Performance Measurement of SWA AMDK 600 ML Bottle Suppliers Based on Vendor Performance Indicator (VPI) with The Analytical Hierarchy Process (AHP) Method at PT Swabina Gatra Gresik

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Abstract. This study aims to measure the performance of 600 ml AMDK bottle supplier PT Swabina Gatra Gresik based on the Vendor Performance Indicator (VPI) with 5 criteria of quality, cost, delivery, flexibility, and responsiveness, with 10 sub-criteria. The method uses Analytical Hierarchy Process (AHP). Calculations from the three suppliers showed that supplier 1 had the highest value of 2.49. Then supplier 2 with a value of 1.60, and finally supplier 3 with the lowest value of 0.91. Thus, supplier 1 is prioritized by the company as the main supplier of 600 ml bottles. Meanwhile, there is a need for further performance evaluation for supplier 3 to improve supplier performance which can affect production.

Keywords: Peformance Measurement, Vendor Performance Indicator (VPI), Analytical Hierarchy Process (AHP)

1. Introduction

PT Swabina Gatra Gresik is an industry that operates in several sectors, one of which is producing bottled drinking water (AMDK) under the SWA brand. SWA AMDK commodities are distributed to almost all regions of Indonesia through the PT Swabina Gatra Operational Office which is divided into many regions of Indonesia. In fulfilling the availability of AMDK, needs, and production processes, the company has a goods and services procurement department called the Procurement Unit. This unit is tasked with carrying out the procurement process, starting from the fulfillment of

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purchase requests, purchase orders, supplier selection, negotiations with suppliers, to pricing and delivery in meeting the availability of AMDK bottles. With the procurement unit, the availability of goods in the form of AMDK bottles can be fulfilled properly, because this unit is directly related to suppliers, so that it can contact suppliers to control procurement activities. PT Swabina Gatra Gresik certainly has several bottle packaging suppliers who are trusted partners in the SWA AMDK business. The determination of this supplier is based on trust and good relations with PT Swabina Gatra Gresik.

In terms of suppliers of 600 ml Bottled Drinking Water (AMDK) bottles, the quality of products from the three suppliers is equally good, but there are often poor quality products such as dented bottles when shipping. Sometimes suppliers also experience delays in delivery. Delays occur because the SWA AMDK bottle supplier is late in delivering products as previously agreed (human error) and the availability of products from suppliers that are lacking on the delivery date. This is due to inconsistent supplier performance. Thus, it often causes the production and packaging of SWA AMDK 600 ml bottles to not be maximized. As a result, the daily production of 600 ml bottles of SWA AMDK is uncertain, because it depends on the availability of the number of bottles in the storage warehouse. The purpose of this study is to determine the criteria and subcriteria of Vendor Performance Indicatros (VPI) that are suitable for measuring the performance of PT Swabina Gatra Gresik bottle suppliers. And to provide suggestions regarding the results of the implementation of the Analytical Hierarchy Process (AHP) as a method for measuring the performance of bottle suppliers.

2. Literature Review

Supply chain management is becoming a unified and important strategy in the aspects of demand, procurement, operations and logistics flow systems. The term supply chain management was coined by Oliver and Weber in 1982. Supply chain management is the flow of overseeing the transformation of raw materials into final products to realize efficient integration and suppliers, manufacturers, agents, stores and customers [1]. Meanwhile, according, supply chain management is a process of controlling activities to obtain raw materials as semi-finished goods and finish good, then distributing products to customers with the distribution process [2]. The process covers the purchasing process with other important processes that condition suppliers with agents. Suppliers as a group of providers of needs required by customers in both physical and non-physical forms (services). In the manufacturing industry, the need for raw materials and supporting components provided by suppliers is an important component in the production line [3]. Suppliers are an important part of SCM and affect the smooth production in the manufacturing industry, and determining the appropriate supplier can minimize procurement costs. To evaluate suppliers, various criteria are needed that can describe the supplier's performance thoroughly, which can increase current value or future value [4].

States that, the supplier performance evaluation method was proposed with the journal title “a new measure for supplier performance evaluation”, utilizing the Vendor Performance Index (VPI) with Quality, Cost, Delivery, Flexibility, and Responsiveness (QCDFR), which is described as follows [5]. States that, the supplier performance evaluation method was proposed by [6] with the journal title “a new measure for supplier performance evaluation”, utilizing the Vendor Performance Index (VPI) with Quality, Cost, Delivery, Flexibility, and Responsiveness (QCDFR), which is described as follows: [7]. Cost, which is the final product that ends with the purchase of finished products Usually related to product costs, logistics costs, ordering costs, inventory costs, warranty costs, maintenance costs, production costs [8]. Delivery, which is the ability to transport goods from the source location to a predetermined destination. Usually related to waiting time, on time, safety and security of components, delivery reliability. Flexibility, flexibility can be described as the supplier's competence in adapting to external changes and maintaining good performance. System performance is characterized by parameters such as capacity, service levels, maintainability, and profitability. External changes are uncontrollable conditions that affect the system, including changes in demand or usage levels, shifts in spatial traffic patterns, loss and degradation of infrastructure, and changes in the price and availability of critical resources such as. Responsiveness, which is the ability to quickly identify react, and recover from changes Supplier responsiveness can also mean an ability to handle order changes, supplier after-sales responsibility and motivation to share skills to solve problems.

AHP is a method that is used as a decision maker, this theory is used to explain the decision-making process by breaking down complex problems into a hierarchical structure of objectives, criteria, sub-criteria and alternatives [9]. Here are the steps to calculate and solve with the AHP method. AHP is a generalized notion of judgment to derive ratio scales from fixed or continuous pairwise comparisons. AHP solves complex multi-criteria problems into a hierarchy. The hierarchy is explained as an example of a complex problem on a multi-level structure, where the initial level is the intention of the level of factors, criteria, and sub criteria to the final level of alternatives.

Table 1. Literature Summary

Approaches	Researcher Name	Decision making method	Title
Single sourching	Wisnugroho, Anthonius Dhinar Hasto, Dkk (2022)	AHP	Analysis of Supplier Selection at UMKM Boutique Rumah Kebaya Berau Regency, East Kalimantan Using the Analytical Hierarchy Process (AHP) Method

Approaches	Researcher Name	Decision making method	Title
	Dhinar, Anthonius, Dkk (2022)	AHP	Analysis of UHT Diamond milk Supplier Selection with Analytical Hierarchy Process (AHP) Method Cafe Milkway Coffee & Milk in Berau Regency, East Kalimantan
	Ni Kadek Nirmalasari, I Gede Putu Krisna Juliharta, Ida Bagus Kresna Sudiatmika (2023)	AHP	Priority Analysis of Raw Material Supplier Selection in Decision Support Systems using the AHP and TOPSIS Methods in Manufacturing Companies (Case Study: PT Asia Garment Internasional)
	Priyo Bagus Pambudi, Ainur Komariah, Rian Prasetyo (2020)	AHP	Implementation of the AHP Method for Evaluating the Performance of Primary Packaging Material Suppliers at PT X
	Pitaloka, Adelia Amanda (2022)	AHP	Evaluation of Production Part Supplier Performance with Analytical Hierarchy Process (AHP) Method at PT. Metindo Erasakti

3. Research Method

The type of research conducted is qualitative research with an interactive approach. Interactive qualitative method, is a rooted analysis utilizing simultaneous data collection techniques from the original environmental object. Researchers describe symptoms and create a comprehensive picture of the informants. This research was conducted at the SWA Bottled Drinking Water (AMDK) Production company located at the Head Office & AMDK Factory of PT Swabina Gatra Gresik located at Jl. R.A. Kartini No.21 A, Gresik 61122, East Java. The problem was taken in the procurement unit because previously the researcher had done an internship for a period of three months. The selection of this unit is because it is directly related to suppliers, so it will be more specific to conduct research in accordance with the problems and themes taken. The division that is the place of observation is the procurement unit at PT Swabina Gatra Gresik. This unit was chosen because the procurement unit is directly related to suppliers at PT Swabina Gatra Gresik. The

selection of this unit as an important informant to support the collection of data sources in the field. The following informants will be involved in research activities:

Table 2. List of Research Informant

No.	Name of Informant	Position	Length of Work
1.	Mrs. M	Unit Manager	12 Years
2.	Mr. IS	Supervisor Warehousing	14 Years
3.	Mr. YDP	Supervisor Supplies	17 Years
4.	Mr. S	Staff Warehousing	26 Years
5.	Mrs. D	Staff Supplies	6 years

The types of data utilized by researchers in this study are subject data and physical data. Subject Data Subject data is information obtained from the research subject, namely the procurement unit. The informants in this study are employees in the procurement unit to find out the procurement process for AMDK bottle packaging products. Physical data is a type of data in the form of physical objects obtained by researchers when conducting research. This physical data can be in the form of samples of bottled bottled water and documents needed to evaluate supplier performance such as purchase order documents, work order documents (SPK), and other supporting documents. This qualitative research utilizes primary data sources as well as secondary data sources. Primary data sources are taken in field research by direct observation related to problems that occur in the company. Primary data sources are taken through observations and interviews with procurement unit employees to find out how the company evaluates supplier performance.

Data collection is needed to obtain the data needed in order to achieve the research objectives as planned. Researchers apply several data collection techniques, such as: According to [10] Structured interviews are used for data mining methods in research by asking and preparing several lists of questions to informants regarding problems in a study so that researchers get information from these interviews. Interviews submitted to the procurement manager unit, supplies supervisor, warehousing supervisor, and procurement staff of PT Swabina Gatra Gresik were conducted by researchers to find out information and find data regarding the problem of delays in sending AMDK bottle packaging and with the topic under study so that it is expected to obtain clearer data. Researchers made direct observations at the company to find out and explore data related to supplier performance

issues related to product quality, price, delivery, flexibility, and supplier response that occurred at PT Swabina Gatra Gresik.

Data analysis technique is a way of systematically grouping data to make it easier for researchers to draw conclusions. According to Bogdan in [11] suggests, data analysis techniques are a way of exploring and systematically arranging the acquisition of data from observations, interviews, and other documents, as a result, it can easily understand the findings and can be shared with the general public. According to Miles and Huberman explained, the flow in qualitative data analysis is carried out interactively and occurs continuously, as a result the data acquisition has been comprehensive. The flow of data analysis, namely data reduction, data display, and conclusion drawing / verification. According to there are a number of tests to test the validity of qualitative research data. Researchers utilize the credibility test or trust in the research results. The data validity test is needed to determine whether or not the data findings presented by the researcher are suitable for field facts. Credibility testing is required through additional observation, seriousness, triangulation, discussion with peers, negative case analysis and member check. But researchers choose member checks according to the needs of researchers.

The purpose of member check is so that the information obtained can be utilized in a like-minded report with the source. The implementation of member check is carried out after one period of data collection is fulfilled. The method can be carried out personally, namely researchers meeting with sources, or through discussion forums. In the discussion forum, the researcher explains the findings to a group of informants. In the discussion, there may be data that is agreed upon, trimmed, added and omitted by the informants. After the data is mutually agreed upon, the informants then sign it to make it more original. This activity is to prove that the researcher has carried out a member check. So, researchers conduct member checks to check the validity of data to employees at PT Swabina Gatra Gresik. The data provided is supplier performance evaluation data and the results of calculations with the AHP method presented.

4. Result and Discussion

Data Collection

Based on the results of interviews with the five interviewees above who are employees in the procurement unit of PT Swabina Gatra Gresik, the researchers can conclude that, the company has actually evaluated suppliers once a year, but perhaps the data and criteria evaluated are still not detailed enough, so there is still less than optimal supplier performance such as there are several product qualities that are not good the third product comes, and there are delays in delivery due to the availability of products and transportation modes that are not ready. Based on the results of the

questionnaire that the researchers conducted on respondents, namely employees of the Procurement Unit at PT Swabina Gatra Gresik regarding evaluating supplier performance. Respondents consisted of five Procurement Unit employees consisting of Unit Manager, Supplies Supervisor, warehousing Supervisor, and two Procurement Staff. Draft a questionnaire to be submitted to respondents and ask for information about the Vendor Performance Indicator (VPI) criteria and sub-criteria related to supplier performance measurement. Data collection from respondents is carried out through questionnaires distributed to respondents. The contents of the questions to respondents include criteria and sub-criteria questions that represent assessments as a measure that affects supplier performance measurement.

Basis For Determining Criteria And Sub-Criteria Of VPI Supplier Performance Measurement

Table 3. Basis for determining criteria and sub-criteria

No	Criteria	Give Thick (✓) for Selected Criteria	Sub-criteria Based on VPI	Give Mark (✓) for Selected Sub-Criteria
1	Quality	✓	Product Quality	✓
			Product Warranty	✓
2	Cost	✓	Product Price	✓
			Term of Payment	✓
3	Delivery	✓	Delivery Timelines	✓
			Accuracy of Quantity or Amount of Raw Materials Delivered	✓
4	Flexibility	✓	Fulfillment of Changes in Ordered Product Demand	✓
			Delivery Time Change	✓
5	Responsiveness	✓	Complaint Response from the Company	✓

No	Criteria	Give Thick (✓) for Selected Criteria	Sub-criteria Based on VPI	Give Mark (✓) for Selected Sub-Criteria
			Response to suppliers coming to the company	x
			Product Return Response	✓

Based on the table 3 above, the determination of criteria and sub-criteria by the Procurement Unit does not have additional criteria, but in the sub-criteria the supplier's response comes to the company to resolve complaints, then the company replaces it with the product return response sub-criteria. Because the supplier's response to the company has never been done, so when the company complains to the supplier, the supplier only responds by telephone. The existing supplier performance assessment at PT Swabina Gatra Gresik almost covers all the criteria and subcriteria of the Vendor Performance Indicator (VPI) that the company wants.

Table 4. Basis for determining criteria and sub-criteria

Criteria	VPI	Sub-criteria
Quality	VPI 1	Product Quality
	VPI 2	Product Warranty
Cost	VPI 3	Product Price
	VPI 4	Term of Payment
Delivery	VPI 5	Delivery Timelines
	VPI 6	Accuracy of Quantity or Amount of Raw Materials Delivered
Flexibility	VPI 7	Fulfillment of Changes in Ordered Product Demand
	VPI 8	Delivery Time Change
Responsiveness	VPI 9	Complaint Response from the Company
	VPI 10	Product Return Response

Analytical Hierarchy Process (AHP) Structure

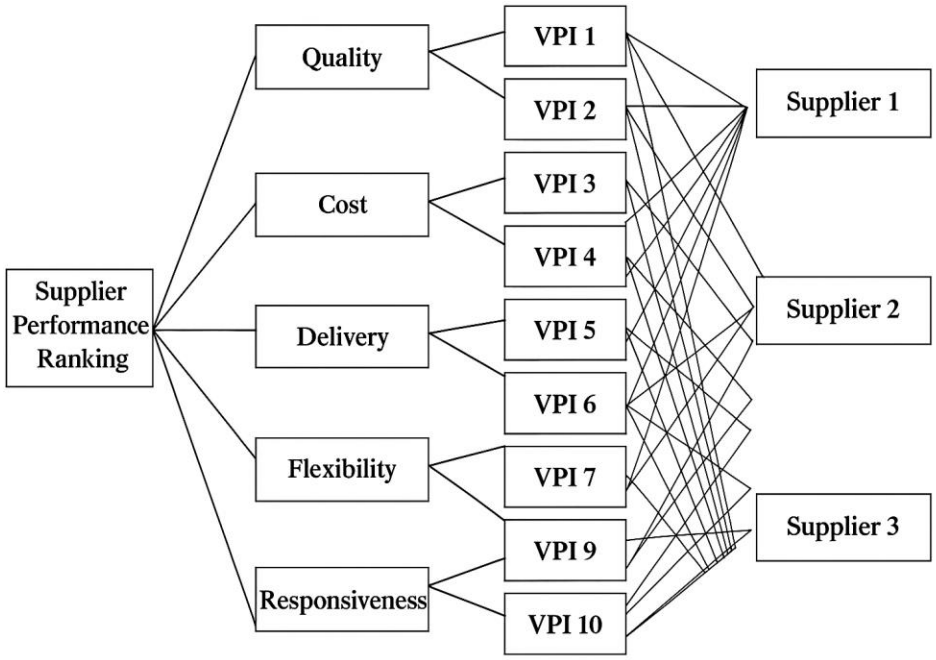

Figure 1. Hierarchical Structure

Calculation of Criteria and Sub-criteria Weights

Determining the level of importance in the Vendor Performance Indicator (VPI) is by using the Analytical Hierarchy Process (AHP) questionnaire based on pairwise comparisons in determining the weight. The weight starts from numbers 1 to 9 where each has the following explanation

1 = Both elements are equally important, two elements with equal influence in decision making

3 = One element is slightly more important than the other, experience and judgment add little value compared to the other element.

5 = One element is more important than the other, experience and judgment are so strong that they can support more than the other element.

7 = One element is clearly more absolutely important than the others, one element is strongly supported and dominant in practice.

9 = One element is absolutely more important than the other, the evidence supporting one and the other element has the highest degree of corroboration possible.

2,4,6,8 = Values between two values of adjacent considerations, this value is given when there are two compromises between two options.

Table 5. Criteria Weights

No	Criteria	Waight																	Criteria
1	*Quality*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Cost*
2	*Quality*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Delivery*
3	*Quality*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Flexibility*
4	*Quality*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Responsiveness*
5	*Cost*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Delivery*
6	*Cost*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Flexibility*
7	*Cost*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Responsiveness*
8	*Delivery*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Flexibility*
9	*Delivery*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Responsiveness*
10	*Flexibility*	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	*Responsiveness*

Table 6. Sub-Criteria Weights

No	Sub-Criteria	Waight																	Sub-Criteria
1	Product Quality (VPI 1)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Product Warranty (VPI 2)
2	Product Price (VPI 3)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Term of Payment (VPI 4)
3	Delivery Timelines (VPI 5)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Accuracy of Quantity or Amount of Raw Materials Delivered (VPI 6)

No	Sub-Criteria	Waight																	Sub-Criteria
4	Fulfillment of Changes in Ordered Product Demand (VPI 7)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Delivery Time Change (VPI 8)
5	Complaint Response from the Company (VPI 9)	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Product Return Response (VPI 10)

Data Process

Table 7. Criteria Weights

Criteria	*Quality*	*Cost*	*Delivery*	*Flexibility*	*Responsiveness*
Quality	1,00	3,00	3,00	5,00	3,00
Cost	1/3	1,00	3,00	3,00	3,00
Delivery	1/3	1/3	1,00	3,00	1,00
Flexibility	1/5	1/3	1/3	1,00	1,00
Responsiveness	1/3	1/3	1,00	1,00	1,00

Table 8. Summation of Criteria Weights

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness
Quality	1,00	3,00	3,00	5,00	3,00
Cost	0,33	1,00	3,00	3,00	3,00
Delivery	0,33	0,33	1,00	3,00	1,00
Flexibility	0,20	0,33	0,33	1,00	1,00
Responsiveness	0,33	0,33	1,00	1,00	1,00
Amount	2,19	4,99	8,33	13,00	9,00

Table 9. Summation of Criteria Weights

Criteria	*Quality*	*Cost*	*Delivery*	*Flexibility*	*Responsiveness*	Total
Quality	0,46	0,60	0,36	0,38	0,33	2,14
Cost	0,15	0,20	0,36	0,23	0,33	1,28
Delivery	0,15	0,07	0,12	0,23	0,11	0,68
Flexibility	0,09	0,07	0,04	0,08	0,11	0,39
Responsiveness	0,15	0,07	0,12	0,08	0,11	0,52
Amount	**1,00**	**1,00**	**1,00**	**1,00**	**1,00**	**5,00**

Table 10. Weight Priority Vector Criteria

Criteria	Total	Priority Vector
Quality	2,14	0,43
Cost	1,28	0,26
Delivery	0,68	0,14
Flexibility	0,39	0,08
Responsiveness	0,52	0,10
Amount	5	1

Table 11. Criteria Calculation Assessment

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness	Priority Vector	Matrix Result
Quality	1,00	3,00	3,00	5,00	3,00	0,43	2,33
Cost	0,33	1,00	3,00	3,00	3,00	0,26	1,36

Criteria	Quality	Cost	Delivery	Flexibility	Responsiveness	Priority Vector	Matrix Result
Delivery	0,33	0,33	1,00	3,00	1,00	0,14	0,71
Flexibility	0,20	0,33	0,33	1,00	1,00	0,08	0,40
Responsiveness	0,33	0,33	1,00	1,00	1,00	0,10	0,55

Table 12. Criteria Calculation Assessment

Matrix Result	Priority Vector	Matrix Priority Vector Result
(1)	(2)	(1) / (2)
2,33	0,43	5,42
1,36	0,26	5,23
0,71	0,14	5,07
0,40	0,08	5,00
0,55	0,10	5,50

The next step is to calculate the max Lamda value (eigen value) by calculating the average value of the matrix / priority vector results that have been obtained, namely:

$$\lambda \max = \frac{\lambda}{n} \qquad \lambda \max = \frac{5,42+5,23+5,07+5,00+5,50}{5} \qquad \text{..... (1)}$$

The next step is to calculate the consistency index and consistency ratio, namely :

$$CI = \frac{\lambda \max - n}{n-1} \qquad CI = \frac{5,24-5}{4} = 0,06 \qquad \text{..... (2)}$$

Table 13. Random Index Consistency (RI)

n	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Source : Saaty (1970)

The next step is to find the Consistency Ratio (CR) using the following formula

$$CR = \frac{CI}{RI} \qquad CR = \frac{0,06}{1.12} = 0,05$$

The comparison matrix is acceptable if the Consistency Ratio (CR) value is <0.1. If the consistency ratio (CR) value is> 0.1, it must revise the assessment. So, the results of the Consistency Ratio value of 0.05 can be said to be consistent for weighting criteria on measuring the performance of 600 ml bottle suppliers at PT Swabina Gatra Gresik.

Table 14. Recapitulation of 600 ml Bottle Supplier Performance Measurement Results PT Swabina Gatra Gresik

Level 0	**Level 1**	**Level 2**	**Sub-criteria priority vector weight**	***Supplier* 1**		***Supplier* 2**		***Supplier* 3**	
				Weight	**Total Weight**	**Weight**	**Total Weight**	**Weight**	**Total Weight**
Performance Measurement of 600 ml Bottle Suppliers PT Swabina Gatra Gresik	*Quality*	Product Quality	0.75	0.60	0.45	0.20	0.15	0.20	0.15
		Product Warranty	0.25	0.39	0.10	0.44	0.11	0.17	0.04
	Cost	Product Price	0.75	0.72	0.54	0.19	0.14	0.08	0.06
		Term of Payment	0.25	0.25	0.06	0.54	0.13	0.16	0.04
	Delivery	Delivery Timelines	0.50	0.11	0.06	0.48	0.24	0.41	0.21
		Accuracy of Quantity or Amount of Raw Materials Delivered	0.50	0.10	0.05	0.62	0.31	0.28	0.14
	Flexibility	Fulfillment of Changes in Ordered Product Demand	0.75	0.63	0.32	0.26	0.13	0.11	0.06
		Delivery Time Change	0.25	0.58	0.29	0.23	0.12	0.19	0.10

Level 0	Level 1	Level 2	Sub-criteria priority vector weight	*Supplier* 1		*Supplier* 2		*Supplier* 3	
				Weight	Total Weight	Weight	Total Weight	Weight	Total Weight
	Responsiveness	Complaint Response from the Company	0.50	0.72	0.36	0.19	0.10	0.08	0.04
		Product Return Response	0.50	0.52	0.26	0.33	0.17	0.14	0.07
	Amount				2.49		1.60		0.91

Table 15. Determination of Performance Value of 600 ml Bottle Supplier PT Swabina Gatra Gresik

Supplier	Weight	Priority
1	2,49	I
2	1,60	II
3	0,91	III

Based on the results of the calculation and weighting of suppliers of 600 ml bottles of SWA AMDK against 5 criteria and 10 sub-criteria based on the Vendor Performance Indicator (VPI), the results obtained by supplier 1 have the highest weight value of 2.49, then followed by supplier 2 with a value of 1.60 and the lowest is supplier 3 with a value of 0.91 at PT Swabina Gatra Gresik.

5. Conclusion

Researchers chose 5 criteria and 10 sub-criteria used in measuring the performance of suppliers of 600 ml bottles of PT Swabina Gatra Gresik AMDK, namely: the first criterion is quality with product quality and product warranty sub-criteria. The second criterion is cost with sub-criteria product prices and payment bill periods. The third criterion is delivery with sub-criteria for timeliness of delivery and accuracy of the quantity of products sent. The fourth criterion is flexibility with sub-criteria for fulfilling changes in demand for the number of products ordered and changes in delivery time. The fifth criterion is responsiveness with sub-criteria for supplier responses to complaints from companies and suppliers responding to returns of products that are of poor quality. Based on the overall calculation results and also the weighting of the three suppliers of 600 ml bottles of PT

Swabina Gatra Gresik AMDK against 5 criteria and 10 sub-criteria based on the Vendor Performance Indicator (VPI) approach, the results show that supplier 1 has the highest value of 2.49. Then supplier 2 with a value of 1.60, and finally supplier 3 with the lowest value of 0.91. Thus, supplier 1 is the company's priority as the main supplier of 600 ml bottles. Meanwhile, there is a need for further performance evaluation for supplier 3 to improve supplier performance which can affect production.

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