 is strict; Safety briefing, PPE, BPJS, routine inspections
3	Fraud in material procurement	Unfair competition; Low moral integrity	3 (Medium)	4 (Weight)	12 (Medium Risk)	Internal audit; SMAP ISO 37001; Transparency & integrity pact
4	Material loss/theft	Low site security; Shipping error	3 (Medium)	5 (Very Heavy)	15 (High Risk)	Guard posts; CCTV; Limited access and tight controls
5	Environmental pollution	The control device is damaged; Waste exceeds capacity	3 (Medium)	4 (Weight)	12 (Medium Risk)	SOPs for waste treatment; Integrated environmental control system

Source: PT PIM Final Report, 2022

b. Market Risk

Market risk is one of the important elements that must be analyzed in the feasibility study of factory operations because it is directly related to external dynamics that can affect the stability and profitability of the business. Market risk reflects potential losses caused by changes in market conditions, including

fluctuations in raw material and product prices, demand uncertainty, to competitive pressures and regulatory changes. Unlike technical or operational risks that can be controlled through internal systems, market risks are external and cannot be completely avoided.

In the context of the operation of hydrogen peroxide plants, market risks include dependence on the price stability of raw materials (such as hydrogen gas and oxygen), downstream sector demand dynamics (e.g. pulp & paper, textile, pharmaceuticals), as well as exposure to macroeconomic factors such as inflation and exchange rates. Managing market risk requires an adaptive and long-term oriented approach. Some mitigation strategies that can be implemented are as shown in the following table:

Table 3. Market Risk Mitigation

Yes	Risk	Cause	Likelihood	Consequence	Risk Level	Risk Treatment
1	Products are not absorbed by the market	The market price is lower than the cost of production; The consumer is already bound by the contract; The product is not on demand; Less competent salespeople	4 (High)	4 (Weight)	16 (High Risk)	Ensure there are offtakers; Production according to market demand; Efficient plant operation
2	Failure of the commissioning/start-up process	The factory has been dormant for a long time; inexperienced human resources; Raw material/utility interconnection is not optimal	4 (High)	4 (Weight)	16 (High Risk)	Involve experienced experts; Equipment testing & strict monitoring
3	Cost estimation errors	Plan and actual price differences	2 (Low)	3 (Medium)	6 (Medium Risk)	More detailed cost estimates; Expert consultation

Source: PT PIM Final Report, 2022

In the context of project management or operational systems and risk mitigation are an important part of ensuring the successful implementation of the scheme in an efficient, safe and sustainable manner. From several H₂O₂ factory operational plan schemes, based on a review of the financial aspects of the self-management scheme provides greater profits for the Company, but it is also necessary to review the advantages and disadvantages of each scheme from the other side with the following resume:

Table 4. Cost & Benefit Operating Scheme

Cooperation Pattern	Advantage	Disadvantage	Mitigation
Self-Managing	Project implementation is faster.	PIM bears the cost of O&M and market risk.	Recruiting operational experts for the H2O2 Plant.
	Increase revenue from product sales.	PIM bears the cost of Reactivation (IDR 120 billion).	Cooperation contract with Offtaker.
	Adding to PT PIM's product portfolio.	PIM bears the cost of Interconnection.	Making a Loan to the Bank.
KSO	PIM does not need to incur reactivation fees.	Net Profit is according to the value of the profit sharing portion.	Appoint the partner who provides the largest profit sharing margin.
	Sharing knowledge related to operations and marketing.	Bear the risks of operation and maintenance.	Recruiting operational experts for the H2O2 Plant.
	Earn income from the sale of raw materials & utilities.		
Rent	PIM earns a fixed income every year from land and factory rental costs.	There is no knowledge sharing related to operations and sales.	Addition of a clause for the use of labor from PIM by a certain percentage.
	PIM does not bear operational risks.	PIM does not have the potential to get maximum profits.	Maximize revenue from raw material and utility sales, factory maintenance services and other services.
	PIM does not bear the risk of sale.		

Source: PT PIM Report, 2022

The determination of the operational scheme in the Hydrogen Peroxide plant project is carried out by considering the balance between financial and risk aspects. This study analyzes three main alternatives, namely lease, operating cooperation (KSO) and self-management with six determinant variables: Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), Discount Rate, Operational Risk, and Market Risk. The analysis of these combinations of variables results in a classification simulation that shows the profile of each scheme as a whole.

Data shows that the self-management scheme provides the most optimal financial performance with an NPV of ±Rp 38.77 billion, an IRR of 14.48%, and a Payback Period of 5.58 years. Market risk is considered moderate and still within mitigable limits, while operational risks are more controllable as management is

fully under the company's internal control. This makes self-management a strategic choice with significant long-term value-added potential.

Meanwhile, the KSO scheme provides a medium NPV value with the sharing of responsibilities and risks between the company and partners. This scheme is suitable for moderate strategies, especially when companies want to reduce their risk burden while still retaining some technical and managerial control.

In contrast, rental schemes show the most unfavorable results, both in terms of NPV and IRR. High market risks and low operational controls are significant limiting factors. This scheme is more appropriately used in conditions where the company faces limited resources or requires a short-term solution.

Based on a combination of quantitative results and risk characteristics, a self-management scheme can be concluded as the most feasible option, as long as the company is able to develop an effective strategy in mitigating market risks and ensuring operational efficiency.

Decision Model Using C4.5 Algorithm

In order to support data-driven decision-making, this study builds a classification model using the C4.5 algorithm. Modeling is done through two approaches: manual using Microsoft Excel and automated using RapidMiner Studio software. The goal is to identify the pattern of relationships between the combination of attributes and the final decision on the operational schema.

The manual approach starts by calculating the entropy value as the basis for measuring uncertainty in the dataset. Furthermore, information gain is calculated to identify the most influential attributes in the classification process. The gain ratio is then used to avoid bias towards attributes with many unique values. From these results, NPV emerged as the attribute with the highest information gain, so it was set as the root node in the decision tree. The next significant attribute is market risk, which reinforces previous findings regarding the importance of external factors in influencing project outcomes.

The resulting decision tree model suggests that a combination of high NPV and low market risk almost always leads to self-managed scheme decisions. This is confirmed by a logical tree structure and is in harmony with the results of the financial simulation. This model also produces if-then rules that can be interpreted practically in a managerial context.

Discussion and Decision Model

Dataset Compilation

The dataset preparation stage is the main foundation in the development of a classification model based on the C4.5 algorithm. In the context of scientific research methodology, the preparation of datasets must meet the principles of validity, reliability, and relevance to the purpose of analysis. Therefore, this stage is carried out systematically in order to produce an accurate and representative database of the phenomenon being studied. The process of collecting secondary

data from various internal sources of PT PIM. These sources include project feasibility study documents, financial statements, technical-operational risk data, and market studies. The data used reflects the actual conditions of the project and is designed to include strategic dimensions that affect the selection of the plant's operational scheme.

The data cleaning process is carried out to ensure the integrity of the dataset. This stage includes eliminating duplication, handling lost values through logical imputation, outlier verification, and adjusting data formats to be consistent. This activity is important to prevent bias and ensure the quality of the data before entering the modeling stage. The next stage is the classification of attribute types, which are divided into two main categories: numerical attributes and categorical attributes. Because the C4.5 algorithm works more optimally with categorical data, numerical attributes such as Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP) need to go through a process of discruption. Dyskritisation is carried out by dividing the range of numerical values into groups of categories such as *low*, *keepand tall* based on statistical distribution or thresholds adapted to the industry context.

After all attributes are categorized, a dataset structure consisting of six main attributes is prepared, namely: *Net Present Value* (NPV), Internal Rate of Return (IRR), Payback Period (PP), Discount Rate, Operational Risk, and Market Risk.

Table 5. Datasheet Structure Description

Column	Data Type	Description
Operational Scheme	Nominal	Scenario of Implementation of Factory Reactivation Investment Activities Selected Mechanism (Lease, KSO, Self-Management)
NPV	Numeric	Net Present Value of the project (Rp Billion).
Operational Risk	Nominal	Risk Category Success in carrying out Reactivation Activities (Successful, Failed)
Market Risk	Nominal	Risk Category Success in Marketing/Sales of Products, Absorbed, Partially Absorbed and Not Absorbed (High, Low SedZng)

The next stage is the validation of the class distribution to ensure that there is no extreme data imbalance that can affect the performance of the classification algorithm. A balance of distribution between classes is important to avoid models that are biased towards one particular scheme. As a final result, the compiled dataset has met the principles of representation, categorical structure, and class balance, all of which are critical to the success of the C4.5 algorithm. As such, this dataset can be used as a basis for modeling that is not only technically accurate, but also logically and strategically interpreted to support data-driven decision-making in the industrial sector.

Table 6. Datasheet from research data

Yes	Schema	NPV	Operational Risk/ Reactivation	Market Risk	Feasibility
1	Self-Managing	38,77	Succeed	Tall	Not Eligible
2	Rent	23,26	Succeed	Tall	Not Eligible
3	KSO	7,08	Succeed	Tall	Not Eligible
4	Self-Managing	38,77	Fail	Tall	Not Eligible
5	Rent	23,26	Fail	Tall	Not Eligible
6	KSO	7,08	Fail	Tall	Not Eligible
7	Self-Managing	38,77	Succeed	Low	Highly Worth It
8	Rent	23,26	Succeed	Low	Proper
9	KSO	7,08	Succeed	Low	Proper
10	Self-Managing	38,77	Succeed	Keep	Proper
11	Rent	23,26	Succeed	Keep	Proper
12	KSO	7,08	Succeed	Keep	Proper
13	Self-Managing	38,77	Succeed	Keep	Proper
14	Rent	23,26	Fail	Tall	Not Eligible

C4.5 Algorithm Calculation

The C4.5 algorithm was used to build a decision tree model aimed at identifying the feasibility of the factory's investment operational scheme based on a number of financial and risk indicators. The calculation is done manually with the help of Microsoft Excel software to calculate the entropy and gain values of each attribute. According to Kusriani, (2009) calculation *Decision Tree* for the C4.5 algorithm to build the decision tree is as follows:

1. Specifies the attribute that has the highest gain value as the root node.
2. Create a branch for each unique value of the selected attribute.
3. Divides the dataset into those branches based on attribute values.
4. Perform a similar process recursively until each branch produces a final classification (decision class).
5. Perform the calculation of the entropy and gain values at each step of the attribute separation.

Table 7. Calculation Results of *entropy* and *gain* values using excel application

Node	Node	Number of Cases	Very Proper	Proper	Not Eligible	Entropy	Gain
1	Total	14	1	7	6	1,295836	
	Schema						
	Self-Managing	5	1	2	2	1,521928	0,752291
	Rent	5	0	3	2	0	
	KSO	4	0	2	2	0	
	NPV						
	38,77	5	1	2	2	1,521928	0,752291
	23,26	5	0	3	2	0	
	7,08	4	0	2	2	0	

Node	Node	Number of Cases	Very Proper	Proper	Not Eligible	Entropy	Gain
Operational Risk/ Reactivation							0,469565
	Succeed	10	1	7	2	1,15678	
	Fail	4	0	0	4	0	
Market Risk							1,295836
	Tall	7	0	0	7	0	
	Keep	4	0	4	0	0	

Source: Calculation results

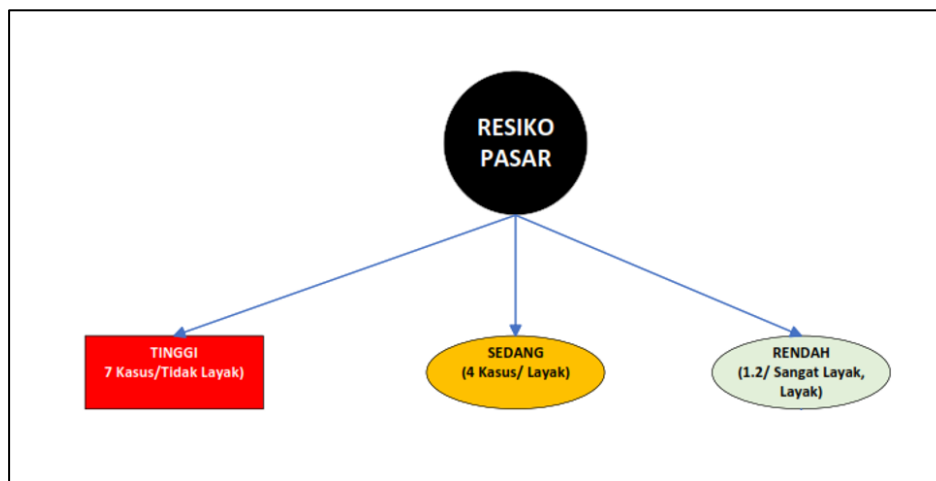


Figure 6. Decision Tree Results

Based on the table and figure above, the Market Risk attribute has the highest Gain value of 1.2958 so it is chosen as the root node of the decision tree. This attribute is divided into three values (branches), namely High, Medium and Low. The results of the initial classification show a very clear pattern:

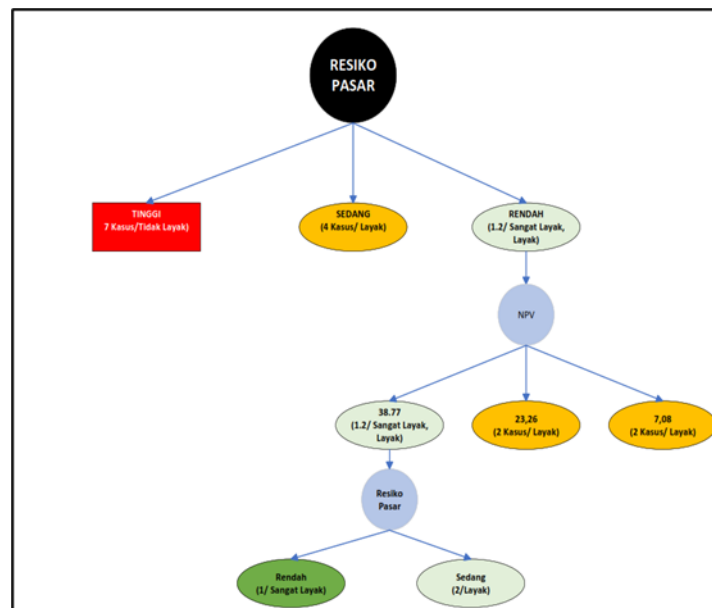
1. High Market Risk → all cases (7 data) were classified as Unfeasible.
2. Medium Market Risk → all cases (4 data) are classified as Feasible.
3. Low Market Risk → classification varies between Viable and Very Feasible.

The analysis indicates that the level of market risk has a dominant influence on the feasibility of investment. High risk indicates great uncertainty to the market and negatively impacts project feasibility. In contrast, medium- and low-risk markets open up more profitable and acceptable investment opportunities. The Low Market Risk Branch still contains variations in decision classes (Feasible and Very Feasible), so further analysis is needed to determine the differentiating factors between the two.

Table 8. Entropy and gain value calculation results using excel

Node	Node	Number of Cases	Highly Worth It	Proper	Not Eligible	Entropy	Gain
1	Market Risk	7	1	6		0,591672779	
	Schema						
	Self-Managing	3	1	2		0,918295834	0,198117
	Rent	2	0	2		0	
	KSO	2	0	2		0	
	NPV						
	38,77	3	1	2		0,918295834	0,198117
	23,26	2	0	2		0	
	7,08	2	0	2		0	
	Operational Risks /Reactivation						0
	Succeed	7	1	6		0,591672779	
	Fail	0	0	0		0	

Source: Calculation results



Picture 1. Decision Tree Results

From the advanced calculations as shown in the table and figure above, the *Net Present Value* (NPV) shows the most significant influence in distinguishing Very Viable and Viable decisions under low market risk conditions. The highest NPV value (38.77) is classified as Very Feasible, while the lower NPV value is only classified as Feasible. This suggests that the potential for high economic gains (in this case NPV) is a strong indicator to increase the feasibility of investment to the highest level. From all the stages of calculation, it can be concluded that:

1. Market Risk is the most decisive attribute in the classification of investment feasibility and is chosen as the root of the decision tree.
2. NPV is a key factor in determining whether an investment is feasible or very feasible, especially in conditions of low market risk.
3. The C4.5 algorithm approach is able to systematically extract decision patterns from the data and present them in a form that is easy to understand and act on.

Thus, the structure of the established decision tree not only helps in the classification process, but also provides strategic insights regarding the factors that determine investment feasibility based on financial and risk indicators.

CONCLUSION

This research successfully established an objective, data-driven framework for selecting the optimal operational scheme for PT *Pupuk Iskandar Muda's* Hydrogen Peroxide (H_2O_2) Plant reactivation, identifying self-management as the most viable option with superior financial performance (NPV of ±IDR 38.77 billion, IRR of 14.48%, and a 5.58-year payback period). Despite the full operational and market risks, self-management remains preferable due to its higher profitability and strategic control, provided that effective mitigation strategies are implemented. The study also demonstrated the effectiveness of the *C4.5 algorithm* in developing a decision tree model, where market risk and NPV were the most influential factors in classifying scheme feasibility. For future research, it is recommended to broaden the analysis by incorporating technical, environmental, and social variables, as well as primary data from surveys or expert assessments, to enhance model accuracy and generalizability. Additionally, exploring alternative classification methods such as Random Forest, CART, or hybrid machine learning techniques would offer valuable comparative insights and further strengthen decision-making frameworks for similar industrial asset reactivation projects.

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