

## INTEGRATION OF TRIPLE BOTTOM LINE IN SUPPLIER SELECTION PROCESS (CASE STUDY AT INDONESIA BOTTLED WATER COMPANY)

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**Abstract:** PT ABC is an Indonesia bottled water company that continues to strive to adopt sustainability efforts in every aspect of its business process, including on their supplier selection process. This study aims to determine the usage of TBL criteria in current formulation of supplier selection decisions at PT Tirta Investama; to determine what are the TBL integrated selection criteria and its assessment indicators which needed to select suppliers appropriately; and how to use them to select suppliers at PT ABC. Researchers conducted in-depth interviews with 4 procurement managers of PT ABC to find out the usage of TBL criteria in current formulation of supplier selection decisions. Currently, economic perspective still becomes the only one focus in supplier evaluation process in PT ABC. In fact, environmental and social concern still not significantly underlie supplier evaluation process which lead to selection decisions. The determination of TBL integrated selection criteria and its assessment indicators begins through literature review and finalized with focus group discussion (FGD). In this study, researchers established 13 TBL integrated selection criteria and 20 assessment indicators to select suppliers at PT ABC. Those criteria and indicators are then used to select suppliers in 4 main material categories of PT ABC using the analytical hierarchy process (AHP) method. Based on this selection process, a ranking of suppliers of each material category is obtained, resulting in PT A2 as top selected supplier in gallon bottle category, PT B1 as top selected supplier in gallon cap category, PT C1 as top selected supplier in preform category, and PT D1 as top selected supplier in screw cap category.

**Keywords:** AHP, business sustainability, supplier selection, supplier selection criteria, triple bottom line

**Abstrak:** PT ABC adalah perusahaan air minum dalam kemasan di Indonesia yang terus berupaya untuk mengadopsi upaya keberlanjutan di setiap sendi operasional bisnisnya, termasuk sejak proses pemilihan pemasok. Penelitian ini bertujuan mengetahui penggunaan kriteria TBL dalam formulasi keputusan seleksi pemasok di PT ABC saat ini; menentukan kriteria seleksi dan indikator penilaian apa saja yang diperlukan dalam ketiga perspektif TBL untuk menyeleksi pemasok secara tepat; dan bagaimana menggunakannya untuk menyeleksi pemasok di PT ABC. Peneliti melakukan wawancara mendalam dengan 4 orang manajer procurement PT ABC untuk mengetahui penggunaan kriteria TBL dalam formulasi keputusan seleksi pemasok. Hasilnya, proses seleksi pemasok di PT ABC saat ini masih berfokus hanya pada perspektif ekonomi. Perspektif lingkungan dan perspektif sosial belum secara nyata mempengaruhi keputusan seleksi pemasok. Penentuan kriteria seleksi dan indikator penilaian terintegrasi TBL diawali dengan literatur review dan difinalisasi dengan focus group discussion (FGD). Dalam penelitian ini, peneliti menetapkan 13 kriteria seleksi dan 20 indikator penilaian terintegrasi TBL untuk menyeleksi pemasok di PT ABC. Kriteria dan indikator yang diperoleh kemudian digunakan untuk menyeleksi pemasok di 4 kategori material utama PT ABC menggunakan metode analytical hierarchy process (AHP). Berdasarkan proses seleksi ini, diperoleh urutan peringkat pemasok di masing-masing kategori, yang menempatkan PT A2 sebagai pemasok teratas di kategori botol gallon, PT B1 sebagai pemasok teratas di kategori tutup gallon, PT C1 sebagai pemasok teratas di kategori preform, dan PT D1 sebagai pemasok teratas di kategori screw cap.

**Kata kunci:** AHP, keberlanjutan bisnis, kriteria seleksi pemasok, seleksi pemasok, triple bottom line

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## INTRODUCTION

PT ABC is fast-moving consumer goods (FMCG) company which produces bottled drinking water in Indonesia. In the first quarter of 2022, the global group launched the company's strategic plan to realize a growing and sustainable business. This is to ensure as well as to show robust commitment on business operation which responsible to people and planet. This strategic plan must be applied in every aspect of business process, including on supplier selection as the very early step to ensure all the business activity always operated in right direction. It is aligned with what Rogers and Hudson (2011) said that nowadays business sustainability is becoming an increasingly popular term in relation to corporate development and objectives. Therefore, adoption of sustainable strategic plan of PT ABC in its supplier selection process is important to address.

In sustainability concept, social dimension and environmental dimension are becoming the focus that is considered as important as economic dimension. John Elkington in 1994 introduced the term triple bottom line (TBL) as an important consideration which involve business operation on achieving organization's sustainability objectives (Sunkari, 2015). TBL consists of 3 perspectives, namely economic perspective, environmental perspective, and social perspective. In simple language, TBL encourages companies to not only focus on the pursuit of profit, but also to pay attention on social and environmental contributions to strengthen their business sustainability. For example, from the consumer point of view, many people are now starting to care about environmental issue, especially plastic waste (Hendrasetyawan and Yunus, 2022). Also, growing interest in the principle of sustainable development promotes pressure from media, government, and consumers to business entity increase impact level toward sustainability (Anggraeni et al. 2022).

In terms of company's spending for suppliers, PT ABC allocates no less than 400 million euros per annum. Therefore, this huge spending allocation demands high precision in terms of supplier evaluation and selection process. PT ABC must ensure that its expenditure is only given to proper suppliers. To support business continuity, it is worth to review supplier eligibility using the TBL framework. This approach is important so that selected suppliers have the same focus on the pursuit of profit, social attention, and environmental contribution to realize business sustainability. Currently, there are still discrepancies in the results of the global evaluation (HEG) to select suppliers at PT ABC comparing to three perspectives of TBL. This picture of inequality is shown in Table 1. The implication is that selected supplier is at risk of not being able to support business sustainability optimally. Therefore, it is important to integrate TBL framework on determining supplier selection criteria and using it to select suppliers at PT ABC.

In the context of manufacturing business, integration of the TBL framework can even be applied as a prerequisite mechanism for supplier before entering company's business ecosystem. Related to supplier evaluation and selection, studies which identify supplier assessment criteria using TBL dimensions are growing. Study conducted by Igarashi et al. (2013) identified an increasing urgency of environmental criteria in supplier evaluation and selection activities. Nevertheless, the research of Azadnia et al. (2015), Shalke et al. (2018), and Ghadimi et al. (2018) identified that spending allocation to suppliers still focuses on minimizing total costs. Laosirihongthong et al. (2019) then emphasized the importance of connection of supply chain decisions to the analysis of economic benefits, environmental attention, and social contributions to ensure realization of sustainable business performance. Lopez and Lopez (2021) also reinforce the importance of considering environmental perspectives and social perspectives in supplier selection.

Table 1. Supplier evaluation result at PT ABC in 2021 and 2022 (%)

Level	2021					2022				
	HEG <sup>a</sup>	HPK <sup>b</sup>	PKM <sup>c</sup>	PRM <sup>d</sup>	MRK <sup>e</sup>	HEG <sup>a</sup>	HPK <sup>b</sup>	PKM <sup>c</sup>	PRM <sup>d</sup>	MRK <sup>e</sup>
High/Good	92	59	42	32	12	89	60	42	32	12
Intermediate	8	33	33	68	88	11	37	35	68	88
Low/Poor	0	8	25	0	0	0	3	23	0	0

Note: <sup>a</sup>Global evaluation results; <sup>b</sup>Quality assessment results; <sup>c</sup>Maintenance compliance assessment; <sup>d</sup>Material recycle management; <sup>e</sup>Work risk management.

Previous research shows that there is still lack of integration of environment and social consideration in supplier selection process. The actual process mainly focused on economic consideration. Following that reality, existing instruments at PT ABC are currently unable to elaborate TBL framework integratively to select suppliers. So that integration of TBL perspective in supplier selection process is becoming proposed contribution in this case study. The focus of supplier selection is PT ABC's existing suppliers who already cooperated regularly. By TBL adoption, PT ABC can integrate its sustainable plan into supplier selection mechanism, resulting in supplier management process which has integrative consideration in profit, people, and planet. Based on this background, this study aims to determine the usage of TBL criteria in current formulation of supplier selection decisions at PT ABC; to determine the assessment criteria required in the TBL framework to select suppliers appropriately, and; to select suppliers at PT ABC using TBL's integrated assessment criteria.

## METHODS

This research was conducted from March 2023 until April 2023 at PT ABC headquarter which is domiciled at Prof. Dr. Satrio Road No. 17 Jakarta. In general, the data used in this study consists of primary data and secondary data. Primary data was obtained from internal resource persons at PT ABC. These resource persons consisted of employees of PT ABC, from the quality, supply chain, procurement, engineering, and research and development (R&D) divisions. The secondary data used in this study were obtained through a literature study from scientific journals published from 2012 to 2023.

Following previous research that mention about lack of integration of environment and social consideration in supplier selection process, proposed hypothesis of this study is that existing instruments at PTABC are currently unable to elaborate TBL framework integratively to select suppliers. Therefore, to understand current usage of TBL criteria in the formulation of supplier selection decisions, researchers used primary data obtained through in-depth interviews with resource persons at PT ABC. Resource persons are determined intentionally (purposive sampling) based on their work function, position, education level, and experience. Resource persons are 4 procurement managers at PT ABC

with minimum education level is bachelor. Resource person has functional relationship with suppliers for at least 5 years. Information obtained through in-depth interviews was analyzed using qualitative descriptive methods to explain how PT ABC places TBL criteria in its current supplier selection mechanism.

The determination of the supplier assessment criteria required in TBL framework for supplier selection is conducted based on primary and secondary data collected. Literature review of 45 journals discussing supplier selection criteria underlies the secondary data obtained. Researchers use scientific journals published from 2012 to 2023. Online searches in academic databases including ProQuest, Elsevier, and Taylor & Francis are conducted to collect those required scientific journals. The keywords used for online search include "supplier selection", "supplier selection criteria", "green criteria for supplier selection", and "green supplier selection". In addition, primary data was obtained through focus group discussion (FGD) based on secondary data obtained from literature review with involving experts from PT ABC. Experts are selected using purposive sampling from cross-divisional team that has functional relationships with suppliers for at least 5 years. The divisions involved are procurement, quality, supply chain, R&D, and engineering. Each division is represented by 2 managers with minimum education level is bachelor. The FGD is aimed at sorting out criteria, reviewing relevance, and determining assessment indicators from these criteria identified.

To select suppliers, each expert in the FGD was asked to justify the fundamental scale for each criterion in pairwise comparison of selection objects for analytical hierarchy process (AHP) analysis. The suppliers used as research objects are 3 major suppliers from each material category in 4 main material categories. The four main material categories are material categories that in total receive 80% allocation of total supplier's expenditure. Those four materials are gallon bottles, gallon caps, preforms, and screw caps. Three suppliers from each selected material category are suppliers who in total receive 70% allocation of the total spending in each category. The tabulation of supplier names based on their material categories as an object of this study is presented in Table 2.

Efforts to achieve business sustainability are able to be strengthened by the implementation of the TBL framework, which also termed as 3P, namely profit,

planet, and people. On this research, TBL integration on determining supplier selection criteria and supplier selection activity requires a multi-criteria analysis from an economic (profit), environmental (planet), and social (people) perspective. Based on the needs of it, researchers then use those selected criteria in AHP analysis to select suppliers. The output from AHP is selected suppliers who are expected to be able to support the sustainability of the company's business. Research framework of integration of TBL in supplier selection process in Figure 1.

## RESULTS

### Usage of TBL Criteria in Current Formulation of Supplier Selection Decisions

In current situation, PT ABC relies on supplier evaluation instrument which issued directly by the global group. This instrument was globally initiated by global procurement division to be applied in all country business unit (CBU). The procurement division itself is division in charge of coordinating supplier selection activities and determining spending allocations

for suppliers. The current global supplier selection instrument consists of a series of criteria which evaluated through filled questionnaires involving related division as an evaluator. Those related divisions are quality, R&D, supply chain, and procurement itself. In this selection instrument, 79% of total weight are coming from economic consideration, 9% of total weight are coming from social consideration, and 12% of total weight are coming from environmental consideration. The outcome of this selection instrument is introduced as the value of global evaluation result (HEG).

Basically, the highest spending allocation should be given to supplier with highest HEG index, and vice versa. Unfortunately, in fact there is no linear correlation between HEG and its spending implications received by each supplier (Figure 2). In practical, the result of current supplier selection instrument has no implications for determining the spending allocation. This phenomenon is caused by: lack of relevancy between selection criteria and business needs; listed selection criteria do not fully accommodate cross-divisional needs in functional relationships with suppliers, and; lack of clarity on how the indicators must be measured in each selection criteria.

Table 2. Material category and its supplier as the object of study

Material category	Supplier name		
Gallon bottle	PT A1	PT A2	PT A3
Gallon caps	PT B1	PT B2	PT B3
Preform	PT C1	PT C2	PT C3
Screw cap	PT D1	PT D2	PT D3

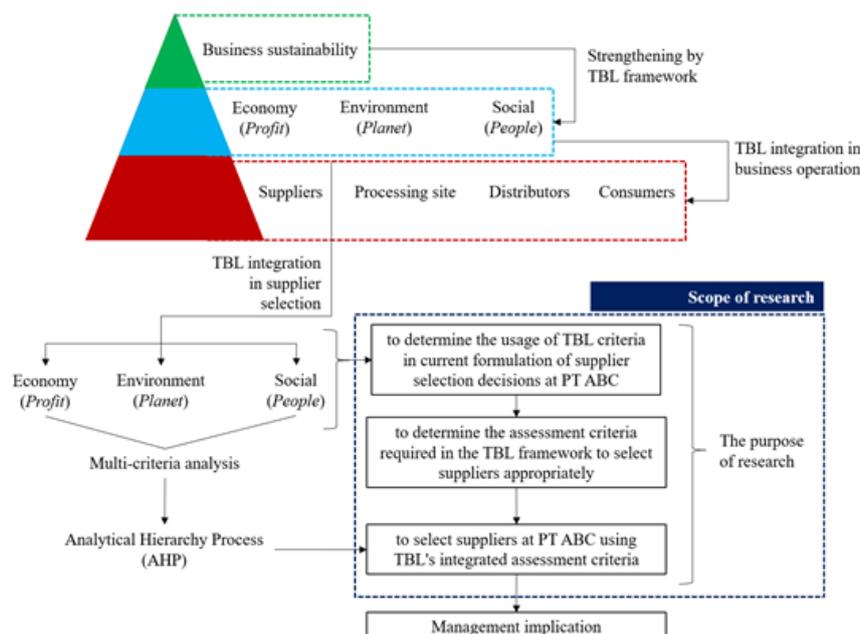


Figure 1. Research framework of integration of TBL in supplier selection process

Currently, PT ABC defines spending allocation for suppliers by only using 4 criteria from an economic perspective, which are price, production capacity, defect rate, and maintenance compliance. In terms of pricing criteria, suppliers who provide the lowest price proposal will be prioritized in the tender process. After that, procurement division sequentially considers defect rate, production capacity, and maintenance compliance. As a summary, the sequence process of consideration of four criteria above during supplier selection and spending allocation is illustrated in Figure 3.

In fact, the spending allocation determination for suppliers only based on economic perspective and totally excludes social perspective and environmental perspective. This is similar to existing reality which discussed in previous research conducted by Azadnia et al. (2015), Shalke et al. (2018), and Ghadimi et al. (2018), which mentioned that supplier selection is still mainly focused on only economic perspective. In the long term, negation of social perspectives and environmental perspectives can potentially erode brand integrity, consumer trust, and profitability.

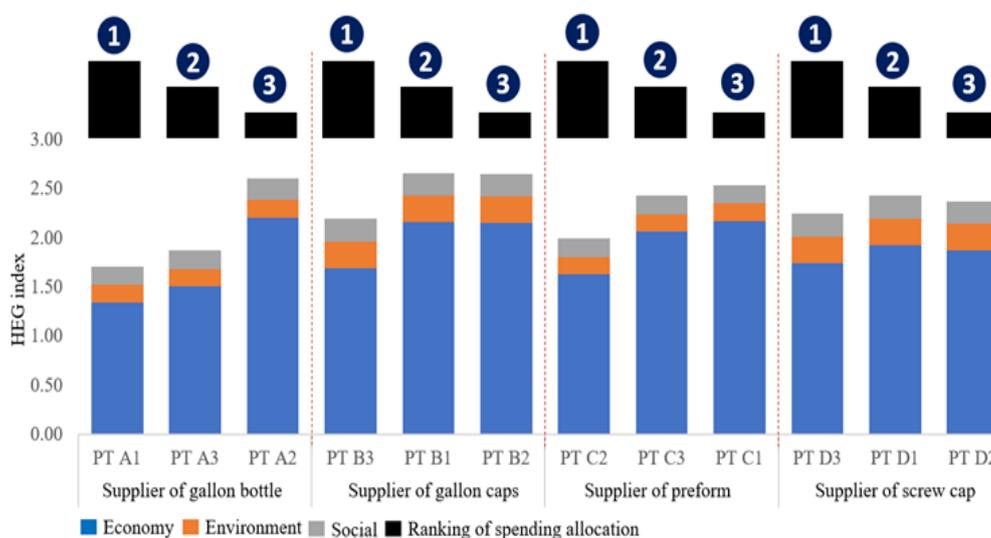


Figure 2. Comparison between HEG and spending allocation

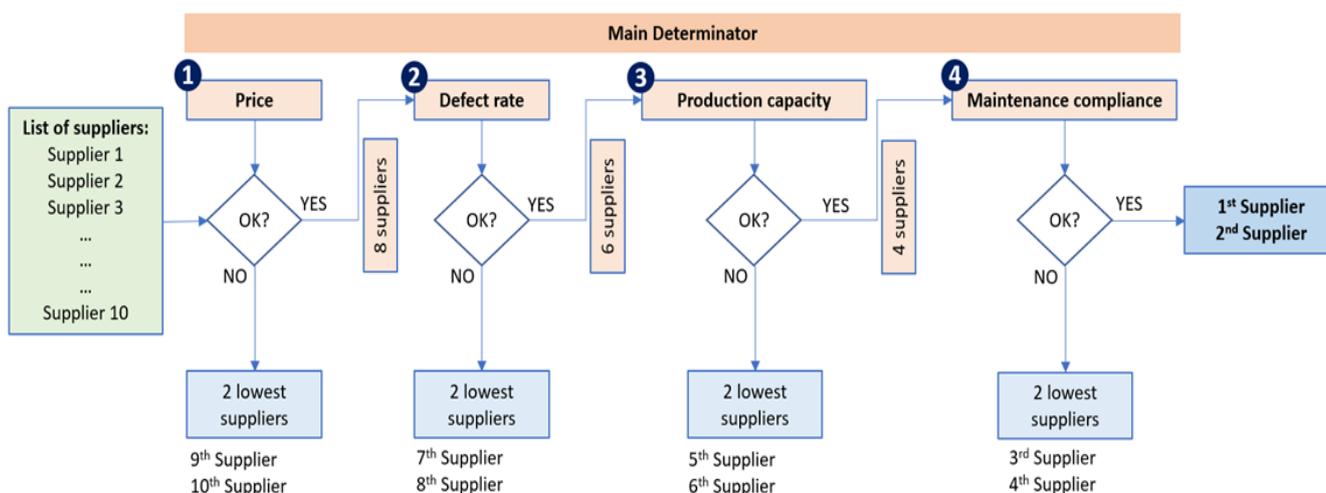


Figure 3. Sequence process of consideration of four criteria in supplier selection decisions

### Assessment Criteria Required in TBL Framework to Properly Select Suppliers

Researchers collected 100 articles from online search results. Of the 100 articles, a total of 45 articles discussed about supplier selection criteria throughout 2012 to 2023. The selection criteria discussed in the 45 articles were identified, so that 603 selection criteria were obtained. Criteria that have similar meaning or aligned objectives are grouped into one category. This grouping resulted in 43 categories of criteria. These criteria categories are then grouped again into economic perspectives, environmental perspectives, or social perspectives. As a result, these grouping places 23 criteria into economic perspective, 13 criteria into environmental perspective, and 7 criteria into social perspective. The sequence in which these criteria are grouped is illustrated in Figure 4.

The economic perspective dominates discussion of supplier selection criteria throughout 2012 to 2023. Economic perspective was discussed in every year among the period of the articles studied. This criterion was discussed by Haldar et al. (2012), Kilic (2013), Ghadimi and Heavey (2014), Azizi et al. (2015), Mavi et al. (2016), Cengiz et al. (2017), Kumar et al. (2018), Taherdoost and Brard (2019), Duarte and Sousa (2020), Tavana et al. (2021), Goodarzi et al. (2022), and Debnath et al. (2023). Of the total supplier selection criteria identified, 75.25% are criteria from economic perspective, 17.28% are criteria from environmental perspective, and 7.48% are criteria from social perspective. The categorization of criteria in stage 3 (see Figure 4) for economic perspective, environmental perspective, and social perspective is presented in Figure 5.

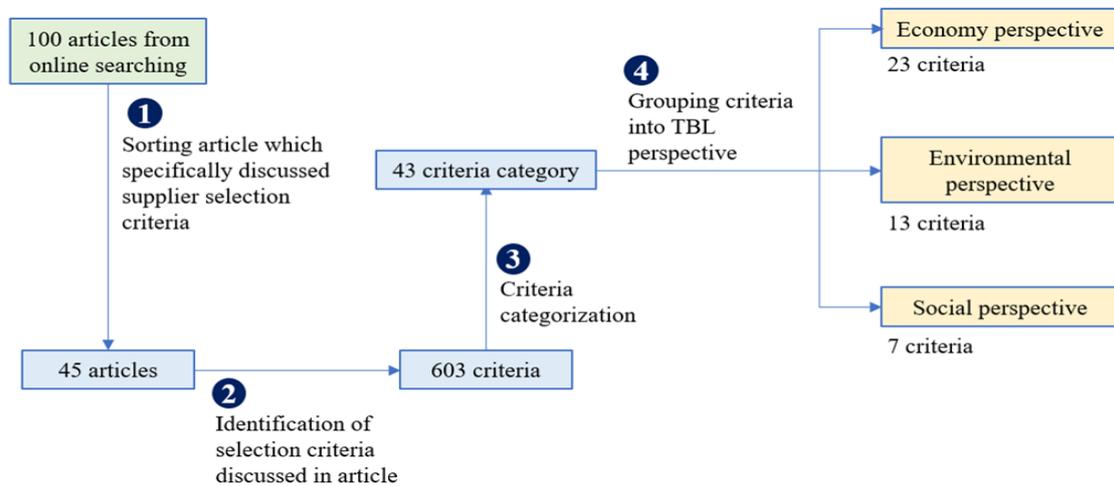


Figure 4. Sequence of selection criteria grouping

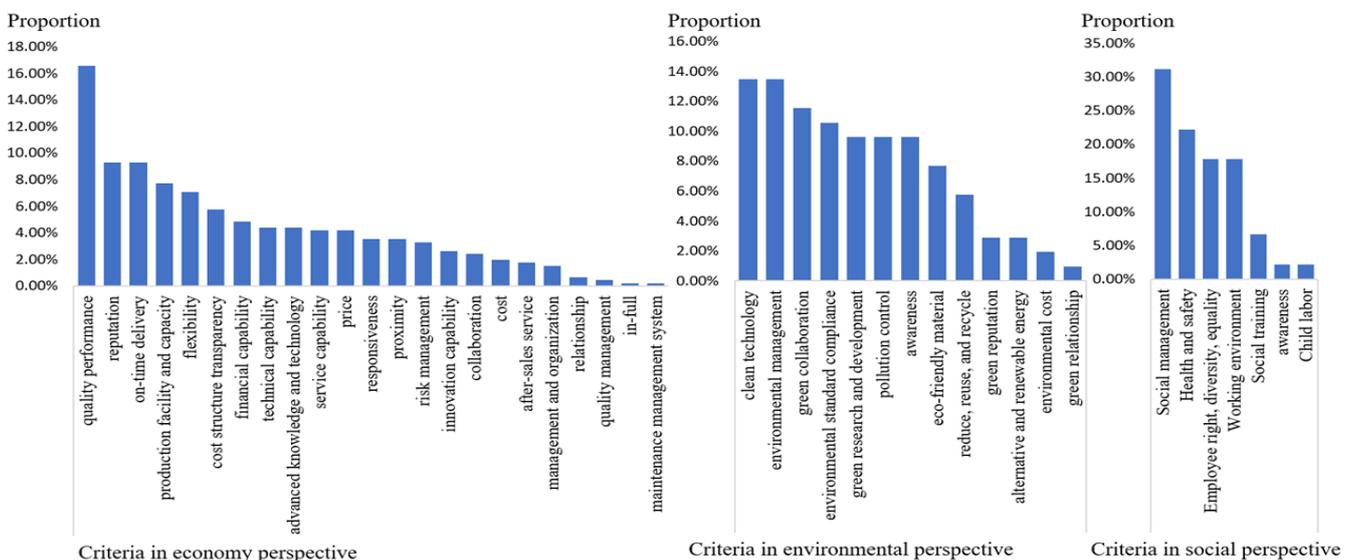


Figure 5. Selection criteria from economic, environmental, and social perspectives

With regard to simplification of the analysis, this category of criteria is then referred to as term ‘criteria’. All of these criteria are then used as FGD material to be evaluated and defined as final selected criteria to select suppliers. All division representatives agreed on rules to determine these criteria, namely: criteria selection in each perspective is based on criteria which cumulatively identified in 50% literature studies; selected criteria must have clarity in terms of assessment indicators; and assessment indicators must have relevancy to business needs and work functions with related divisions. Based on the rules, researchers inventoried 13 selected criteria and 20 assessment indicators as a result from FGD, as presented in Table 3.

### Implementation of TBL Integrated Assessment Criteria to Select Suppliers

Based on the established criteria and indicators, researchers construct a hierarchical structure for AHP analysis as illustrated in Figure 6. The selection object consisting of 12 suppliers from 4 material categories was then assessed based on above hierarchical

structure. AHP analysis carried out to select suppliers in each material category. Experts consisting of 10 people from cross-divisional teams were asked to do pairwise comparisons for each level of the hierarchy. Pairwise comparisons are made through consensus generated in FGDs. To quantify these subjective judgments, ordinal scales with reciprocal principles are used in determining relative importance between one element to another element in the same level of criteria (Saaty, 2008). If the importance of element A is equal to “x” of element B, then the importance of element B must be “1/x” of element A. This ordinal scale is shown in Table 4.

The consistency of pairwise comparisons of subjective justifications is measured using consistency ratio (CR). Saaty (1987) said that pairwise comparison is consistent if the CR value is  $\leq 10\%$ . Therefore, experts must ensure that the justification is carried out logically and consistently to obtain CR value less than or equal to 10%. The results of supplier selection based on AHP are presented in Figure 7.

Table 3. Supplier selection criteria and its assessment indicators

Perspective	Criterion	Assessment indicators		
Economy (E)	Quality Performance (E1)	Defective rate (E1-1)		
		Downtime ratio (E1-2)		
		Reject rate (E1-3)		
	Reputation (E2)	Stakeholder satisfaction with supplier performance in the previous period (E2-0)		
	On-Time Delivery (E3)	On-time delivery ratio (E3-0)		
	Production facility and capacity (E4)	Non-negotiable equipment (NNE) ratio (E4-1)		
Spare capacity ratio (E4-2)				
Maintenance compliance (E4-3)				
Flexibility (E5)	Lead time order (E5-1)			
	Term-of-payment (E5-2)			
Cost Structure Transparency (E6)		Clear cost structure breakdown, including raw material, overhead cost, storage, transportation, profit ratio, and final price (E6-0)		
		Environment	Clean technology (V1)	Implementation of management and circular technology (V1-0)
		(V)	Environmental Management (V2)	Availability of environmental management governance- (V2-1)
				Resource availability (V2-2)
			Green Collaboration (V3)	Ratio of green projects carried out with customers (V3-0)
			Environmental Standard Compliance (V4)	ISO 14001 certification (V4-0)
Social (S)	Green Research and Development (V5)	The existence of research and development projects of environmentally friendly technology and materials (V5-0)		
	Social management (S1)	No critical and major SEDEX non-compliance (S1-0)		
	Health and safety (S2)	ISO 45001 certification (S2-1)		
		Implementation of K3 management (S2-2)		

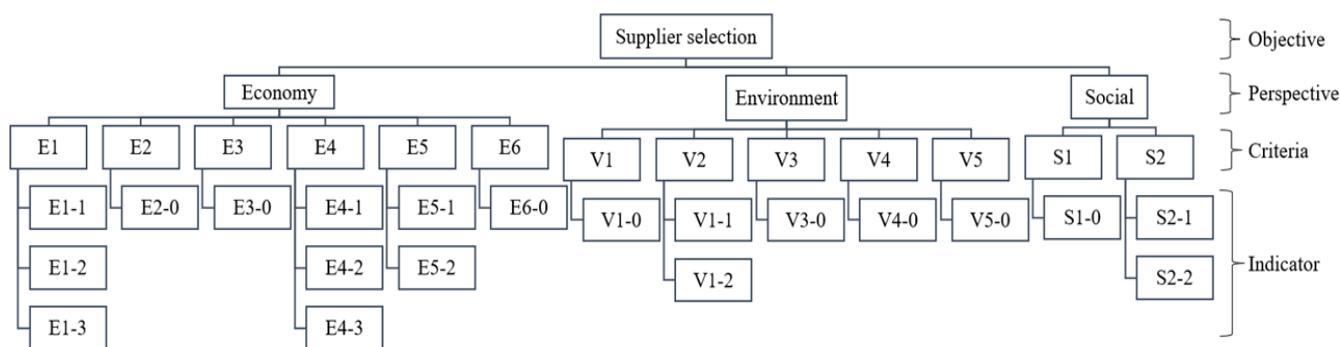


Figure 6. Hierarchical structure for supplier selection

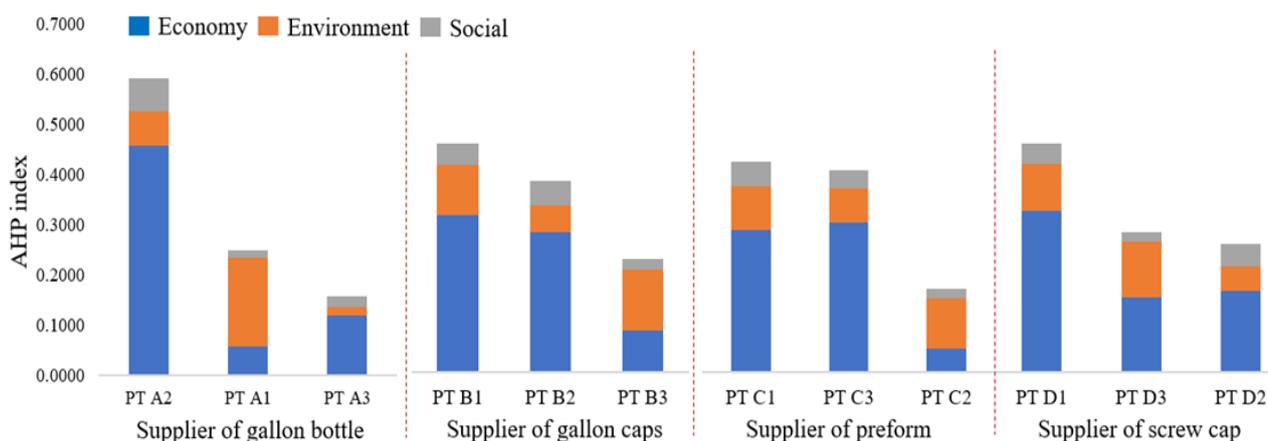


Figure 7. Supplier selection result based on AHP

Table 4. Ordinal scale for AHP justification<sup>a</sup>

Ordinal scale	Definition
1	Both elements are equally important and have the same influence
3	One element is slightly more important than the other elements
5	One element is more important than the other elements
7	One element is clearly more important than the other elements
9	One element is absolutely more important than the other elements
2, 4, 6, 8	The average value between two adjacent considerations. This value is given if there is a compromise between the two adjacent considerations
Reciprocal principle	If the importance of element A is equal to “x” of element B, then the importance of element B must be “1/x” of element A

In gallon bottle category, PT A2 is selected supplier in the first rank, followed by PT A1 in the second rank, and PT A3 in the third rank. PT A2 has total AHP index of 0.5927. Compared to PT A1 and PT A3, PT A2 is supported by performance excellence in economic perspective index of 0.4580 and social perspective index of 0.0677. In the gallon cap category, PT B1 ranked first in selected suppliers, followed by PT B2 in second place, and PT B3 in third place. Total AHP index of PT B1 is 0.4292. This value is slightly above AHP index of PT B2 which is 0.3583. Compared to PT B2 and PT B3, PT B1 is supported by performance

advantages in economic perspective of 0.2947 and environmental perspective of 0.0946.

The preform category has PT C1 as the selected supplier in the first rank, PT C3 in the second rank, and PT C2 in the third rank. Total AHP index of PT C1 is 0.4249. An interesting thing is that the performance of economic perspective indicator of PT C1 (0.2873) is actually below that PT C3 (0.3015). However, PT C1 can outperform PT C3 because the performance of its environmental perspective and social perspective indicators is above PT C3. The advantages of these

two perspectives makes AHP index of PT C1 greater than PT C3. In the screw cap category, PT D1 is the selected supplier in the first rank, followed by PT D3 in the second rank, and PT D2 in the third rank. PT D1 has total AHP index of 0.4594. Compared to PT D3 and PT D2, PT D1 is supported by performance excellence in economic perspective of 0.3249 and environmental perspective of 0.0946. In terms of economic perspective, this performance advantage makes total AHP index of PT D1 far exceed PT D3 and PT D2.

Unique performance characteristic in each supplier shows that every supplier has its own strength and performance gap. Moreover, the lack of economic performance is not the only factors that erode the whole performance, as reflected by PT C1. In this study, each TBL perspective can proportionally support supplier performance to make it outstanding among the competitors. This finding enriches what Azadnia et al. (2015), Shalke et al. (2018), and Ghadimi et al. (2018) discussed in their study, which previously identified that spending allocation to suppliers still focuses on only economic consideration, which is total costs minimization. Also, this finding strengthens what Laosirihongthong et al. (2019) and Lopez and Lopez (2021) discussed previously, in which the analysis of economic benefits, environmental attention, and social contributions are beneficial to be emphasized in supplier selection process.

### Managerial Implications

Researchers analyze managerial implications related to opportunities for reducing ineffective spending and reducing errors in program setting for supplier

development. For calculation of ineffective spending, researchers used information of 320 million euros total spending for all four material categories, with allocations of 45% for gallon bottle suppliers, 25% for gallon cap suppliers, 20% for preform suppliers, and 10% for screw cap suppliers. As much as 70% of the total spending allocation in each category was received by those three suppliers in the same category. The first-ranked supplier obtains 50% allocation, the second-ranked supplier obtains 30% allocation, and the third-ranked supplier obtains 20% allocation. Based on this information, the expenditure value base used by researchers to assess the chances of reducing ineffective spending is shown in Table 5.

A comparison of supplier rankings based on AHP total index against the realization of expenditure allocations provided at the beginning of 2023 is shown in Figure 8. In the gallon bottle, gallon cap, and screw cap categories, the order in which the amount of expenditure allocation is given is very different from the AHP index obtained.

Calculation of the value of ineffective spending is done by calculating the difference between the expenditure that should be obtained by the supplier and the actual expenditure received by the supplier. The expenditure that suppliers should receive is calculated in a proportional approach based on AHP index received by each supplier. Meanwhile, the actual expenditure received by suppliers is based on spending allocation received by those suppliers at the beginning of 2023. After that, total ineffective spending is calculated based on spending value which diverted from one supplier to another. To animate the description, researchers present an illustration of ineffective spending in Figure 9.

Table 5. Base value of expenditure allocation

Material category	Total expenditure allocation (in million euro)	Expenditure allocation for top 3 suppliers (in million euro)	Actual allocation for 1 <sup>st</sup> rank supplier (%)	Actual allocation for 2 <sup>nd</sup> rank supplier (%)	Actual allocation for 3 <sup>rd</sup> rank supplier (%)
Gallon bottle	144	100.8	22.5	13.5	9
Gallon caps	80	56	12.5	7.5	5
Preform	64	44.8	10	6	4
Screw cap	32	22.4	5	3	2
Total	320	224	50	30	20

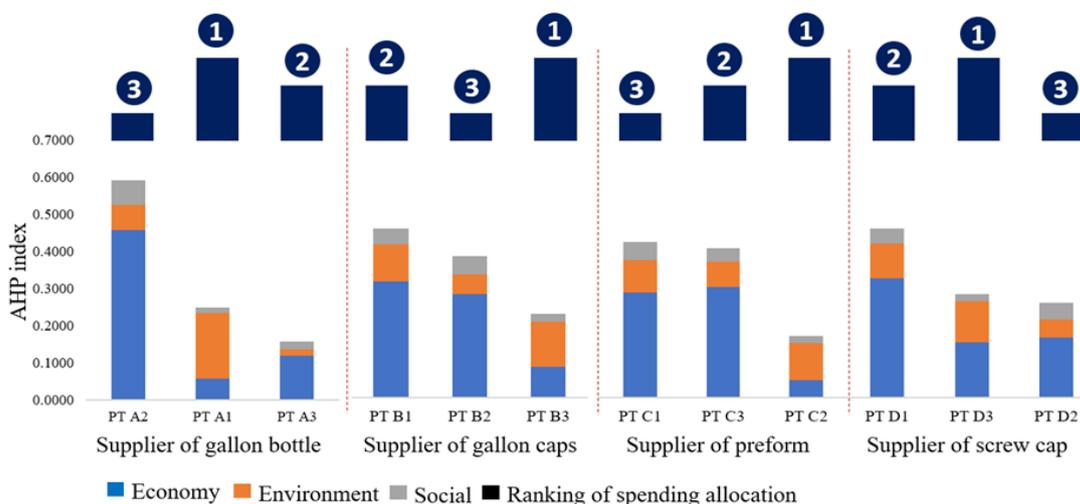


Figure 8. Comparison of AHP index to expenditure allocation obtained

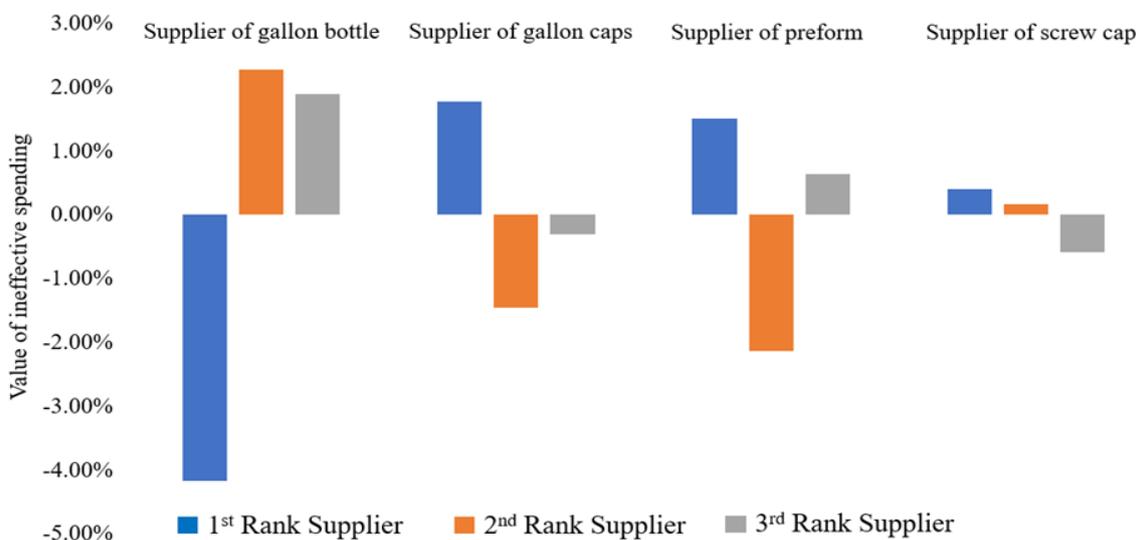


Figure 9. Value of ineffective spending of four material categories

In *gallon* bottle category, the 2nd place supplier received an overspend allocation of 2.28% and the 3rd place supplier received an overspend of 1.89%. This total allocation of 4.17% should be given to the 1st ranked supplier in the gallon bottle category. Meanwhile, in the gallon cap category, the 1st ranked supplier received an overspend of 1.77%. This value should be received by the 2nd ranked supplier by 1.46% and the 3rd ranked supplier by 0.31%. Based on these two illustrations, the value of ineffective spending is 4.17% for the gallon bottle category and 1.77% for the gallon cap category. Similarly, the value of ineffective spending for the preform category is 2.14%, and is 0.58% for screw cap. Of all these calculations, the total of identified value of ineffective spending is 8.66%.

Therefore, by using assumption of base spending value of 224 million euros per year, the total of ineffective spending that has the potentiality to be reduced is 19.4 million euros per year. Also, by using assumption of an exchange rate of Rp16,000.00 for 1 euro, PT ABC can possibly reduce the total of ineffective spending worth 310 billion rupiah per year.

In relation to the establishment of follow-up programs for supplier development, PT ABC can refer to the acquisition of AHP index for each supplier. The reason for using this AHP index is because it is able to show performance deficiencies more clearly, as shown in Figure 10.

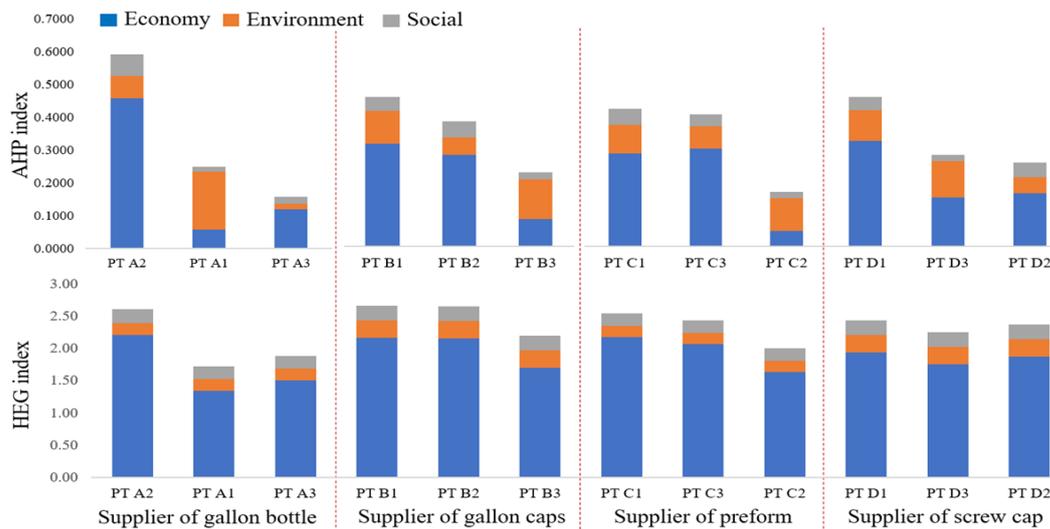


Figure 10. Supplier performance profile based on AHP index and HEG index

Certain perspective that has the smallest index can be prioritized for determining mitigation plans or supplier development program. For example, development programs that should be prioritized for PT A1 are programs which projected to strengthen economic performance, while development programs that should be given to PT A3 should focus on strengthening all three perspectives. Such inputs cannot be reflected by HEG index, which merely shows that both PT A1 and PT A3 only have deficiencies of economic performance compared to PT A2. The HEG index also indicates that there is no problem of inequality in environmental performance and social performance in those three suppliers. This kind of data reflection risks triggering wrong decision and extravagancy of supplier development costs for PT ABC.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

This research shows that basically, PT ABC has included three TBL perspectives in existing selection instrument. However, these three perspectives do not integratively have implications for supplier selection outcomes. In fact, the results of supplier selection for determining expenditure allocation are only determined by 4 criteria from an economic perspective, which are price, production capacity, defect rate, and maintenance compliance. This is similar to what Azadnia et al.

(2015), Shalke et al. (2018), and Ghadimi et al. (2018) discussed in their study, which previously identified that spending allocation to suppliers still focuses on only economic consideration.

By extracting expectations across divisions, determining relevant selection criteria, and setting clear indicators presents an alternative selection instrument consisting of 3 TBL perspectives, 13 selection criteria, and 20 indicators for selecting suppliers. Based on this alternative instrument, a ranking of suppliers of each material category is obtained, resulting in PT A2 as top selected supplier in gallon bottle category, PT B1 as top selected supplier in gallon cap category, PT C1 as top selected supplier in preform category, and PT D1 as top selected supplier in screw cap category. Also, the result reflects respective performance profile of each supplier in terms of TBL perspective which shown supplier's own strength and performance gap. In this study, each TBL perspective can proportionally support supplier performance to make it outstanding among the competitors. Moreover, the lack of economic performance is not the only factors that erode the whole supplier performance. Therefore, this study also amplifies what Laosirihongthong et al. (2019) and Lopez and Lopez (2021) discussed previously, which mentioning that the analysis of economic benefits, environmental attention, and social contributions are beneficial to be emphasized in supplier selection process.

## Recommendations

To support the strengthening of business sustainability goals while avoiding ineffective spending, PT ABC needs to align spending allocation decisions and supplier development programs based on this supplier ranking order and performance. Furthermore, in terms of future science development, researchers suggest to explore on how to quickly assess selection indicators at the supplier selection level. Researchers believe it can be an alternative solution for pairwise comparison, especially if the selection process involves large number of suppliers. Exploration of this alternative assessment method is also expected to reduce potency of expert saturation during selection process. In addition, the determination of alternative strategy maps based on supplier performance profiles is also important to explore. This alternative strategy map is believed to be able to provide clear guidance for developing mitigation plans and development programs that must be provided by the company for each supplier.

## REFERENCES

- Anggraeni AS, Jahroh S, Suparno O. 2022. Sustainable business strategy at hotel selarong bogor. *Business Review and Case Studies* 3(3): 181-192. <https://doi.org/10.17358/brcs.3.3.181>
- Azadnia AH, Saman MZM, Wong KY. 2015. Sustainable supplier selection and order lotsizing: an integrated multi-objective decision-making process. *International Journal of Production Research* 53(2): 383-408. <https://doi.org/10.1080/00207543.2014.935827>
- Azizi A, Aikhuele DO, Souleman FS. 2015. A Fuzzy TOPSIS Model to Rank Automotive Suppliers. *Procedia Manufacturing* 2:159–164. <https://doi.org/10.1016/j.promfg.2015.07.028>
- Cengiz AE, Aytakin O, Ozdemir I, Kusan H, Cabuk A. 2017. A Multi-criteria Decision Model for Construction Material Supplier Selection. *Procedia Engineering* 196:294–301. <https://doi.org/10.1016/j.proeng.2017.07.202>
- Debnath B, Bari ABMM, Haq MdM, de Jesus Pacheco DA, Khan MA. 2023. An integrated stepwise weight assessment ratio analysis and weighted aggregated sum product assessment framework for sustainable supplier selection in the healthcare supply chains. *Supply Chain Analytics* 1:100001. <https://doi.org/10.1016/j.sca.2022.100001>
- Duarte BM, Sousa SD. 2020. Supplier pre-qualification method for the Portuguese construction industry. *Procedia Manufacturing* 51:1703–1708. <https://doi.org/10.1016/j.promfg.2020.10.237>
- Ghadimi P, Heavey C. 2014. Sustainable Supplier Selection in Medical Device Industry: Toward Sustainable Manufacturing. *Procedia CIRP* 15:165–170. <https://doi.org/10.1016/j.procir.2014.06.096>
- Ghadimi P, Toosi FG, Heavey C. 2018. A multi-agent systems approach for sustainable supplier selection and order allocation in a partnership supply chain. *European Journal of Operational Research* 269(1): 286-301. <https://doi.org/10.1016/j.ejor.2017.07.014>
- Goodarzi F, Abdollahzadeh V, Zeinalnezhad M. 2022. An integrated multi-criteria decision-making and multi-objective optimization framework for green supplier evaluation and optimal order allocation under uncertainty. *Decision Analytics Journal* 4:100087. <https://doi.org/10.1016/j.dajour.2022.100087>
- Haldar A, Banerjee D, Ray A, Ghosh S. 2012. An integrated approach for supplier selection. *Procedia Engineering* 38:2087–2102. <https://doi.org/10.1016/j.proeng.2012.06.251>
- Hendrasetyawan BE, Yunus EN. 2022. New product development strategy for sustainable rigid plastic packaging at XYZ company in 2022-2023. *Business Review and Case Studies* 3(3): 193-205. <https://doi.org/10.17358/brcs.3.3.193>
- Igarashi M, De Boer L, Fet AM. 2013. What is required for greener supplier selection? A literature review and conceptual model development. *Journal of Purchasing and Supply Management* 19(4): 247-263. <https://doi.org/10.1016/j.pursup.2013.06.001>
- Kilic HS. 2013. An integrated approach for supplier selection in multi-item/multi-supplier environment. *Applied Mathematical Modelling* 37(14):7752–7763. <https://doi.org/10.1016/j.apm.2013.03.010>
- Kumar S, Kumar S, Barman AG. 2018. Supplier selection using fuzzy TOPSIS multi criteria model for a small scale steel manufacturing unit. *Procedia Computer Science* 133:905–912. <https://doi.org/10.1016/j.procs.2018.07.097>
- Laosirihongthong T, Samaranayake P, Nagalingam S. 2019. A holistic approach to supplier evaluation and order allocation towards sustainable procurement. *Benchmarking: An International*

- Journal* 26(8): 2543-2573. <https://doi.org/10.1108/BIJ-11-2018-0360>
- Lopez AP, Lopez NR. 2021. A decision support tool for supplier evaluation and selection. *Sustainability* 13(12387): 1-17. <https://doi.org/10.3390/su132212387>
- Mavi RK, Goh M, Mavi NK. 2016. Supplier Selection with Shannon Entropy and Fuzzy TOPSIS in the context of supply chain risk management. *Procedia Soc Behav Sci.* 235: 216–225. <https://doi.org/10.1016/j.sbspro.2016.11.017>
- Rogers K, Hudson B. 2011. The triple bottom line: the synergies of transformative perceptions and practices for sustainability, with Barclay Hudson, OD Practitioner (Fall 2011). *OD Practitioner*.
- Saaty RW. 1987. The analytic hierarchy process: what it is and how it is used. *Mathl Modelling* 9(3-5): 161-176. [https://doi.org/10.1016/0270-0255\(87\)90473-8](https://doi.org/10.1016/0270-0255(87)90473-8)
- Saaty TL. 2008. Decision making with the analytic hierarchy process. *International Journal of Services Sciences* 1(1): 83-98. <https://doi.org/10.1504/IJSSCI.2008.017590>
- Shalke PN, Paydar MM, Hajiaghahi-Keshteli M. 2018. Sustainable supplier selection and order allocation through quantity discounts. *International Journal of Management Science and Engineering Management* 13(1): 20-32. <https://doi.org/10.1080/17509653.2016.1269246>
- Sunkari PA. 2015. Using the triple bottom line to select sustainable suppliers for a major oil and gas company [tesis]. Arkansas: University of Arkansas
- Taherdoost H, Brard A. 2019. Analyzing the Process of Supplier Selection Criteria and Methods. *Procedia Manufacturing* 32:1024–1034. <https://doi.org/10.1016/j.promfg.2019.02.317>
- Tavana M, Shaabani A, Di Caprio D, Amiri M. 2021. An integrated and comprehensive fuzzy multicriteria model for supplier selection in digital supply chains. *Sustainable Operations and Computers* 2:149–169. <https://doi.org/10.1016/j.susoc.2021.07.008>