FORMULATION OF CARBON EMISSION REDUCTION STRATEGY THROUGH SWOT AND AHP ANALYSIS AT PUPUK ISKANDAR MUDA COMPANY

Oleh
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Abstrak

The industrial sector is a major contributor to carbon emissions, driving the greenhouse effect and global warming. Pupuk Iskandar Muda (PIM) Company, as a petrochemical company, is committed to reducing carbon emissions through enhanced energy efficiency and low-emission technology adoption, although its carbon emissions remain high and have significantly increased. This study aims to identify internal and external factors influencing PIM's Company carbon emission reduction strategy and to determine the optimal priority strategy. The research uses a quantitative descriptive method. The respondents are employees of Pupuk Iskandar Muda Company, selected using the purposive sampling technique, resulting in a sample size of 11 people. The research data includes primary data obtained from observations, interviews, and questionnaires, while secondary data is gathered from supporting literature. Data analysis techniques include SWOT analysis, Analytical Hierarchy Process (AHP), and post-risk-based strategy. The research results identified 12 alternative strategies, with two prioritized alternatives selected as the best options based on a post-risk internal strategy analysis, incorporating financial mitigation considerations. These prioritized strategies are: "enhancing an intensive marketing relationship program and increasing employees' understanding of the importance of sustainable practices to achieve emission reduction targets (CBA 4.54); Replacing part of the factory equipment in accordance with company policies to reduce carbon emissions while contributing to national food and energy security (CBA 2.24).

Kata Kunci: Carbon Emission Reduction, Air Pollution, Strategy, SWOT, AHP

INTRODUCTION

Air pollution caused by carbon emissions from various sectors, especially industry, has become an urgent global issue to be addressed. One of the main causes of the climate crisis we are currently facing is greenhouse gas emissions that trigger the greenhouse effect phenomenon. Research by Gunawan also confirms that industry is a significant contributor to pollution, with Indonesia being one of the largest carbon emitters in the world.(Gunawan & Berliyanda, 2024). For this reason, reducing carbon emissions is an important component in the sustainability agenda promoted by many countries and companies, including Indonesia. Based on data from Ritchie & Roser (2020), found that from 2017 to 2022, CO_2 gas emissions were above 35 million tons per year.

Pupuk Iskandar Muda (PIM) Company, as one of the leading petrochemical companies in Indonesia, realizes the importance of their role in reducing the negative impacts of carbon emissions. As a company engaged in the fertilizer and agro-industrial chemical sector, PT PIM has developed a long-term carbon emission reduction strategy that focuses on the implementation of low-emission technology and increasing energy efficiency throughout its business processes. Based on PT PIM's carbon

emission reduction roadmap until 2030, the main initiatives undertaken include the development of Solar Power Plants (PLTS), the implementation of Carbon Capture Utilization and Storage (CCUS) technology, and the production of Blue and Green Ammonia.

PIM's Company efforts are also driven by the Enhanced Nationally Determined Contribution (ENDC) target set by the Indonesian government, which is to reduce carbon emissions by 29% by 2030. This target includes reducing emissions in various sectors, including energy, forestry, agriculture, and waste management. In supporting this target, PT PIM focuses on reducing carbon emissions in the form of carbon dioxide (CO2) through energy efficiency, the success indicator of which is seen from the achievement of the emission reduction target against the amount of emissions set. Thus, the carbon emission reduction strategy implemented by PT PIM not only affects air quality and global warming mitigation, but also strengthens the company's competitiveness in the industry, making it more efficient and competitive in the global market.

To ensure the successful implementation of the carbon emission reduction strategy, PIM Company has formed a special division under the Department of Energy and Environmental Management. This division is responsible for managing and implementing various programs related to emission reduction, such as energy efficiency and CCUS implementation. This division also ensures that every step taken by the company is in accordance with applicable regulations and supports government efforts to reduce carbon emissions. In addition, this division is tasked with overseeing the use of appropriate technology, as well as monitoring and evaluating the company's environmental performance on an ongoing basis.

In the context of strategic management, PIM Company uses two main approaches, namely SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis and the Analytical Hierarchy Process (AHP) method. SWOT analysis is used to identify internal and external factors that affect the company's carbon emission reduction strategy. By analyzing strengths, weaknesses, opportunities, and threats, the company can formulate a more focused and relevant strategy to market conditions and changing environmental dynamics. In addition, SWOT analysis allows PIM Company to maximize its competitive advantage in the market and anticipate challenges that may arise in the future.

SWOT analysis is a systematic analysis of the identification of various factors to formulate a company strategy. This analysis is based on logic that can maximize strengths and opportunities, but at the same time can minimize weaknesses and threats (Paramarta, 2018). Meanwhile, SWOT analysis according to Kristanto et al., (2017) SWOT analysis is the identification of various factors to formulate a company's strategy. Furthermore, conducting an analysis, namely after the data and information are collected, the values of internal and external factors that have been obtained from the internal strategy factor matrix and the external strategy factor matrix, are described in the form of a SWOT diagram by subtracting the strength value from the weakness value and the opportunity value from the threat value. The use of SWOT and AHP analysis methods in formulating PIM's Company strategy provides many benefits. With this approach, PIM Company can identify the best opportunities to reduce carbon emissions while supporting government programs in achieving national emission reduction targets.

Based on the background of the problem, PIM Company needs to increase efforts to improve energy efficiency and reduce carbon emissions. Therefore, PIM Company needs to conduct a SWOT and AHP analysis in Formulating a Carbon Emission Reduction Strategy. The objectives of the study are: 1) Identifying Strengths, Weaknesses, Opportunities and Threats in reducing carbon emissions at Pupuk Iskandar Muda Company,

2) Formulating alternative internal and external improvement strategies in reducing carbon emissions at Pupuk Iskandar Muda Company and 3) Selecting the best strategy for reducing carbon emissions at Pupuk Iskandar Muda Company

LITERATURE REVIEW

Air Pollution

Air pollution is the entry or entry of substances, energy, from other components into the ambient air by human activities, so that the air quality drops to a certain level which causes the ambient air to not be able to fulfill its function (PP No. 22/2021).

Carbon Management Hierarchy

The Carbon Management Hierarchy is a framework that provides a step-by-step guide for organizations to manage and reduce their carbon emissions (Tayebi et al., 2022). This framework is based on environmental management principles that emphasize the priority of "avoiding" unnecessary emissions, before moving on to other mitigation measures such as raw material "substitution", energy "efficiency", carbon emission "absorption", and "compensation" through offset mechanisms (Zhou, 2020).

SWOT Analysis

SWOT analysis according to Kotler (2009) interpreted as an evaluation of the overall strengths, weaknesses, opportunities, and threats. SWOT analysis is basically a technique for systematically identifying various factors and determining elements in the development of an institution (Fadilah & Weriantoni, 2019);(Ambarwati, 2020); (Fakhrurrazi, 2021).

Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) method is a tool that breaks down multi-factor problems into a hierarchy, allowing subjective assessment of the relative importance of various variables. AHP is a relevant method and provides important consistency value calculations in determining the priority of criteria (Saaty, 1993)

Risk Based Strategy Analysis

Risk-Based Strategy is a decision-making approach that considers risk as a major factor in choosing the best alternative among several options. Through this approach, decision makers can weigh the benefits offered by each alternative while considering the level of risk that may arise from implementing the alternative (Pasman et al., 2022;Mutlu & Sari, 2022).

RESEARCH METHOD

Research Design

Quantitative research focuses on collecting and analyzing numerical data to answer research questions and test hypotheses (Sekaran & Bougie, 2017).

Jenis dan Sumber Data

Research data sources consist of Primary Data Sources as the type and source of research data obtained directly from the first source (not through intermediaries).(Sekaran & Bougie, 2017). Primary data is obtained from the results of interviews and questionnaire distribution. While secondary data is a source of research data obtained by researchers indirectly through intermediary media. (Sekaran & Bougie, 2017). Secondary data was obtained from Journals, Literature and documents of Pupuk Iskandar Muda Company which are in line with this research.

Teknik Pengumpulan Data

At the data collection stage, it begins with identifying internal and external factors that influence the reduction of carbon emissions. This stage will use primary data, namely interviews and questionnaires. The interview was conducted with the source of the Vice President of Business Development as a senior leader so that it is expected to provide relevant and comprehensive internal and external factors. In the questionnaire method, it will be carried out on 11 employees of Pupuk Iskandar

Muda Company. In this study, 5 types of questionnaires will be used, namely Questionnaire 1 list of internal and external factors, Questionnaire 2 list of internal and external factors AHP, Questionnaire 3 Rating SWOT, Questionnaire 4 list of questions in determining priority improvement strategies and Questionnaire 5 list of questions in determining risks in implementing selected strategies.

Data Analysis
Data analysis using SWOT analysis using the Analytic Hierarchy Process (AHP) method

RESULTS AND DISCUSSION

Internal Factor Identification Results

Based on Porter's value chain, internal factors are divided into 2 (two) activities, namely primary and supporting. Primary activities are core activities that process input into output. Supporting activities are activities that support primary activities.

Table 1 Internal Factor (Supporting Activities)

Internal Factors (Supporting)	Respondents
1) *Human Resource Management*	
Employee training and skills development	9
Placement of positions according to employee competency	4
Experienced employees operating petrochemical plants	1
Incentives for employees who use bicycles or electric vehicles	3
Rewarding employees who are able to contribute to energy efficiency in factory production	4
Employee's working period	5
The team that handles the carbon emission reduction program	4
2) *Firm Infrastructure*	
Business strategies in achieving carbon emission reduction goals	7
Company policy in implementing carbon emission reduction programs	9
Periodic inter-departmental coordination in implementing carbon emission reduction programs	3
Leadership and culture are formed	5
Availability of company funds	2
Management considerations regarding carbon emission reduction in every decision taken	9
Have cooperation with several strategic partners on a global scale	10
3) *Technology Development*	
The company provides infrastructure in the carbon emission reduction program	9
Information system for collecting, reporting and analyzing data	5
Media platform for accessing PIM profiles for partners	3
A system for reducing energy consumption in factory equipment	6
Integrated information system between units and across departments	4
Industrial land for business development	2
4) *Procurement*	

Internal Factors (Supporting)	Respondents
The existence of company cooperation with the Environmental Service and Waste Management Agency in the carbon emission reduction program	3
Cooperation Scheme between PIM and partners	7
The existence of Risk Assessment in the carbon emission reduction program	9
Database of partners and carbon user partners	4
Partner assessment and appointment system	4
Cooperation Scheme with the Ministry of Environment	3
The existence of a green procurement policy that includes carbon footprint certificates as the main requirement in the selection of goods and services.	9

Based on Table above supporting activities consist of 4 activities, namely human resource management, firm infrastructure, technology development, procurement where in human resource management, all respondents agree that the factor "Training and development of employee skills" affects employees in carbon emission reduction strategies. With employees having good skills, employees understand what strategies must be carried out to reduce carbon emissions at PIM Company.

In firm infrastructure, respondents agreed that “Company policy in implementing carbon emission reduction program” is an influential factor in PIM Company because the more effective and smooth the coordination and policy process, the faster the performance of the company's strategy is delivered. In addition, “Having cooperation with several global strategic partners” has also been determined by PIM Company to increase the company's collaboration with global partners such as the Japanese company Itocu.

In technology development, all respondents agreed that "The company provides infrastructure in the carbon emission reduction program" such as a new ammonia tank to accommodate blue/green ammonia products so that with complete infrastructure, employees feel that the company also cares about reducing carbon emissions.

In procurement, respondents agreed that "The existence of a Risk Assessment in the carbon emission reduction program" has an impact on reducing carbon emissions because the process does not only provide an offer letter or proposal, but a risk assessment also needs to be carried out as a material for decision making for management to mitigate possible risks, and analysis from various business perspectives so that the project or opportunity is worthy of being continued.

Table 2 Internal Factor (Primary Activities)

Internal Factors (Main)	Respondents
1) *Inbound Logistics*	
Policies related to the Inbound Logistics (IBL) process	3
Administration in the IBL process	2
IT Tools that assist the IBL process	1
Availability of product storage warehouses	3
Strategic factory locations	2
Availability of raw materials and transportation	4
Close to Carbon Capture Storage (CCS) locations	5
Partner/vendor assessment and appointment system	2

Internal Factors (Main)	Respondents
A green procurement policy that includes carbon footprint certificates as the main requirement in the selection of goods and services.	5
Price agreement with partners/vendors	1
2) *Operation*	
Use of factory equipment that affects carbon emission reduction programs	11
Replacement of materials with low emission material substitutes	6
Dashboard monitoring of process and energy efficiency	6
Predictive and preventive maintenance of old technology	6
Factories that support energy efficiency and the application of environmentally friendly technologies	8
Low energy consumption	5
3) *Outbound Logistics*	
Policies related to the Outbound Logistics (IBL) process	7
Administration in the IBL process	0
IT Tools that assist the IBL process	3
Partner/vendor assessment and appointment system	3
Product storage warehouse availability	1
Raw material and transportation availability	2

Internal Factors (Main)	Respondents
Payment to partners/suppliers as agreed in the contract	3
Price agreement with partners	2
Fast OBL process to ensure on-time delivery	4
SLA to monitor the OBL process	6
Product delivery that meets national and international quality standards	5
Certification of environmentally friendly products	7
4) *Marketing & Sales*	
Product knowledge PIM updated	6
Market Analysis of blue/green product enthusiast trends	9
Marketing programs to improve customer relationships	9
Latest solution support and anticipation of competitor killer products	4
Policy for getting new partners	4
Profitability measurement	4
5) *Service*	
After Sale Service Policy for blue/green products offered	2
Service Level Agreement (SLA) in after sale service	2
Complaint service to customers if there is a disruption	3
Digital Transaction to partners/customers	4

Based on the table above, primary activities consist of 5 activities, namely inbound logistics (IBL), operations, outbound logistics (OBL), marketing & sales, and service. In inbound logistics, "Close to the Carbon Capture Storage (CCS) location" and "The existence of a green procurement policy that includes a carbon footprint certificate as the main requirement in the selection of goods and services" are important because they are documented in the system so that they can be monitored with the business process of the applicable policy. An example of inbound logistics at PIM Company is electricity rental in buildings, IKG (building cable installation) which involves building managers so that there needs to be cooperation between PIM Company and building owners such as tenants.

In operations, there is “Use of factory equipment that affects the carbon emission reduction program” such as replacing superheater tubes in energy efficiency to see whether the factory equipment currently used really affects the carbon emission reduction program at PIM Company.

In Outbound logistics (OBL) at PIM Company also affects "Policies related to the Outbound Logistics (OBL) process", and "Certification of environmentally friendly products". The company does not only focus on a product but also the company prioritizes sustainability in a product by carrying out environmentally friendly certification.

In marketing & sales, the importance of "Marketing programs in improving customer relationships" as guidance for PIM Company to be able to communicate with customers and strengthen engagement. From market analysis, it can also be identified what products can be proposed to customers and according to what customers need. This is in line with the "Market Analysis factor on the trend of blue/green product enthusiasts", so that PIM Company can be more confident in proposing to customers so that they can get to know customers more deeply to the level of consumer trust. In service, "Digital Transactions to partners/customers" also influence employees in reducing carbon emissions.

From the results of the analysis of internal factors that most influence employees with the highest number of agreed values, namely: Human Resource Management, Firm Infrastructure, Technology Development and Marketing & Sales.

Table 3 External Factor

External Factors	Respondents
1. Politics, Government, Law	
Import process control policy and export increase	3
Downstreaming	4
The existence of Enhanced Nationally Determined Contribution (ENDC) targets from the government	3
Economic Value (NEK) policy in carbon trading	8
Carbon capture, storage and utilization policies in fertilizer and petrochemical companies	9
Changes in government regulations related to fertilizer subsidies	4
2. Economy	
The fertilizer industry sector as a driver of economic growth and national food security	9
Increase in the price of goods (inflation)	6
The weakening of the rupiah against the US dollar	5
Cooperation in carbon emission trading with local and international companies	7
3. Social, Cultural, Demographic, Environmental	

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External Factors	Respondents
Customers who transact on the i-Pubers digital platform	6
Use of fertilizers for farmers and plantations	4
Accessibility of product distribution	5
Certification of environmentally friendly products	6
Products that comply with national and international quality standards	7
4. Technology	
The need for selling digital products to partners	6
Implementation of industry 4.0	7
Use of Carbon Capture Store (CCS) Technology	9
Implementation of SmartFarming	5
5. Competition	
Business competition in the fertilizer sector is getting higher	5
Fertilizer raw material prices fluctuate	5
Potential natural gas sources from Gebang, Tangguh and Andaman	8
Cooperation between fertilizer holding companies	6
Located in the Arun-Lhokseumawe Special Economic Zone (KEK)	9
The emergence of new fertilizer producers that provide low prices	4
Potential oil and gas wells for Carbon Capture Storage (CCS)/Carbon Capture Utilization Storage (CCUS)	10

Based on the table above, there are 5 external factors that influence companies in reducing carbon emissions, namely politics-government-law, economy, socio-culture-demography-environment, technology, and competition. In politics-government-law, "Carbon capture, storage and utilization policies in fertilizer and petrochemical companies" is an issue that can be an opportunity for PIM Company to be able to reduce carbon emissions in the company, with the policies implemented.

In economics, “The fertilizer industry sector as a driver of economic growth and national food security” is the factor that most influences PIM Company in reducing carbon emissions.

For socio - cultur e – demography - environment, respondents who agree that "Products that meet National and International quality standards" indicate that PT PIM's products currently show the best quality. In technology, respondents agree that "Use of Carbon Capture Store (CCS) Technology" so that PT PIM as an agricultural company must be able to compete with other competitors by using CCS technology in its utilization. And for competition, all respondents agree that "Potential oil and gas wells for Carbon Capture Storage (CCS) / Carbon Capture Utilization Storage (CCUS)".

Data Processing Results

Input Stage

Based on the assessment of internal factors obtained through the questionnaire method, the strengths and weaknesses of PT PIM were compiled through Focus Group Discussions (FGD) with respondents.

Table 4 Matrix IFE IPM Company

No	*Strength*	Weight (W)	Rating (R)	Value (WxR)
S1	Replacement of factory equipment that affects the carbon emission reduction program	0,12	3.36	0.4
S2	Company policy in implementing the carbon emission reduction program	0,13	3.55	0.5
S3	The company has data resources for blue/green product enthusiasts	0,09	3.09	0.3
S4	The company has facilities and infrastructure in the carbon emission reduction program	0,13	3.00	0.4
S5	Has cooperation with several global strategic partners	0,08	3.45	0.3
No	***Weakness***	**Weight (W)**	**Rating (R)**	**Value (WxR)**
W 1	Employee knowledge related to carbon emission reduction is still uneven	0.10	3.00	0.3
W 2	There is no procurement policy for goods/services integrated with carbon footprint certification	0.11	2.82	0.3
W 3	The need to improve the marketing relationship program	0.11	3.18	0.3
W 4	Management considerations related to carbon emission reduction in every decision taken	0.07	3.45	0.2
W 5	There is no Risk Assessment in the carbon emission reduction program	0.06	3.36	0.2
Total		1		3.2

The results of the identification of PIM's Company strengths and weaknesses, continued with the assessment of the weight and rating of each factor and multiplied to obtain the total number. In Table 4.5, the total value of the IFE matrix is 3.2. This value indicates that PIM's Company position has internally balanced strengths and weaknesses. One of the strengths

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with a large value of 0.5 is the company's policy in implementing the carbon emission reduction program.

Meanwhile, in terms of weaknesses, the most influential for PIM Company is that employee knowledge regarding carbon emission reduction is still uneven, the factor that there is no procurement policy for goods/services that is integrated with carbon footprint certification, and the factor that there is a need to improve the marketing relationship program, each of which has a value of 0.3.

Table 5 Matrix EFE IPM Company

No	*Opportunity*	Weight (W)	Rating (R)	Value (WxR)
O1	The fertilizer industry sector as a driver of economic growth and national food and energy security	0.09	3.18	0.3
O2	Potential natural gas sources from Gebang, Tangguh and Andaman	0.22	3.36	0.7
O3	Potential oil and gas wells for Carbon Capture Storage (CCS)/Carbon Capture Utilization Storage (CCUS)	0.13	3.64	0.5
O4	Located in the Arun-Lhokseuma we Special Economic Zone (KEK)	0.15	3.27	0.5
No	***Threats***	**Weight (W)**	**Rating (R)**	**Value (WxR)**
T1	Carbon tax rules for downstream industrial sectors other than oil and gas	0.13	3.27	0.4
T2	Not yet published Carbon capture, storage and utilization policy in fertilizer and petrochemical companies	0.14	3.09	0.4
T3	Carbon Capture Storage (CCS)/Carbon Capture Utilization Storage (CCUS) technology is still under development	0.13	3.27	0.4
Total		1		3.3

The results of the identification of opportunities and threats of PIM Company, continued with the assessment of the weight and rating of each factor and multiplied to obtain the total number. The total value of the EFE matrix is 3.3 which indicates that the conditions in external factors have opportunities and threats that are quite strong in influencing PIM Company. For opportunities

that are very influential are the potential of natural gas sources from Gebang, Tangguh and Threats 0.7. While for threats, all factors have the same value, namely 0.4.

Matching Stage

After identifying internal and external factors, compiling each SWOT (strength, weakness, opportunity, threat) factor, conducting weight and rating assessments, an IE matrix and SWOT matrix were created to determine the right strategy in reducing PIM's Company carbon emissions.

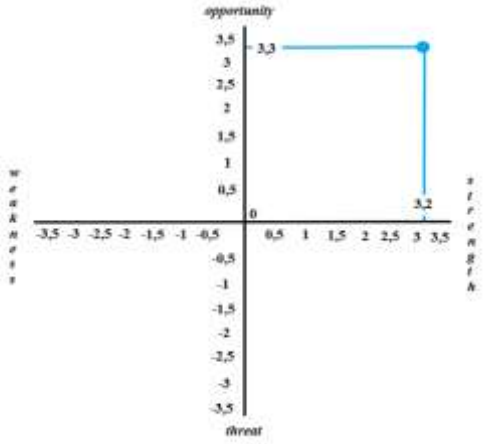

Figure 1 Matrix SWOT

If the Internal Factor Evaluation (IFE) score is 3.2 and the External Factor Evaluation (EFE) score is 3.3, this indicates that the organization is in a very strong strategic position both internally and externally. A high IFE score (3.2) reflects significant internal strengths, such as resources, operational capabilities, and effective management, that support the organization's performance. Meanwhile, a high EFE score (3.3) indicates that the organization is able to optimally utilize external opportunities and manage threats from the environment well, for example through adaptation to market trends or effective strategies. This combination of scores places the organization in a competitive position that allows for aggressive growth strategies, such as vertical or horizontal integration, product or market development, and related diversification.

In compiling the SWOT matrix, focus group discussions were conducted to obtain more objective alternative strategies that were in accordance with PIM's Company current strengths and weaknesses and the opportunities and threats in external factors.

Table 6 Matrix SWOT

Matrix SWOT	**Strenght (S1, S2, S3, S4, S5, S6)**	**Weakness (W1, S2, S3, S4, S5, S6)**
Opportunity (O1, O2, O3, O4)	1. Replacement of some factory equipment in accordance with company policy to reduce carbon emissions in order to meet national food and energy security (S1S2-O1)	1. Increasing intensive marketing relationship programs, as well as employee understanding of the importance of sustainable practices to achieve emission reduction targets. (W1W3-O1)
	2. The company has infrastructure to reduce carbon emissions close to the carbon storage location and the potential for Andaman gas sources (CCS/CCUS) (S4-O2O3)	2. Its strategic location in the Arun-Lhokseumawe Special Economic Zone (KEK) opens up great opportunities to implement integrated goods/services procurement policies with carbon footprint certification (W2-O4).
	3. International cooperation	3. Conducting a comprehensive

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Matrix SWOT	Strenght (S1, S2, S3, S4, S5, S6)	Weakness (W1, S2, S3, S4, S5, S6)
	with low-carbon product offtakers is supported by the potential of natural gas sources near the factory site, which is located within the Arun-Lhokseumawe Special Economic Zone (KEK) (S3S5-O4)	risk assessment of each program by considering the potential of natural gas sources in Gebang, Tangguh, and Andaman, as well as the utilization of oil and gas wells for CCS/CCUS so that effective solutions are provided so that with each decision-making, the company can achieve sustainability goals (W4W5-O2O3)
Threat (T1, T2, T3)	1. The implementation of carbon tax regulations for downstream industrial sectors other than oil and gas will encourage companies to be more serious in implementing carbon emission reduction policies, as an effort to reduce the burden of operational costs (S2-T1)	1. An integrated approach that includes increasing employee knowledge, strengthening marketing relationship programs, and implementing carbon tax regulations for downstream industries can be a driver for companies to achieve sustainability targets (W1W3-T1)
	2. Replacing more efficient factory equipment and utilizing CCS/CCUS technology, and supported by adequate infrastructure, the company is committed to achieving carbon emission reduction targets (S1S4-T3)	2. Comprehensive policies are immediately needed to address the problem of carbon emissions, including the implementation of carbon footprint certification in the procurement of goods/services, as well as the development of regulations that support carbon capture, storage and utilization in fertilizer and petrochemical companies (W2-T2).
	3. Having adequate resources and a global network, the unavailability of carbon capture, storage and utilization policies is a gap that needs to be	3. The company conducts a comprehensive risk assessment to ensure that this technology can be implemented effectively and efficiently, in line

Matrix SWOT	Strenght (S1, S2, S3, S4, S5, S6)	Weakness (W1, S2, S3, S4, S5, S6)
	filled immediately by fertilizer and petrochemical companies to meet the demands of a market that is increasingly concerned about the environment (S3S5-T2)	with the company's commitment to sustainable decision-making (W4W5-T3)

Based on the SWOT Matrix above, several SWOT strategies were obtained, namely:

1. SO Strategy (*Strength-Opportunity*)
   a. AS1 = Replacement of some factory equipment in accordance with company policy to reduce carbon emissions in order to meet national food and energy security (S1S2-O1).
   b. AS2: The company has infrastructure to reduce carbon emissions close to the carbon storage location and the potential for Andaman gas sources (CCS/CCUS) (S4-O2O3)
   c. AS3: International cooperation with low-carbon product offtakers is supported by the potential of natural gas sources near the factory site, which is located within the Arun-Lhokseumawe Special Economic Zone (KEK) (S3S5-O4)
2. WO Strategy (*Weakness-Opportunity*)
   a. AS4: Increasing intensive marketing relationship programs, as well as employee understanding of the importance of sustainable practices to achieve emission reduction targets. (W1W3-O1)
   b. AS5: Its strategic location in the Arun-Lhokseumawe Special Economic Zone (KEK) opens up great opportunities to implement integrated goods/services procurement policies with carbon footprint certification. (W2-O4)
   c. AS6: Conducting a comprehensive risk assessment of each program by considering the potential of natural gas sources in Gebang, Tangguh, and Andaman, as well as the utilization of oil and gas wells for CCS/CCUS so that effective solutions so that every decision-making, the company can achieve sustainability goals. (W4W5-O2O3)
3. ST Strategy (*Strength-Threats*)
   a. AS7: The implementation of carbon tax rules for downstream industrial sectors other than oil and gas will encourage companies to be more serious in implementing carbon emission reduction policies, as an effort to reduce the burden of operational costs. (S2-T1)
   b. AS8: Replacing more efficient factory equipment and utilizing CCS/CCUS technology, and supported by adequate infrastructure, the company is committed to achieving carbon emission reduction targets. (S1S4-T3)
   c. AS9: Having adequate resources and global networks, the unavailability of carbon capture, storage, and utilization policies is a gap that needs to be filled immediately by fertilizer and petrochemical companies to answer the demands of a market that is increasingly concerned about the environment. (S3S5-T2)
4. WT Strategy (*Weakness-Threats*)
   a. AS10: An integrated approach that includes increasing employee knowledge, strengthening marketing relationship programs, and implementing carbon tax regulations for downstream industries can be a driver

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for companies to achieve sustainability targets. (W1W3-T1)

b. AS11: Comprehensive policies are urgently needed to address carbon emissions issues, including the implementation of carbon footprint certification in the procurement of goods/services, as well as the development of regulations that support carbon capture, storage, and utilization in fertilizer and petrochemical companies. (W2-T2)
c. AS12: The company conducted a comprehensive risk assessment to ensure that the technology could be implemented effectively and efficiently, in line with the company's commitment to sustainable decision-making. (W4W5-T3)

Decision Stage

After formulating alternative strategies from focus group discussions, each alternative strategy is weighted using the AHP (analytical hierarchy process) method to obtain a more objective weight value for each alternative strategy. Then, the results of the FGD selected 5 (five) alternative strategies with the largest weights to be measured using the Risk Based Analysis method.

Table 7 AHP Results

No	Note	Weight
AS7	Increasing intensive marketing relationship programs, as well as employee understanding of the importance of sustainable practices to achieve emission reduction targets	0.122
AS1	Replacing some factory equipment in accordance with company policy to reduce carbon emissions in meeting national food and energy security	0.102
AS8	Its strategic location in the Arun-Lhokseumawe Special Economic Zone (KEK) opens up great opportunities to implement integrated goods/services procurement policies with carbon footprint certification	0.100
AS6	Having adequate resources and a global network, the unavailability of carbon capture, storage, and utilization policies is a gap that needs to be filled immediately by fertilizer and petrochemical companies to meet market demands that are increasingly concerned about the environment	0.099
AS5	Replacing more efficient factory equipment and utilizing CCS/CCUS technology, and supported by adequate infrastructure, the company is committed to achieving carbon emission reduction targets	0.088
AS4	The implementation of carbon tax regulations for downstream industrial sectors other than oil and gas will encourage companies to be more serious in implementing carbon emission reduction policies, as an effort to	0.086

No	Note	Weight
	reduce the burden of operational costs	
AS12	The company conducts a comprehensive risk assessment to ensure that this technology can be implemented effectively and efficiently, in line with the company's commitment to sustainable decision making	0.077
AS10	An integrated approach that includes increasing employee knowledge, strengthening marketing programs relationship, and the implementation of carbon tax regulations for downstream industries can be a driver for companies to achieve sustainability targets	0.072
AS9	Implementing a comprehensive risk assessment of each program by considering the potential of natural gas sources in Gebang, Tangguh, and Andaman, as well as the utilization of oil and gas wells for CCS/CCUS so that effective solutions so that every decision-making, the company can achieve sustainability goals	0.068
AS2	The company has infrastructure to reduce carbon emissions that are close to the Carbon storage location and the potential of Andaman gas sources	0.065
AS3	International cooperation with low-carbon product offtakers is supported by the potential of natural gas sources near the factory location, which is located in the Arun-Lhokseumawe Special Economic Zone (KEK)	0.061
AS11	A comprehensive policy is immediately needed to address the problem of carbon emissions including the implementation of carbon footprint certification in the procurement of goods/services, as well as the development of regulations that support carbon capture, storage, and utilization in fertilizer and petrochemical companies	0.059

Based on the results of the analysis above, 5 alternative priority strategies were obtained, namely:

1. AS7: Increasing intensive marketing relationship programs, as well as employee understanding of the importance of sustainable practices to achieve emission reduction targets. (0.122).
2. AS1: Replacement of some factory equipment in accordance with company policy to reduce carbon emissions in order to meet national food and energy security. (0.102).
3. AS8: Its strategic location in the Arun-Lhokseumawe Special Economic Zone

(KEK) opens up great opportunities to implement integrated goods/services procurement policies with carbon footprint certification. (0.100).

4. AS6: Having adequate resources and a global network, the unavailability of carbon capture, storage and utilization policies is a gap that needs to be filled immediately by fertilizer and petrochemical companies to meet the demands of a market that is increasingly concerned about the environment (0.099).
5. AS5: Replacing factory equipment with more efficient ones and utilizing CCS/CCUS technology, and supported by adequate infrastructure, the company is committed to achieving its carbon emission reduction target (0.088).

Of the five alternative strategies, two alternative strategies were selected, namely AS7 and AS1, which are strategies for internal PT PIM. While AS8, AS5, and AS6 are strategies for external PIM Company that are uncontrollable in relation to Government Policy. The two alternative strategies selected will be assessed using the Post Risk Based Strategy method to obtain priority strategies to be implemented first at PIM Company

From the 2 alternatives, a discussion will be conducted on the Post Risk Based Strategy using the application of the risk management process using SNI ISO 31000-based risk management. The following are the alternative strategies obtained, namely:

1. Improve Marketing Relationship Programs and Employee Understanding of Sustainable Practices (AS7)

This strategy aims to increase the intensity of the marketing relationship program by paying attention to sustainability, as well as equipping employees with knowledge about sustainable practices to support the target of reducing carbon emissions. The identified risk is the uneven understanding of employees, which is caused by the lack of related training. The proposed solution is to write to work units to prepare training and ensure smooth implementation. Monitoring is carried out by evaluating the results of the training as a whole. With an implementation cost of IDR 612 million, this strategy offers great benefits with a CBA (Cost-Benefit Analysis) of 4.54. Several stages of strategy implementation:

a. Human Resource Competency Improvement: Management needs to develop a comprehensive training and outreach program to improve employee understanding of sustainability and sustainable practices, as well as the importance of marketing relationships in supporting emission reduction. The HR manager must facilitate this program on an ongoing basis.
b. Development of a Marketing Strategy that is Aligned with Sustainability: The marketing department must develop a marketing strategy that not only focuses on commercial aspects, but also includes sustainability and environmental values. This requires close coordination between the marketing team.
c. Program Evaluation and Monitoring: Management needs to design a systematic monitoring mechanism to evaluate the effectiveness of training and its impact on marketing performance and carbon emission reduction. Feedback from training participants and long-term impact analysis will help improve the strategy.

2. Replacement of some factory equipment in accordance with company policy to reduce carbon emissions in order to meet national food and energy security (AS1)

This alternative involves replacing obsolete plant equipment with more efficient and environmentally friendly technology to reduce carbon emissions. Key risks include high costs and potential operational disruption during the transition process. The solution includes procurement of tube superheater

equipment, equipment suitability testing, and employee training on the new technology. Monitoring focuses on the progress of the installation and its impact on operational performance. The implementation cost of Rp 5.57 billion yields significant benefits with a CBA of 2.24. Several stages of strategy implementation:

a. Investment Planning and Financial Management: Replacement of plant equipment and investment in tube superheater equipment require a large budget allocation. The financial manager must prepare a realistic financing plan, both through internal and external funding, and ensure that expenditures are in line with the company's projections and capacity.
b. Project Management and Procurement: To ensure the smooth implementation of new technology, an experienced and trained project team is needed to manage the procurement of equipment and technology, as well as its installation. The project manager is responsible for preparing the timeline, managing risks, and monitoring the achievement of project targets.
c. Human Resource Management and Training: Employees involved in the operation of new equipment and technology must undergo intensive training. The HR manager needs to work with the technology vendor and technical team to design an adequate training program. In addition, there needs to be monitoring of the performance of employees who have been trained.
d. Technology Monitoring and Evaluation: After implementation, the company must conduct regular monitoring of equipment performance. Operations managers and PPE must work together to assess the effectiveness of the technology in reducing carbon emissions and operating costs.

CONCLUSION & SUGGESTION

Conclusion

The conclusion of the study is:

1. There are 10 internal factors and 7 external factors that affect PT PIM in reducing carbon emissions. For internal factors, there are strengths such as Replacement of factory equipment that affects the carbon emission reduction program, company policies in implementing carbon emission reduction programs, the company has data resources for blue/green product enthusiasts, has cooperation with several global strategic partners, the company has infrastructure in the carbon emission reduction program. While for weaknesses, employee knowledge related to carbon emission reduction is still uneven, there is no procurement policy for goods/services that is integrated with carbon footprint certification, the need to improve the marketing relationship program, management considerations related to carbon emission reduction in every decision taken, there is no risk assessment in the carbon emission reduction program. In external factors, there are several opportunities including the fertilizer industry sector as a driver of economic growth and national food and energy security, potential natural gas sources from Gebang, Tangguh and Andaman, Potential oil and gas wells for Carbon Capture Storage (CCS)/Carbon Capture Utilization Storage (CCUS), located in the Arun-Lhokseumawe Special Economic Zone (KEK). For the threat, namely the carbon tax regulation for the downstream industrial sector other than oil and gas, the policy for carbon capture, storage and utilization in fertilizer and petrochemical companies has not been issued, the technology for utilizing Carbon Capture Storage (CCS)/Carbon Capture Utilization Storage (CCUS) is still under development.
2. From all the proposed alternative

strategies, the results of the AHP Analysis obtained 5 alternatives that were selected, namely: Increasing intensive marketing relationship programs, as well as employee understanding of the importance of sustainable practices to achieve emission reduction targets; Replacing some factory equipment according to company policy to reduce carbon emissions in meeting national food and energy security; Its strategic location in the Arun-Lhokseumawe Special Economic Zone (KEK) opens up great opportunities to implement integrated goods/services procurement policies with carbon footprint certification; Having adequate resources and a global network, the unavailability of carbon capture, storage, and utilization policies is a gap that needs to be filled immediately by fertilizer and petrochemical companies to answer market demands that are increasingly concerned about the environment; Replacing more efficient factory equipment and utilizing CCS/CCUS technology, and supported by adequate infrastructure, the company is committed to achieving its carbon emission reduction target.

3. Two alternative strategies, namely Improving Marketing Relationship Programs and Employee Understanding (AS7) and Replacing Factory Equipment for Efficiency

Suggestion

The following are suggestions in this research:

1. It is necessary to measure and evaluate the strategies that have been formulated, whether they have an effect on reducing carbon emissions or whether they should be changed to other strategies.
2. The existence of factors that are of concern is further improved, such as strengths, weaknesses, opportunities and threats, so that later these factors have a smaller consistency ratio than the current one.

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