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PRIORITIZING SUPPLIER SELECTION TO REDUCE SCOPE 3 EMISSIONS USING THE ANALYTIC HIERARCHY PROCESS (AHP)

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Abstract

The research addresses problems in supplier selection for collaboration to reduce Scope 3 emissions at PT Sejahtera Indonesia (PTSI). It is driven by the company's need to achieve net-zero emissions by 2050, in line with the global target. Reducing Scope 3 emissions is important because it covers most of the total emissions. However, the company faces difficulties in reducing emissions because of a large number of suppliers. The company can't collaborate with all suppliers due to limited time and resources. Therefore, the company must prioritize suppliers that will have a significant impact on collaboration to reduce Scope 3 emissions. This research will use qualitative methods through literature review and FGD, and quantitative methods through a pairwise comparisons questionnaire for AHP. Previous journals have used various criteria for supplier selection. These criteria are then filtered based on their suitability for the research topic, resulting in six criteria that will be proposed and discussed in the FGD. FGD is conducted with four experts to determine the final criteria to be used in the AHP method. AHP is used as a data analysis method to prioritize criteria and alternatives based on the determined criteria. The final criteria are green image, environmental management system, environmental commitment, and carbon emissions. In the alternatives result, Supplier B is the most priority supplier, with a weight of 56.96%. Supplier B has the highest score and is showing strong performance across all criteria. Followed by Supplier E, Supplier A, Supplier D, and Supplier C. These results provide solutions for PTSI, enabling collaboration with suppliers with the highest potential for emissions reduction, considering several criteria.

Keywords: Analytic Hierarchy Process (AHP), carbon emissions, Scope 3 emissions, supplier selection, sustainability

INTRODUCTION

The global average temperature increased by 1.55 ± 0.13 °C in 2024 compared to the pre-industrial era in 1850-1900 (WMO, 2025). The increasing temperature results from the greenhouse effect, a natural process that warms the surface of the Earth due to rising greenhouse gas (GHG) emissions caused by natural and human activities. One human activity that contributes to greenhouse gas emissions is burning fossil fuels such as coal, oil, and gas. This activity has been happening for years and has caused an increase in greenhouse gas emissions, leading to climate change. Climate change is shifting in temperatures, weather patterns, precipitation, and storm events in the long term (Dietz et al., 2020). Climate change's effects include droughts, floods, water shortages, fires, rising sea levels, melting polar ice, storms, and interference with biodiversity (IPCC, 2022).

The Paris Agreement 2015 was held to avoid the worst effects of climate change and maintain a livable Earth's temperature. The Paris Agreement 2015 committed to keeping the average global temperature increase below 2°C compared to pre-industrial levels and striving to limit the increase to below 1.5°C above pre-industrial levels. Every country commits to reducing greenhouse gas emissions in all sectors. It will evaluate every five years with an ambitious climate action plan, known as the Nationally Determined Contribution, or NDC. To limit the global temperature increase below 1.5°C, emissions must be reduced by 45% by 2030 and achieve net-zero emissions by 2050 (IPCC, 2018). Several sectors are causing an increase in greenhouse gas emissions. Some primary sectors producing high gas emissions are the power sector, transport, agriculture, and industry. In 2023, greenhouse gas emissions achieved a new record of 57.1 Gt, or 1.3% higher than in 2022. The power sector contributes 15.1 Gt of gas emissions, the transport sector contributes 8.4 Gt, while agriculture and industry each contribute 6.5 Gt, or 11% of total gas emissions (UNEP, 2024). The industry sector is pushed to reduce greenhouse gas emissions across its value chain, as it is a top contributor to total carbon emissions. As one of the industry sectors, PTSI has set ambitious

targets in reduce carbon emissions to net-zero across the value chain by 2050, aligning with the global target. PTSI has made progress in reducing Scope 1 and Scope 2 emissions across its business activities. Meanwhile, PTSI faces difficulty reducing Scope 3 emissions within the company's value chain. Reducing Scope 3 emissions is important, as Scope 3 upstream emissions cover more than 70% of total carbon emissions in a company (Valdre & Hawkins, 2023). One of the challenges faced by the company in reducing upstream Scope 3 emissions is having a large number of suppliers (Schmidt et al., 2022). With such a large number of suppliers, it is pretty tricky to measure and track Scope 3 emissions, but a company doesn't need to do everything at once to make a huge impact (Herman, 2022). In addition, a company doesn't need to engage with all suppliers and must prioritize suppliers based on emissions and influence (CDP, 2022). PTSI has more than 100 suppliers, indicating a complex supply chain, and it doesn't have direct control over Scope 3 emissions, making emission reduction highly dependent on supplier collaboration. PTSI must collaborate with its suppliers to reduce Scope 3 emissions, but it is also difficult for PTSI to collaborate with every supplier due to limited resources. It aligns with Klaver et al. (2023), who stated that resource constraints are the main challenge in Scope 3 emissions, and with Velázquez et al. (2025) in who reported that 39.1% of respondents face challenges in Scope 3 emissions due to limited internal expertise or resources. Without a systematic supplier prioritization approach, PTSI can allocate resources to suppliers with low-impact emissions, which will slow progress toward the net-zero goal. Therefore, this research will help PTSI systematically prioritize suppliers that will have a significant impact on collaboration on Scope 3 emissions reduction and accelerate progress to achieve net-zero goals. This issue is important to the company, which is committed to achieving net-zero emissions by 2050 as part of its ESG activity, and to many other stakeholders.

LITERATURE REVIEW

ESG Concept

Environmental, Social, and Governance, or ESG, refers to standards for three main criteria in measuring sustainability and evaluating a company's performance. ESG is important because it is critical for long-term value and is used by customers, suppliers, investors, companies, and regulators for investment purposes (Edmans, 2023). ESG has three individual elements. The E, environmental criteria, include energy use, resource use, impacts on living systems, carbon emissions, and climate change. The S, social criteria, refer to how a company manages relationships with its stakeholders, including people and institutions. S includes labor relations, diversity, equity, and inclusion. The G, governance criteria, refer to the company's rules, processes, and practices used to manage itself, make effective decisions, ensure compliance with the law, and meet stakeholders' needs (Henisz et al., 2019).

This research focuses on environmental elements, specifically Scope 3 carbon emission reduction with suppliers. The ESG framework provides guidelines in achieving a company's sustainability goals, including managing indirect emissions in the value chain. ESG principles guide the selection of suppliers in reducing Scope 3 emissions that align with the PTSI's environmental sustainability goals. By prioritizing suppliers based on their ESG performance, with a focus on environmental performance, PTSI ensures working with suppliers committed to reducing emissions and with strong governance in place to track and manage their environmental impact. This is crucial for reducing Scope 3 emissions.

Carbon Emission Categories

Carbon emissions have three main scopes, which are Scope 1, Scope 2, and Scope 3, as explained by the Greenhouse Gas (GHG) Protocol. These categories help companies to calculate and manage their emissions. GHG Protocol Corporate Standard divides the emissions into direct and indirect emissions. Scope 1 refers to direct emissions, while Scope 2 and Scope 3 refer to indirect emissions. Scope 1 emissions come from the company's owned operations and are directly controlled by the company. Scope 2 emissions are from the consumption of purchased electricity, steam, heating, or cooling. Scope 3 emissions are all indirect emissions that occur in the company's value chain, including upstream and downstream emissions. It includes the production of purchased products, the transportation of purchased products, or the use of sold products.

Scope 3 emissions represent most of the company's total carbon emissions (WRI & WBCSD, 2011). Supply chain emissions (upstream Scope 3 emissions) are on average 11.4 times larger than the company's direct emissions (CDP, 2023). Scope 3 emissions are the most complex, making them harder to track and manage, and they are a critical area for reduction (Busch et al., 2022). At the same time, the company has received pressure to reduce carbon emissions in order to combat climate change. Therefore, collaboration with suppliers is essential to overcome Scope 3 emission challenges. PTSI should prioritize suppliers with a strong commitment to sustainability, focusing on the suppliers that significantly contribute to Scope 3 emissions.

Analytic Hierarchy Process (AHP)

Multi-Criteria Decision-Making methods have been widely used in supplier selection, and AHP is one of the most frequently used methods (Govindan et al., 2015; Schramm et al., 2020; Tronnebati et al., 2022). Thomas L. Saaty created AHP. Saaty (1980) defines AHP as a systematic decision-making strategy for solving complicated problems by ranking sub-problems by priority. AHP uses pairwise comparisons with multiple criteria to quantify qualitative judgment. AHP is utilized in planning, option selection, optimization, and project management. In this research, AHP method provides a structured way to prioritize suppliers, which is important given the complexity of Scope 3 emissions and the variation of supplier's commitment to sustainability. AHP helps the company to prioritize suppliers based on their ability to reduce emissions and alignment with the company's sustainability goals. AHP is used to rank suppliers based on some criteria obtained from the literature review.

Conceptual Framework

This research will demonstrate the application of the Analytical Hierarchy Process (AHP) in supplier selection by identifying and weighting criteria and prioritizing alternatives in reduce Scope 3 emissions. AHP is chosen because it allows the evaluation of many criteria, including qualitative and quantitative criteria, and provides robustness. AHP is also used due to its effectiveness, easy to understand, flexible to changes, and lack of complexity for decision makers (Deretarla et al., 2023; Govindan et al., 2015). The process starts with identifying the criteria in supplier selection. Since the criteria differ from common supplier selection in the sourcing process, the criteria will be developed based on previous research and finalized through a Focus Group Discussion (FGD) with experts. The Analytical Hierarchy Process (AHP) is used to help decision-makers make decisions in defining the prioritized criteria for supplier selection in reducing Scope 3 emissions. AHP will compare each criterion and sub-criterion pairwise based on individual judgment. It will also compare each alternative against each criterion. All individual judgments are aggregated to synthesize inputs from all decision-makers, considering the relative importance of each decision-maker, ensuring the final evaluation reflects the team's perspective. Then, a priority weight calculation will be conducted for each criterion and its sub-criteria. This process will result in a ranking of the criteria and sub-criteria. Thereafter, the criterion and sub-criterion weights will be multiplied by the alternative score to obtain the alternative priority. It can identify which suppliers to approach for collaboration to cut Scope 3 emissions and provide a solution for the company. Unlike previous research, which selected suppliers for procurement decision-making and focused on cost, quality, delivery, and green criteria, this study aims to rank and prioritize suppliers for collaboration in reducing Scope 3 emissions, resulting in different AHP criteria. Each organization will have different criteria for supplier selection, depending on its characteristics (Manik, 2023) and the specific case (Stević, 2017).

METHOD

The first step of this research is problem identification. Identifying the problem is an important step to ensure it is clear and relevant, and that it can be solved by the company. The next step is followed by research questions and objectives to solve the business problems. The main objective of this research is to determine the criteria and prioritize suppliers in collaboration to reduce Scope 3 emissions. The following literature review draws on journals, reports, and official websites to discuss supplier selection and Scope 3 emissions, supporting this research. This research will use qualitative methods through FGD and a literature review, and quantitative methods through a pairwise-comparison questionnaire for AHP. The literature review is based on previously published journals. Previous journals have used various criteria for supplier selection in various industries and purposes. These criteria are then filtered based on their suitability to the research topic, and the selected criteria are green image, environmental management system (EMS), environmental commitment, carbon footprint, ease of communication, and geographic location of supplier. These criteria will be proposed and discussed in the FGD to obtain the final criteria. The Focus Group Discussion (FGD) method used in this research aims to collect qualitative data and finalize criteria for supplier prioritization to reduce Scope 3 emissions in accordance with PTSI's conditions. The FGD will also try to dig into the criteria that have not been captured in the literature review. FGD will be conducted offline for 1 hour and involve several participants to discuss and determine the relevant criteria for supplier prioritization. Since this research topic is specific, the participants of FGD will be selected based on their expertise and experience in supplier selection and Scope 3 emissions management. Four people are capable of providing information on the specific topic. The participants are the Procurement Manager, Sustainability Champion, Strategic Procurement, and Procurement Specialist. By involving these participants, the researchers can achieve data saturation of supplier prioritization for Scope 3 emissions, which are important in qualitative research. The AHP questionnaire will be distributed to the same participants as the FGD.

Each participant will be asked to complete the questionnaire based on their individual opinions for the pairwise comparisons of criteria and the alternative pairwise comparisons for each criterion. Each participant has a different hierarchy so that they will be given different weights based on their level of importance. Previous data from the pairwise comparison questionnaire will be analyzed using the AHP method. All calculations in the AHP will be done in Excel. There are some steps in conducting AHP. The first step is problem definition. It is important to identify the problem and determine the goal before proceeding to the next step. The second step is criteria identification. Identify the criteria and sub-criteria that will be used for decision-making for several alternatives. The third step is hierarchy formation. It is created by defining the goal at the top, followed by criteria (and sub-criteria) and alternatives at the bottom. The fourth step is to create a pairwise comparison questionnaire. The identified criteria and sub-criteria from the previous step will be input into the questionnaire and then distributed to the participants, along with the alternatives. Participants will be given a scale from 1 to 9 to compare each criterion, sub-criterion, and alternative (element) at the same level with others, based on their individual judgment, to determine their importance level. The scale is usually called Saaty's scale, and each has its own definition. After all participants have completed giving their judgments, the next step is to create a pairwise comparison matrix. The questionnaire results are transformed into a pairwise comparison matrix for each criterion, sub-criterion, and alternative. The fifth step is to calculate the weight for each criterion and sub-criterion, and the score for each alternative using the eigenvector method to derive relative weights. First, the normalized matrix is calculated. The priority values matrix is then obtained.

$$a'_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}, \qquad i,j = 1,2,\dots,n$$

$$w = \left(\frac{1}{n}\right)\sum_{i=1}^{n} a'_{ij} \quad , \qquad i,j = 1,2,\dots,n$$

n = number of criteria or alternative

Consistency checks are important for validating results in each pairwise comparison matrix. The consistency ratio (CR) is calculated using the formula CR = CI/RI. The Consistency Ratio (CR) value must be below 0.1 to ensure consistency. Otherwise, the matrix will be considered inconsistent. Consistency index (CI) is measured using the following formula.

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

The last step is to calculate the final score for each alternative by multiplying the relative weights of each criterion, sub-criterion, and alternative's score from the previous result. The final score will be used to determine and rank the alternatives according to the identified criteria, with the output being supplier prioritization for Scope 3 emission collaboration. In addition, there are two ways to aggregate each participant's pairwise comparison matrices into a group decision. According to Brunelli (2014), there are two methods for obtaining the group priority vector (wG) from a set of pairwise comparison matrices, which are Aggregation of Individual Judgments (AIJ) and Aggregation of Individual Priorities (AIP). In the aggregation step, each participant's level of importance will also be considered. This research uses the Aggregation of Individual Judgments (AIJ) method. In the Aggregation of Individual Judgments (AIJ), matrices A1, …, Am can be aggregated into a single pairwise comparison matrix AG = (aGi j). The aggregation is conducted before eliciting the priorities. For the Aggregation of Individual Judgments, entries of the group matrix AG = (aij) nxn are obtained using the following parametric formula,

$$a_{ij}^{G} = \prod_{h=1}^{m} a_{ij}^{(h)^{\lambda_h}}$$

with $\lambda_h > 0$ for all h and $\lambda_1 + \cdots + \lambda_m = 1$. The most common interpretation of a given λ_h is that it should be proportional to the importance of the h-th decision maker.

RESULTS AND DISCUSSION

AHP Criteria

The FGD was held on Wednesday, October 1st, 2025, for 1 hour and attended by four participants, including Procurement Manager, Sustainability Champion, Strategic Procurement, and Procurement Specialist. The previous six identified criteria in the literature review were proposed to the decision makers and asked their opinion one by one for each proposed criterion. FGD also explored and asked experts' opinions on other possible criteria to be used in prioritizing suppliers for collaboration in reducing Scope 3 emissions at PTSI. However, no new criteria are emerging from the decision-makers. After discussion, decision-makers agreed to use four criteria, which are green image, environmental management system, environmental commitment, and carbon emissions. These four criteria are sufficient for solving the issue at PTSI on supplier prioritization in reducing Scope 3 emissions. Decision makers decided to drop the ease of communication and geographic location of suppliers criteria because they were irrelevant to solving issues at PTSI. The ease of communication criterion was dropped because it is unrelevant, as PTSI selects suppliers for collaboration in reducing Scope 3 emissions based on other factors, such as carbon emissions levels. At the same time, the geographic location of supplier was dropped because the initial purpose of this criterion is to reduce landed cost and lead time. Some suppliers at PTSI are from overseas. For overseas suppliers, Scope 3 management emissions will be handled by other factories in the same country. That is why the geographic location is irrelevant to the suppliers' selection criteria for Scope 3 emissions reduction at PTSI. The first criterion is a green image. A green image is a perception of a company as environmentally friendly or sustainable, capable of producing green products. A green image indicates that a company is perceived as reducing its carbon footprint, using eco-friendly materials, and supporting sustainability initiatives (Rouyendegh et al., 2020; Memari et al., 2019). Suppliers with a positive green image will be more prioritized because they might influence PTSI's brand image and support its environmental goals. PTSI will collaborate with suppliers who are not only effective in reducing emissions but also have a positive image in the market.

The second criterion is the Environmental Management System (EMS). EMS is a set of systematic processes and practices that enable a supplier to reduce its environmental impact. It includes environmental objectives, planning, and implementation of policies (e.g., ISO 14001) to protect the environment (Dos Santos et al., 2019; Liu et al., 2019; Rouyendegh et al., 2020). Suppliers with EMS indicate they are better at managing their environmental impact, ensuring compliance with environmental regulations, and effectively reducing emissions. Suppliers with EMS certifications are likely to be more reliable partners in achieving Scope 3 emission reductions because they have structured frameworks for continuous improvement in environmental performance. The third criterion is environmental commitment. Environmental commitment is a company's effort to minimize its environmental impact (Liu et al., 2019). In addition, Large & Thomsen (2011) stated that environmental commitment can be a source of competitive advantage and contribute to a company's sustainable development. Since Scope 3 emissions are outside the company’s direct control, active collaboration with suppliers is essential. PTSI has an environmental commitment document, called the Net Zero Pathway Commitment (NZPC), which the supplier must sign. It shows suppliers' commitment to reducing carbon emissions and achieving the net-zero target in 2050. By turning commitment into action, suppliers must also submit a sustainability roadmap. Environmental commitment is one of the most significant factors in the decision-making process because it indicates whether the supplier is motivated and actively working to reduce its carbon emissions in line with PTSI’s long-term target. A high level of commitment increases the likelihood that the supplier will be a strong partner in Scope 3 emissions reduction.

The last criterion is carbon emissions. It refers to the total of CO2 or greenhouse gas emissions produced by a company’s release to the atmosphere. It covers direct and indirect emissions from company activities (Kumar & Jain, 2010). This criterion refers to the actual level of carbon emissions each supplier contributes. It can identify suppliers that make the highest contribution to PTSI's Scope 3 emissions. The carbon emissions of all suppliers are displayed in the Carbon Web Assessment (CWA). Several factors influence the calculation of carbon emissions, including purchase volume order (PVO), suppliers’ business lines, the emission factor, and others. Suppliers with higher carbon emissions are prioritized because their emissions are the largest share of Scope 3 emissions within the company's value chain. Reducing emissions from high-emission suppliers will have a significant impact on the company’s overall carbon footprint, making them an important target for collaboration.

AHP Hierarchy Structure

Image 1 illustrates the hierarchy of the AHP, including the goal, criteria, and alternatives. Alternatives are selected and limited to the top five suppliers with the highest total carbon emissions in FY2024. This determination is based on several sustainability frameworks. According to CDP (2022), focusing efforts on the highest contributing

suppliers is more effective in reducing Scope 3 emissions. The GHG protocol also suggests ranking suppliers by emissions contribution from highest to lowest (SBTi, 2025). The five alternatives are Supplier A, Supplier B, Supplier C, Supplier D, and Supplier E.

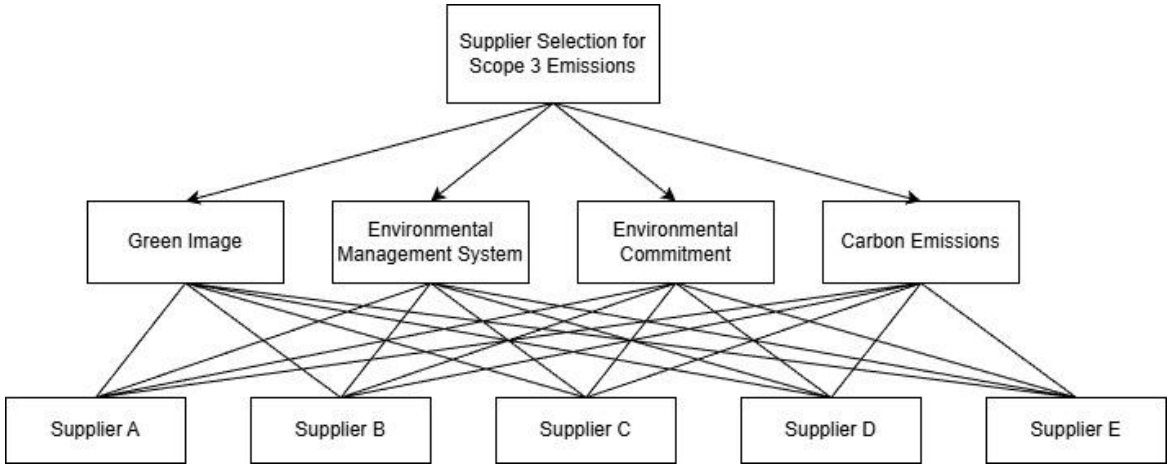

Image 1. Hierarchy Structure of AHP

Weight Calculation for Criteria

Each decision maker provides their individual judgment for the pairwise comparisons of criteria. The results are then aggregated using the Aggregation of Individual Judgments (AIJ) method to obtain collective results. The results are shown in Table 1. It shows that environmental commitment is the number one priority criterion, with a weight of 37.44%, followed by carbon emissions at 32.38%, environmental management systems at 22.33%, and green image at 7.86%. The consistency ratio is 2.76%, indicating that the answers from the pairwise comparisons of all participants are consistent.

Table 1. Weight Calculation for Criteria

Criteria	Green Image	Environmental Management System	Environmental Commitment	Carbon Emissions	Weight	Priority Rank
Green Image	1.00	0.25	0.21	0.31	7.86%	4
Environmental Management System	3.94	1.00	0.45	0.64	22.33%	3
Environmental Commitment	4.68	2.22	1.00	0.94	37.44%	1
Carbon Emissions	3.21	1.55	1.07	1.00	32.38%	2

The number one priority criterion in supplier selection for Scope 3 emission reduction is environmental commitment, with a weight of 37.4%. Environmental commitment becomes the number one priority criterion because it is the basic thing to have when suppliers want to reduce emissions. If the supplier has environmental commitments, it will have a good impact on other criteria, such as carbon emissions reduction, having an EMS, and a good green image. Based on the FGD results, this criterion is important because it becomes one of the mandatory requirements that suppliers must meet to complete Scope 3 emissions at PTSI. Suppliers must sign the Net Zero Pathway Commitment (NZPC). At the same time, suppliers must submit their plans to reduce emissions. It does not have to be a significant plan, but a small plan to reduce emissions will be appreciated.

The second priority criterion is carbon emissions, with a weight of 32.4%. Carbon emissions are another condition that suppliers must fulfill to complete Scope 3 emissions at PTSI, based on the FGD results. Carbon emission is included in the CWA system, which suppliers can access. In CWA, suppliers must complete all documents related to their current business information, including carbon emissions and carbon calculations for every activity and item. The third priority criterion is EMS, with a weight of 22.3%. One example of EMS is shown by ISO 14001. Currently, ISO 14001 is not mandatory at PTSI. However, PTSI encourages its existing suppliers to obtain ISO 14001 certification or, at a minimum, to initiate implementation of the concept within their companies.

In the future, ISO 14001 will become a mandatory requirement in supplier sourcing and selection at PTSI. EMS indicates the supplier's capability for continuous improvement. The lowest-priority criterion is the green image, with a weight of 7.9%. Green image still plays a role in supplier selection for Scope 3 emissions. It has become one of the key considerations for companies evaluating their suppliers externally, including supplier reputation, environmental responsibilities, support for ESG, customer appeal, and competitive advantage.

Alternatives Final Score Calculation

After the calculation for criteria and alternatives pairwise comparison is done, the weight of each criterion will be multiplied by the score for each alternative in the same criteria based on the previous pairwise comparison result. Table 2 presents the results of the pairwise comparison of criteria and alternatives. It also shows each alternative's score on the same criteria and which criteria each alternative excels in.

Table 2. Alternatives Final Score Calculation

Criteria	Weight	Supplier A	Supplier B	Supplier C	Supplier D	Supplier E
Green Image	0.079	0.008	0.042	0.007	0.009	0.012
Environmental Management System	0.223	0.018	0.140	0.016	0.024	0.025
Environmental Commitment	0.374	0.038	0.209	0.027	0.050	0.051
Carbon Emissions	0.324	0.040	0.178	0.040	0.021	0.044
	SUM	10.46%	56.96%	8.94%	10.39%	13.25%
	RANK	3	1	5	4	2

Supplier B becomes the most priority supplier in terms of collaboration in reducing Scope 3 emissions with a total score of 56.96%. It has the highest score in every criterion compared to other alternatives. The total score between Supplier B and another alternative is relatively high. Supplier B is a manufacturer of copper busbars. Copper busbar manufacturing companies typically generate substantial carbon emissions. Based on the PTSI PVO to Supplier B, Supplier B's emissions rank second-highest in FY2024. It is important to prioritize Supplier B for collaboration in Scope 3 emissions. In addition, communication is easier with Supplier B, the manufacturer rather than the distributor, as it is simpler to discuss related issues and shorten lead times, such as reducing Scope 3 emissions. Furthermore, Supplier B adheres to several international standards, including ISO 14001 for Environmental Management Systems (EMS). These reasons align with the established criteria, nominating Supplier B as the top priority for collaboration.

The second-prioritized supplier is Supplier E, with a total score of 13.25%. Supplier B is a steel machining manufacturer. As a manufacturer, communication regarding Scope 3 emissions reduction between PTSI and the Supplier E will be easier for manufacturers than for distributors. Based on the PTSI PVO to Supplier E, Supplier E's emissions rank fifth-highest in FY2024. The third-prioritized supplier is Supplier A, with a total score of 10.46%. Supplier A is a distributor company, especially in copper busbar items. In FY2024, PTSI had the highest purchase volume order with Supplier A, resulting in Supplier A being the number one contributor to PTSI's Scope 3 emissions. Since Supplier A is a distributor, it finds it more challenging to collaborate with them to reduce Scope 3 emissions than if Supplier A were a manufacturer. The fourth-prioritized supplier is Supplier D, with a total score of 10.39%. Supplier D is a distributor for electrical items. In FY2024, the PVO of PTSI was relatively high, influencing the contribution of Supplier D's emissions to PTSI, and ranked as the fourth-highest emitter. Since Supplier D is a distributor, it is more challenging for them to collaborate in reducing Scope 3 emissions than for a manufacturer.

The last prioritized supplier is Supplier C with a total score of 8.94%. Supplier C is a distributor of copper busbars. PTSI had a high PVO-to-Supplier C ratio in FY2024, which also led in high carbon emissions, making it the third-highest emitter. However, in FY2025, PTSI ceased purchasing from Supplier C due to changes in purchasing regulations. It becomes challenging to communicate with Supplier C in reducing Scope 3 emissions, as orders placed for them in FY25 are decreased, despite their high carbon emissions, based on their history in FY2024. As a result, Supplier C has the lowest score in most criteria, such as environmental commitment, EMS, and green image, and becomes the last priority alternative. The results show that prioritizing suppliers considers commitment, ESG awareness, and carbon emissions. It makes Scope 3 emission reduction strategic and efficient by focusing on suppliers who are most likely to meet the company's net-zero goals. PTSI will collaborate with all five suppliers,

starting with the highest-priority supplier, Supplier B, and proceeding to Supplier E, Supplier A, Supplier D, and ending with Supplier C. PTSI expects to reduce Scope 3 emissions by 58% through this collaboration.

CONCLUSION

This research focuses on addressing problems in supplier selection to determine supplier priorities for collaboration in reducing Scope 3 emissions at PTSI. The purpose of the collaboration is to achieve net-zero emissions by 2050. PTSI will collaborate with existing suppliers, selecting five suppliers that contribute the highest emissions in fiscal year 2024. FGD was conducted to gather information and finalize the AHP criteria with the experts. The FGD results identified the final four criteria in accordance with the PTSI conditions, which are a green image, an environmental management system, environmental commitment, and carbon emissions. Each decision maker provides their judgment on the pairwise comparison of the criteria, and then the aggregate individual judgment method is used to calculate the result of the AHP analysis. Based on the criteria's weight calculations, the results show that environmental commitment is the most prioritized criterion, with a weight of 37.4%, followed by carbon emissions at 32.4%, environmental management system at 22.3%, and green image at 7.9%. The AHP results for the alternatives show that Supplier B is the most prioritized supplier for collaboration, with a total score of 56.96%. It is followed by Supplier E at 13.25%, Supplier A at 10.46%, Supplier D at 10.39%, and Supplier C, which is the least prioritized at 8.94%. By collaborating with these five suppliers, PTSI will achieve a 58% increase in progress toward achieving its Scope 3 emissions reduction goals, reaching a final progress of 70%.

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