Supplier Performance Measurement and Evaluation System for Flexible Packaging Industry with DEMATEL Method and Analytical Network Process

Bonita, T Yuri M Zagloel
Industrial Engineering Department, Faculty of Engineering
Universitas Indonesia
Salemba 10430, Indonesia
bonita11@ui.ac.id, yuri@ie.ui.ac.id

Abstract

In the current era of globalization, industrial development is progressing rapidly. This situation makes the condition of business competition more intense. Competition becomes a challenge for the company to continue to improve its performance in order to produce the output that is able to meet customer needs. The output to be produced by the company is strongly influenced by the quality of the products provided by supplier. Therefore, supplier performance measurement and evaluation activities are important for the company in order to improve competitive strength, customer satisfaction, and company profitability. This study uses Decision-Making Trial and Evaluation Laboratory (DEMATEL) and Analytical Network Process (ANP) methods. DEMATEL method is used to obtain a Total Influence Matrix where the matrix can be known which criteria and sub-criteria are the most important and which affect the most. The results of DEMATEL method are used as input to ANP method to calculate the weight of each criteria and sub-criteria. From the weight of the criteria and sub-criteria that have been obtained, the weighted value of each supplier can be calculated to find out which supplier has the highest to lowest value.

Keywords
Supplier Performance Measurement and Evaluation, DEMATEL, Analytical Network Process, Multi Criteria Decision Making

1. Introduction
The increasingly intense market competition makes companies race each other to provide the best quality. Competition is a challenge for companies to continuously strive to improve their performance in order to produce the output that is able to meet customer needs. Each company must have certain criteria such as what specifications are needed in the material and the quality of the material must be in accordance with company standards (Bayazit, 2006). In other words, the output that will be produced by the company is strongly influenced by the quality of the products provided by suppliers. Therefore, the activity of measuring supplier performance is one part that is always emphasized in the quality management system (ISO 9001:2015).

Suppliers are one part of the supply chain that has an important role in the procurement process. Suppliers affect the sustainability of the company's operating system. If suppliers are less responsible in fulfilling material needs, it can cause problems in the production floor (Kumar et al, 2018). Companies that have many alternative suppliers must be selective in selecting suppliers as the company's business partners. The company must conduct an evaluation to find out how much supplier's performance is in meeting company's needs which is then used in making supplier selection decisions. Thus, between companies and suppliers can create a mutually beneficial relationship to increase the ability to achieve their respective targets (Elmuthi & Kathawala, 2001).

The manufacturing industry in general cannot be separated from the role of the packaging industry. In terms of material, the packaging in circulation is divided into three categories as shown in Figure 1, namely 44% in the form of flexible packaging, 14% in the form of rigid plastic packaging, and 28% in the form of paperboard packaging. The proportion of flexible packaging is believed to increase higher than other types of packaging driven by the rapid increase in the digital market which makes product mobility even higher (Kementrian Perindustrian Republik

Indonesia, 2020). Based on research conducted by AT Kerney (2019) in Asia, there are several shifts in packaging trends from being more concerned with appearance, to being more concerned with packaging strength and durability.

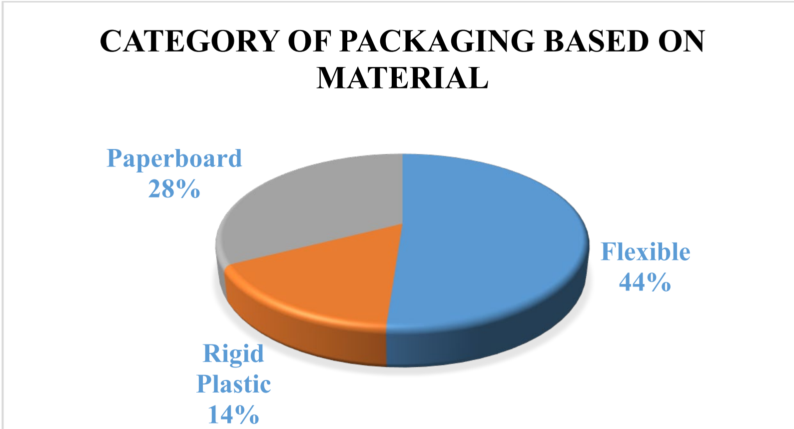

Figure 1. Category of Packaging Based on Material

In order to meet material requirements, flexible packaging companies have a number of alternative suppliers from local and international sources. Based on these conditions, companies need the right Multi Criteria Decision Making (MCDM) method to be used in measuring and making decisions on supplier performance evaluation, one of them by using DEMATEL and ANP.

As far as can be ascertained, no research has been carried out on the measurement and evaluation of supplier performance in the packaging industry. In addition, measuring and evaluating supplier performance with DEMATEL and ANP methods has not been widely used. Thus, this problem is worth continuing as research on measuring and evaluating supplier performance in the packaging industry, especially flexible packaging.

1.1 Objectives

The purpose of this study is to obtain supplier performance measurement and evaluation system in flexible packaging industry. It is intended to assist companies in making decision regarding suppliers. From the measuring system that has been formed with DEMATEL and ANP methods, it will be used to evaluate suppliers. In the assessment, it will be seen which suppliers have the highest to lowest value and on what sub criteria need to be improved by suppliers.

2. Literature Review

Supplier is a group or individual providing resources needed by the company and competitors to produce certain goods or services (Kumar et al, 2018). Supplier plays an important role in the smooth operation of the company. Thus, supplier selection is a strategic activity, especially if the supplier will supply critical materials or materials that will be used in the long term (Liao & Kao, 2011). Supplier is one of the factors that need to be taken into account in the production process because suppliers have a linkage to the quality of finished products that will be produced by the company. In order to support company's production process, suppliers are expected to understand the requirement needed to be able to compete in achieving the desired goals or targets. Suppliers intensively support the company's production process, usually in the form of materials so that the quality of the supplier can be seen from the final product that will be sold by the company to customers. The price given by the supplier will have an impact on production costs which in turn will have an impact on the price given to customers. In the supply chain concept, suppliers are one of the most important and influential parts of the survival of a company because suppliers are the ones who deliver materials to the company. Therefore, it can be concluded that suppliers are an important element for companies and have a significant influence on the company's operational processes. Companies that have several alternative suppliers are required to be selective in choosing suppliers, if companies are wrong in determining suppliers, it will have an impact on operational activities, especially in the availability of material stock.

Supplier performance evaluation is an activity or process of measuring and assessing supplier performance during the process of buying and selling a product, both goods and services (Luthra et al, 2016). Supplier performance evaluation are important for company in order to improve overall supply chain performance, competitive strength, customer satisfaction, and company profitability. Supplier performance evaluation can be an instrument of the company to influence the actions of suppliers. If the effort to influence supplier's actions is successful, it will be evidenced by the supplier's attitude in line with company's interests, where the supplier's capabilities and performance will increase, which can ultimately benefit the company (Prahinski & Benton, 2004).

The Decision-Making Trial and Evaluation Laboratory (DEMATEL) method was first developed by the Battelle Memorial Institute (BMA) in 1971 at the Geneva Research Centre. DEMATEL aims to study and solve complex and interrelated problems (Tzeng, Chiang, & Li, 2007). DEMATEL is an appropriate method to design and analyse complex problems by creating a structured model of the causal relationships between factors in the system (Wu & Lee, 2007). Solving complex problems using DEMATEL presented graphically making it easier for researchers to perform problem solving and system planning. DEMATEL method is specialized to show visualization of relationship structure in a complex matrix. Company will find many criteria that must be considered in evaluating implementation. From these criteria, a very common problem arises, namely the effect of interrelationships between criteria. Therefore, to make overall improvements in a business unit, it is necessary to identify the influence relationship of each criteria so that it will be obtained which criteria have the greatest influence.

Analytical Network Process (ANP) is a multi-criteria assessment method for decision structuring and analysis that has the ability to measure the consistency of assessment and flexibility in choices at the criteria level (Saaty, Vargas, & Whitaker, 2009). ANP uses the network without having to assign levels as in the hierarchy used in Analytical Hierarchy Process (AHP) which is the starting point of ANP. The main concept in ANP is influence, while the main concept in AHP is preference. AHP with its dependency assumptions about clusters and elements is a special case of ANP. ANP is a new approach to the decision-making process that provides a general framework for treating decisions without making assumptions about the independence of elements at a higher level from elements at a lower level and about the independence of elements at a level. The first difference lies in the structure of the model framework, which is hierarchical in AHP and network-shaped in ANP. This makes ANP can be applied more widely than AHP. The shape of the ANP network can also be very varied and more able to reflect the problem as the real situation. The difference between hierarchy and network is where the hierarchy has a goal or source point node as well as criteria and sub criteria or sink node. It is a linear structure from top to bottom without any feedback from the lowest level to the level above. Moreover, loops occur only at the lowest level. The network spreads in all directions and allows the influence of a cluster on other clusters as well as the cluster itself and the feedback that forms a cycle (Saaty, 2004).

Many studies have successfully applied ANP method (Govindan, Shankar, & Kannan, 2016). The ability to consider interdependencies between criteria is the main advantage of ANP compared to other MCDM methods. Methods such as Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and AHP do not consider dependencies between elements. Examining interdependencies between criteria is important because all problems in real life are interrelated (Wu & Olson, 2008). Certainly, ANP considers dependencies between criteria, but only describes reciprocal relationships. Thus, to overcome the shortcomings of ANP, DEMATEL is often combined with ANP method.

In recent years, many methods have emerged in the literature to model interactions between criteria. To overcome the difficulty of modeling with ANP, the researchers used DEMATEL to improve modeling capabilities and support the ANP methodology to function better. As powerful tools allow modeling of cause-and-effect relationships, the application of the DEMATEL method has increased and many different hybrid technique variants have been proposed in the context of MADM. DEMATEL-Based ANP method using total relation matrix in determining NRM model decision. In traditional ANP method, an unweighted supermatrix is formed through pairwise comparison and weighting of criteria corresponding to the eigenvalues are assigned into corresponding column of supermatrix.

3. Methods

To overcome the difficulties experienced by decision makers, DEMATEL-Based ANP method modifies the pairwise comparison. DEMATEL-Based ANP method is able to form a comprehensive unweighted supermatrix by constructing a direct influence matrix where pairwise comparisons are carried out not only within groups, but also for the entire system with a problem structure. When the unweighted matrix is constructed, total relationship matrix between the groups is used to measure corresponding portion of supermatrix to obtain weighted supermatrix. The following are steps in using the DEMATEL-Based ANP method (Hsu, Liou, & Chuang, 2013):

Step 1: Create an average matrix (A)
The average matrix is obtained through the assessment of each expert's opinion regarding the influence relationship between each sub-criteria and then calculated the overall average. Each expert assigns a score using a five-point integer scale ranging from zero (0) to four (4) that represents the measurement standards of no influence (0), low influence (1), medium influence (2), high influence (3), and very high influence (4). This matrix is obtained from the average score of all expert opinions on the direct relationship matrix with the equation $\boldsymbol{A} = [\boldsymbol{a_{ij}}]_{\boldsymbol{nxn}}$, where $\boldsymbol{a_{ij}}$ indicates the level of influence of criteria i on performance j. Matrix A will take the form like the following equation.

$$A = \begin{bmatrix} a_{11} & a_{1j} & \dots & a_{1n} \\ a_{i1} & a_{ij} & \dots & a_{in} \\ \vdots & \vdots & \dots & \vdots \\ a_{n1} & a_{nj} & \dots & a_{nn} \end{bmatrix} \quad (1)$$

Step 2: Create a direct relationship matrix (X)
Matrix X is obtained by normalizing matrix A using the following equation where in principle all diagonal elements of the matrix are zero.

$$z = \min \left[\frac{1}{max_{1\le i\le n}\sum_{j=1}^{n} a_{ij}}, \frac{1}{max_{1\le i\le n}\sum_{i=1}^{n} a_{ij}}\right] \quad (2)$$

$$X = z.A \quad (3)$$

Step 3: Create a total influence matrix
After the normalized matrix X is obtained, the total influence Matrix T is obtained by operating the following equation where I represents the identity matrix.

$$T = X(I - X)^{-1} \quad (4)$$

After that, calculate the sum of the rows and columns of the total relation Matrix T based on the following equation.

$$T = [t_{ij}], i, j = 1,2, \dots, n \quad (5)$$

$$r = [r_i]_{nx1} = [\Sigma_{j=1}^{n} t_{ij}]_{nx1}\ , s = [s_j]_{nx1} = [\Sigma_{i=1}^{n} t_{ij}]_{1xn} \quad (6)$$

If r_i is the number of i-th rows in Matrix T, then r_i summarizes direct and indirect impact that criteria i has on other criteria. If s_j indicates the number of j-th columns in Matrix T, then s_j indicates direct and indirect impact that criteria j receives from other factor. When *i = j,* $(r_i + s_j)$ indicates the level of effect given and accepted by criteria i in the system. If $(r_i - s_j)$ is positive, then criteria i is the causative factor. Conversely, if $(r_i - s_j)$ is negative, then criteria i is affected by another criteria. Total influence matrix $T_C = [t_{ij}]_{nxn}$ is obtained from sub-criteria and $T_D = [t_{ij}^{d}]_{nxn}$ is obtained from criteria in T_C.

Step 4: Normalization of the total influence matrix
After obtaining the total influence matrix for each criterion and sub-criteria, the next step is to form the unweighted supermatrix for sub-criteria and criteria through the following equation.

$$W_D = (T_D^{\alpha})^t atau\, W_c = (T_C^{\alpha})^t \quad (7)$$

Therefore, it is necessary to normalize the T_D and T_C matrices. T_D^{α} matrix is obtained by dividing each row element of criteria matrix by the average of each row element in criteria matrix, while T_C^{α} matrix is obtained by dividing each row element of sub-criterion matrix by the average of each row element in sub-criterion matrix which can be seen in the following equation.

$$T_C^{\alpha 11} = \begin{bmatrix} \frac{t_{c11}^{11}}{d_{c1}^{11}} & \cdots & \frac{t_{c1j}^{11}}{d_{c1}^{11}} & \cdots & \frac{t_{c1m_1}^{11}}{d_{c1}^{11}} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \frac{t_{ci1}^{11}}{d_{ci}^{11}} & \cdots & \frac{t_{cij}^{11}}{d_{ci}^{11}} & \cdots & \frac{t_{cim_1}^{11}}{d_{ci}^{11}} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \frac{t_{cm_11}^{11}}{d_{cm_1}^{11}} & \cdots & \frac{t_{cm_1j}^{11}}{d_{cm_1}^{11}} & \cdots & \frac{t_{cm_1m_1}^{11}}{d_{cm_1}^{11}} \end{bmatrix} = \begin{bmatrix} t_{c11}^{\alpha 11} & \cdots & t_{c1j}^{\alpha 11} & \cdots & t_{c1m_1}^{\alpha 11} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_{ci1}^{\alpha 11} & \cdots & t_{cij}^{\alpha 11} & \cdots & t_{cim_1}^{\alpha 11} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_{cm_11}^{\alpha 11} & \cdots & t_{cm_1j}^{\alpha 11} & \cdots & t_{cm_1m_1}^{\alpha 11} \end{bmatrix} \quad (8)$$

Step 5: Create an unweighted supermatrix (W)

The unweighted supermatrix is obtained by transposing T_D^α matrix and the T_C^α matrix. The unweighted supermatrix generates a local priorities or local weights of sub-criteria. After normalizing the total influence matrix, a new T_C^α matrix will be obtained which is shown by the following equation.

$$W = (T_C^\alpha)' = \begin{matrix} D_1 \\ \vdots \\ D_i \\ \vdots \\ D_n \end{matrix} \begin{matrix} c_{11} \\ c_{12} \\ \vdots \\ c_{1m_1} \\ c_{21} \\ c_{22} \\ \vdots \\ c_{2m_2} \\ \vdots \\ c_{n1} \\ c_{n2} \\ \vdots \\ c_{nm_n} \end{matrix} \overset{\begin{matrix} D_1 & D_j & D_n \\ c_{11}\cdots c_{1m_1} & c_{j1}\cdots c_{jm_j} & c_{n1}\cdots c_{nm_n} \end{matrix}}{} \begin{bmatrix} W^{11} & \cdots & W^{i1} & \cdots & W^{n1} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ W^{1j} & \cdots & W^{ij} & \cdots & W^{nj} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ W^{1n} & \cdots & W^{in} & \cdots & W^{nm} \end{bmatrix} \quad (9)$$

Step 6: Obtain the weighted supermatix (W^α)

After that, it can build a weighted supermatrix through the following equation.

$$T_D = \begin{bmatrix} t_D^{11} & \cdots & t_D^{1j} & \cdots & t_D^{1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_D^{i1} & \cdots & t_D^{ij} & \cdots & t_D^{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_D^{n1} & \cdots & t_D^{nj} & \cdots & t_D^{nn} \end{bmatrix} \quad (10)$$

$$T_D^\alpha = \begin{bmatrix} \frac{t_D^{11}}{d_1} & \cdots & \frac{t_D^{1j}}{d_1} & \cdots & \frac{t_D^{1n}}{d_1} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \frac{t_D^{i1}}{d_2} & \cdots & \frac{t_D^{ij}}{d_2} & \cdots & \frac{t_D^{in}}{d_2} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \frac{t_D^{n1}}{d_3} & \cdots & \frac{t_D^{nj}}{d_3} & \cdots & \frac{t_D^{nn}}{d_3} \end{bmatrix} = \begin{bmatrix} t_D^{\alpha 11} & \cdots & t_D^{\alpha 1j} & \cdots & t_D^{\alpha 1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_D^{\alpha i1} & \cdots & t_D^{\alpha ij} & \cdots & t_D^{\alpha in} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ t_D^{\alpha n1} & \cdots & t_D^{\alpha nj} & \cdots & t_D^{\alpha nn} \end{bmatrix} \quad (11)$$

First, each column will be summed for normalization. After obtaining the normalized matrix results, then proceed with the second stage, which is the multiplication of each element of W_D with each division of the W_C matrix according to criteria to generate the weighted supermatrix as in the following equation.

$$W^\alpha = T_D^\alpha . W \quad (12)$$

Step 7: Obtain the limit supermatrix

The last step in DEMATEL-Based ANP method is to multiply the weighted supermatrix several times to get the limit supermatrix according to the following equation.

$$Limit = \lim_{z \to \infty} (W^{\alpha})^{z} \quad (13)$$

4. Data Collection

The selection of criteria and sub-criteria used to measure supplier performance is obtained through literature studies. Based on previous research, criteria and sub-criteria shown in the following Table 1.

Table 1. Supplier Performance Criteria and Sub-criteria

Criteria	Sub-Criteria	Reference
Product Quality Capability	Quality	Amindoust & Saghafinia, 2016; Guarnieri & Trojan, 2019; Guo, Liu, Zhang, & Yang, 2017
	Product Reliability	Rezaei, 2015; Rezaei & Ortt, 2012
Financial Capability	Price	Amindoust & Saghafinia, 2016; Guarnieri & Trojan, 2019; Guo, Liu, Zhang, & Yang, 2017
	Cost Reduction Program	Azimifard, Moosavirad, & Ariafar, 2018
	Financial Position	Guarnieri & Trojan, 2019; Rezaei & Ortt, 2012
Delivery Capability	On-Time Delivery	Amindoust & Saghafinia, 2016; Guarnieri & Trojan, 2019; Guo, Liu, Zhang, & Yang, 2017
	Leadtime	Guarnieri & Trojan, 2019; Guo, Liu, Zhang, & Yang, 2017
	Accuracy of Item Quantity	Amindoust, Ahmed, Saghafinia, & Bahreininejad, 2012; Dweiri, Kumar, Khan, & Jain, 2016; Luthra, Govindan, Kanaan, Mangla, & Garg, 2017
	Geographical Location	Guarnieri & Trojan, 2019; Guo, Liu, Zhang, & Yang, 2017
Technical Capability	Process Capability	Rezaei, 2015; Rezaei & Ortt, 2012
	Production Facilities and Capacity	Guarnieri & Trojan, 2019
	Technology Development	Azimifard, Moosavirad, & Ariafar, 2018
Service Capabilty	Repair Service	Rezaei & Ortt, 2012; Guo, Liu, Zhang, & Yang, 2017
	After-Sales Service	Rezaei, 2015; Guo, Liu, Zhang, & Yang, 2017
	Response to Claims and Warranty Policy	Rezaei & Ortt, 2012; Liao & Kao, 2011
	Term of Payment	Rezaei & Ortt, 2012; Liao & Kao, 2011
Willingness to Share Information and Communication Ethics	Respectful and Honest Communication	Santos, Moura, Osiro, Henrique, & Lima, 2017
	Information Disclosure	Santos, Moura, Osiro, Henrique, & Lima, 2017
	Willingness to Share Information, Ideas, Technology, and Cost Savings	Rezaei & Ortt, 2012
	Ethical Standards	Rezaei, 2015; Rezaei & Ortt, 2012; Liao & Kao, 2011; Azimifard, Moosavirad, & Ariafar, 2018
	Impression	Rezaei & Ortt, 2012; Liao & Kao, 2011
Willingness to Engage in a Long-Term Relationship	Long-term Relationship	Rezaei, 2015; Rezaei & Ortt, 2012
	Closeness of Relationship	Rezaei, 2015; Rezaei & Ortt, 2012; Liao & Kao, 2011
	Previous Experience with Suppliers	Rezaei & Ortt, 2012; Liao & Kao, 2011; Santos, Moura, Osiro, Henrique, & Lima, 2017
	Willingness to Design and Participate in Product Development	Rezaei, 2015; Rezaei & Ortt, 2012
	Consistency	Rezaei & Ortt, 2012; Liao & Kao, 2011

The criteria and sub-criteria obtained through literature study were then assessed by experts through the stage I questionnaire, which assessed the level of importance of the criteria in the supplier performance measurement process. This questionnaire is needed to select criteria that match the actual conditions in the industry under study. If the criteria listed are not suitable, they will be eliminated, while if appropriate, they will be used in the next stage. The questionnaire will be filled by four experts using a likert scale of one (1) to five (5). The use of likert scales by experts are weighted and measured using geometric mean (geomean) to calculate the average of the weights of each criteria. The use of geometric averages can result in better accuracy compared to normal averages. Geomean is a geometric mean that uses a measure of concentration. Systematically, geomean is expressed as follows.

$$G = \sqrt[n]{x_1 . x_2 . x_3 . x_n} \qquad (14)$$

In one study, criteria that were assessed using five likert scales used a value of 3.475 ≈ 3.5 as the average that would be accepted in making a criterion still considered (Mohapatra, Mohanty, & Dhalla, 2010). If there are variables that do not reach a value of 3.5, they will be eliminated in the next step in this study. Based on the results of assessment of sub criteria of supplier performance measurement, 22 sub criteria of supplier performance measurement are grouped into seven criteria. Sub-criteria used for supplier performance measurement are presented in Table 2. The Label of each sub criteria will be used as a sign in the research model and data processing. Criteria and sub-criteria evaluation obtained from the previous stage, then assessed by the four experts to be weighting through questionnaires stage II regarding the assessment of pairwise comparison.

Table 2. Selected Criteria and Sub-criteria for Supplier Performance Measurement

Criteria	Label	Sub-criteria
A1: Product Quality Capability	B1	Quality
	B2	Product Reliability
A2: Financial Capability	B3	Cost Reduction Program
A3: Delivery Capability	B4	On-Time Delivery
	B5	Leadtime
	B6	Accuracy of Item Quantity
A4: Technical Capability	B7	Process Capability
	B8	Production Facilities and Capacity
	B9	Technology Development
A5: Service Capabilty	B10	Repair Service
	B11	After-Sales Service
	B12	Response to Claims and Warranty Policy
A6: Willingness to Share Information and Communication Ethics	B13	Respectful and Honest Communication
	B14	Information Disclosure
	B15	Willingness to Share Information, Ideas, Technology, and Cost Savings
	B16	Ethical Standards
	B17	Impression
A7: Willingness to Engage in a Long-Term Relationship	B18	Long-term Relationship
	B19	Closeness of Relationship
	B20	Previous Experience with Suppliers
	B21	Willingness to Design and Participate in Product Development
	B22	Consistency

The importance of each criteria and sub-criteria will affect the assessment in the supplier performance measurement process. Data processing of the results of the assessment of the second questionnaire was conducted using the DEMATEL method to see the relationship between sub-criteria. The next step, the results of the assessment of the total influence of sub criteria used to calculate the weighting criteria or sub criteria supplier performance. The ANP method is used to perform weighting by considering dependencies between sub-criteria. The pairwise comparison questionnaire provides an assessment of the influence of one sub-criteria on another. The questionnaire will be completed by the same experts using four likert scales from zero (0) to three (3). At the initial stage of data processing, the results obtained through the questionnaire stage II will be processed using the arithmetic mean to obtain the average value of the assessment conducted by four experts. The average value of the results of expert assessment of the relationship between the sub-criteria is formed into a direct-relationship matrix (A) as shown in the Table 3. Direct relationship matrix (A) will be used as the initial matrix in data processing to calculate the relationship between sub criteria supplier performance.

Table 3. Direct Relationship Average Matrix (A)

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	Total
B1	0,00	3,00	2,25	1,25	1,50	1,00	2,25	1,50	2,00	2,50	2,25	1,25	1,00	1,00	1,50	1,00	2,25	2,25	1,75	1,25	2,25	2,25	37,25
B2	3,00	0,00	1,75	1,00	1,00	1,00	2,25	1,50	1,50	2,50	2,25	1,50	1,25	1,25	1,50	0,75	2,25	2,25	1,75	1,00	2,00	2,00	35,25
B3	2,25	1,75	0,00	1,50	1,25	1,25	1,50	1,75	2,50	2,25	1,75	1,00	1,00	1,50	1,50	0,75	1,25	1,75	1,25	1,00	2,25	1,25	32,25
B4	1,50	1,25	0,75	0,00	2,75	1,75	1,50	1,75	1,25	1,75	1,50	1,00	1,25	1,25	1,00	1,25	2,00	2,25	2,25	1,00	0,75	2,00	31,75
B5	0,75	0,75	1,25	2,75	0,00	1,75	1,75	1,50	1,50	2,00	1,75	1,25	1,50	1,00	0,75	1,25	2,50	2,50	2,00	1,25	1,25	2,00	33,00
B6	1,25	1,00	1,25	2,00	2,25	0,00	1,25	1,50	1,00	1,75	1,50	1,75	1,50	1,25	0,75	1,25	2,25	2,25	2,25	1,25	1,25	2,00	32,50
B7	2,75	2,75	1,75	2,00	2,25	2,00	0,00	2,00	2,25	2,50	2,25	1,50	0,75	0,75	1,75	0,75	2,00	2,00	1,50	0,75	2,25	2,50	39,00
B8	2,00	2,00	1,75	2,25	2,25	2,25	2,50	0,00	2,50	2,00	1,75	1,75	1,00	1,00	1,75	1,25	2,00	2,00	1,75	0,75	1,75	2,00	38,25
B9	2,75	2,75	2,50	2,00	2,00	2,00	2,50	2,25	0,00	2,00	1,75	1,25	1,50	1,50	1,75	1,25	2,00	2,00	1,50	1,00	2,00	2,25	40,50
B10	2,00	1,75	2,00	0,75	0,75	0,75	1,25	1,50	1,25	0,00	1,50	2,00	2,00	1,50	1,50	1,75	2,25	2,25	2,25	0,75	1,75	1,50	33,00
B11	1,25	1,50	1,25	0,75	0,75	0,75	0,75	1,00	1,50	2,00	0,00	1,50	1,50	1,50	1,75	1,75	2,25	2,50	2,25	1,25	1,75	1,75	31,25
B12	1,25	1,25	1,00	0,75	0,50	1,00	1,25	1,00	1,00	2,00	2,00	0,00	2,00	2,00	1,75	2,25	2,25	2,25	2,25	1,25	1,75	1,75	32,50
B13	1,25	1,00	1,00	1,50	0,75	1,25	0,50	1,00	1,00	2,25	2,25	2,00	0,00	2,25	2,00	2,75	2,75	2,50	2,50	1,25	1,50	1,75	35,00
B14	1,00	1,00	1,25	1,00	0,75	0,75	1,00	1,00	1,75	1,75	1,75	2,00	2,25	0,00	2,00	2,00	2,50	2,50	2,25	1,25	1,75	1,75	33,25
B15	2,25	2,00	2,25	1,75	1,75	1,50	1,75	1,75	2,00	1,75	1,75	1,50	1,75	2,00	0,00	1,75	2,25	2,25	2,00	1,25	2,00	1,50	38,75
B16	1,25	1,25	1,00	1,50	1,50	1,25	1,50	1,25	1,25	2,25	2,25	2,00	2,25	2,25	2,00	0,00	2,50	2,50	2,50	1,50	1,50	1,50	36,75
B17	1,25	1,25	1,00	1,25	1,25	1,25	1,25	1,25	1,25	1,75	1,75	1,75	2,00	1,75	1,75	2,00	0,00	2,75	2,75	1,75	1,50	1,50	34,00
B18	1,75	1,50	1,25	1,50	1,50	1,50	1,50	1,50	1,50	2,00	2,00	2,00	2,50	2,00	2,25	2,00	2,25	0,00	2,50	1,25	2,00	2,50	38,75
B19	1,75	1,75	1,75	1,75	1,75	1,75	1,00	1,00	1,25	2,25	2,25	2,25	2,50	2,50	2,50	2,50	2,75	2,75	0,00	1,50	2,25	2,25	42,00
B20	1,50	1,50	1,25	1,25	1,25	1,25	1,50	1,00	1,25	1,50	1,50	1,75	1,50	1,50	1,50	1,50	2,00	2,00	1,75	0,00	1,50	1,75	31,50
B21	2,00	2,00	2,00	1,00	1,25	1,25	2,00	1,50	2,00	1,50	1,50	1,25	1,75	2,00	2,00	1,75	2,00	2,00	2,00	1,50	0,00	1,75	36,00
B22	2,50	2,50	1,75	2,00	2,00	2,25	2,00	1,75	1,50	1,75	1,75	1,75	1,50	1,50	1,50	1,25	2,25	2,50	2,50	1,50	1,50	0,00	39,50
Total	37,25	35,50	32,00	31,50	31,00	29,50	32,75	30,25	33,00	42,00	39,00	34,00	34,25	33,25	34,75	32,75	46,50	48,00	43,50	25,25	36,50	39,50	782,00

The next step, obtaining a normalized direct relationship matrix (D). To obtain a normalized direct relation matrix (D) the value of S is required, where the value of S can be obtained using the Equation 2. The direct relationship matrix (A) is summed over each row and column element and the largest value of the sum of each row and column element is identified. Based on the calculation, the largest value obtained from the sum of rows is 42 and columns is 48. Therefore, the column sum value will be used to obtain the value of k, which is 48. The value of S is used as a constant for the normalization of the matrix of direct relations using Equation 3. The value of S used for normalization is 0.021. Normalized direct relationship matrix (D) can be seen in the Table 4.

Table 4. Normalized Direct Relationship Average Matrix (D)

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	Total
B1	0,000	0,063	0,047	0,026	0,032	0,021	0,047	0,032	0,042	0,053	0,047	0,026	0,021	0,021	0,032	0,021	0,047	0,047	0,037	0,026	0,047	0,047	0,782
B2	0,063	0,000	0,037	0,021	0,021	0,021	0,047	0,032	0,032	0,053	0,047	0,032	0,026	0,026	0,032	0,016	0,047	0,047	0,037	0,021	0,042	0,042	0,740
B3	0,047	0,037	0,000	0,032	0,026	0,026	0,032	0,037	0,053	0,047	0,037	0,021	0,021	0,032	0,032	0,016	0,026	0,037	0,026	0,021	0,047	0,026	0,677
B4	0,032	0,026	0,016	0,000	0,058	0,037	0,032	0,037	0,026	0,037	0,032	0,021	0,026	0,026	0,021	0,026	0,042	0,047	0,047	0,021	0,016	0,042	0,667
B5	0,016	0,016	0,026	0,058	0,000	0,037	0,037	0,032	0,032	0,042	0,037	0,026	0,032	0,021	0,016	0,026	0,053	0,053	0,042	0,026	0,026	0,042	0,693
B6	0,026	0,021	0,026	0,042	0,047	0,000	0,026	0,032	0,021	0,037	0,032	0,037	0,032	0,026	0,016	0,026	0,047	0,047	0,047	0,026	0,026	0,042	0,683
B7	0,058	0,058	0,037	0,042	0,047	0,042	0,000	0,042	0,047	0,053	0,047	0,032	0,016	0,016	0,037	0,016	0,042	0,042	0,032	0,016	0,047	0,053	0,819
B8	0,042	0,042	0,037	0,047	0,047	0,047	0,053	0,000	0,053	0,042	0,037	0,037	0,021	0,021	0,037	0,026	0,042	0,042	0,037	0,016	0,037	0,042	0,803
B9	0,058	0,058	0,053	0,042	0,042	0,042	0,053	0,047	0,000	0,042	0,037	0,026	0,032	0,032	0,037	0,026	0,042	0,042	0,032	0,021	0,042	0,047	0,851
B10	0,042	0,037	0,042	0,016	0,016	0,016	0,026	0,032	0,026	0,000	0,032	0,042	0,042	0,032	0,032	0,037	0,047	0,047	0,047	0,016	0,037	0,032	0,693
B11	0,026	0,032	0,026	0,016	0,016	0,016	0,016	0,021	0,032	0,042	0,000	0,032	0,032	0,032	0,037	0,037	0,047	0,053	0,047	0,026	0,037	0,037	0,656
B12	0,026	0,026	0,021	0,016	0,011	0,021	0,026	0,021	0,021	0,042	0,042	0,000	0,042	0,042	0,037	0,047	0,047	0,047	0,047	0,026	0,037	0,037	0,683
B13	0,026	0,021	0,021	0,032	0,016	0,026	0,011	0,021	0,021	0,047	0,047	0,042	0,000	0,047	0,042	0,058	0,058	0,053	0,053	0,026	0,032	0,037	0,735
B14	0,021	0,021	0,026	0,021	0,016	0,016	0,021	0,021	0,037	0,037	0,037	0,042	0,047	0,000	0,042	0,042	0,053	0,053	0,047	0,026	0,037	0,037	0,698
B15	0,047	0,042	0,047	0,037	0,037	0,032	0,037	0,037	0,042	0,037	0,037	0,032	0,037	0,042	0,000	0,037	0,047	0,047	0,042	0,026	0,042	0,032	0,814
B16	0,026	0,026	0,021	0,032	0,032	0,026	0,032	0,026	0,026	0,047	0,047	0,042	0,047	0,047	0,042	0,000	0,053	0,053	0,053	0,032	0,032	0,032	0,772
B17	0,026	0,026	0,021	0,026	0,026	0,026	0,026	0,026	0,026	0,037	0,037	0,037	0,042	0,037	0,037	0,042	0,000	0,058	0,058	0,037	0,032	0,032	0,714
B18	0,037	0,032	0,026	0,032	0,032	0,032	0,032	0,032	0,032	0,042	0,042	0,042	0,053	0,042	0,047	0,042	0,047	0,000	0,053	0,026	0,042	0,053	0,814
B19	0,037	0,037	0,037	0,037	0,037	0,037	0,021	0,021	0,026	0,047	0,047	0,047	0,053	0,053	0,053	0,053	0,058	0,058	0,000	0,032	0,047	0,047	0,882
B20	0,032	0,032	0,026	0,026	0,026	0,026	0,032	0,021	0,026	0,032	0,032	0,037	0,032	0,032	0,032	0,032	0,042	0,042	0,037	0,000	0,032	0,037	0,662
B21	0,042	0,042	0,042	0,021	0,026	0,026	0,042	0,032	0,042	0,032	0,032	0,026	0,037	0,042	0,042	0,037	0,042	0,042	0,042	0,032	0,000	0,037	0,756
B22	0,053	0,053	0,037	0,042	0,042	0,047	0,042	0,037	0,032	0,037	0,037	0,037	0,032	0,032	0,032	0,026	0,047	0,053	0,053	0,032	0,032	0,000	0,830
Total	0,782	0,746	0,672	0,662	0,651	0,620	0,688	0,635	0,693	0,882	0,819	0,714	0,719	0,698	0,730	0,688	0,977	1,008	0,914	0,530	0,767	0,830	16,422

The next step is to obtain a total relation matrix using Equation 4. Data processing uses an n x n identity matrix (I) as shown in Table 5.

Table 5. Identity Matrix (I)

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22
B1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
B10	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
B11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
B12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
B13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
B14	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
B15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
B16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
B17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
B18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
B19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
B20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
B21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
B22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

After obtaining the matrix (I), the subtracted between identity matrix (I) and normalized direct relationship matrix (D) is calculated as can be seen in Table 6. Next, the matrix (I - D) is inversed to get the matrix $(I - D)^{-1}$ as shown in Table 6-7.

Table 6. (I – D) Matrix

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22
B1	1	-0,063	-0,047	-0,026	-0,032	-0,021	-0,047	-0,032	-0,042	-0,053	-0,047	-0,026	-0,021	-0,021	-0,032	-0,021	-0,047	-0,047	-0,037	-0,026	-0,047	-0,047
B2	-0,063	1	-0,037	-0,021	-0,021	-0,021	-0,047	-0,032	-0,032	-0,053	-0,047	-0,032	-0,026	-0,026	-0,032	-0,016	-0,047	-0,047	-0,037	-0,021	-0,042	-0,042
B3	-0,047	-0,037	1	-0,032	-0,026	-0,026	-0,032	-0,037	-0,053	-0,047	-0,037	-0,021	-0,021	-0,032	-0,032	-0,016	-0,026	-0,037	-0,026	-0,021	-0,047	-0,026
B4	-0,032	-0,026	-0,016	1	-0,058	-0,037	-0,032	-0,037	-0,026	-0,037	-0,032	-0,021	-0,026	-0,026	-0,021	-0,026	-0,042	-0,047	-0,047	-0,021	-0,016	-0,042
B5	-0,016	-0,016	-0,026	-0,058	1	-0,037	-0,037	-0,032	-0,032	-0,042	-0,037	-0,026	-0,032	-0,021	-0,016	-0,026	-0,053	-0,053	-0,042	-0,026	-0,026	-0,042
B6	-0,026	-0,021	-0,026	-0,042	-0,047	1	-0,026	-0,032	-0,021	-0,037	-0,032	-0,037	-0,032	-0,026	-0,016	-0,026	-0,047	-0,047	-0,047	-0,026	-0,026	-0,042
B7	-0,058	-0,058	-0,037	-0,042	-0,047	-0,042	1	-0,042	-0,047	-0,053	-0,047	-0,032	-0,016	-0,016	-0,037	-0,016	-0,042	-0,042	-0,032	-0,016	-0,047	-0,053
B8	-0,042	-0,042	-0,037	-0,047	-0,047	-0,047	-0,053	1	-0,053	-0,042	-0,037	-0,037	-0,021	-0,021	-0,037	-0,026	-0,042	-0,042	-0,037	-0,016	-0,037	-0,042
B9	-0,058	-0,058	-0,053	-0,042	-0,042	-0,042	-0,053	-0,047	1	-0,042	-0,037	-0,026	-0,032	-0,032	-0,037	-0,026	-0,042	-0,042	-0,032	-0,021	-0,042	-0,047
B10	-0,042	-0,037	-0,042	-0,016	-0,016	-0,016	-0,026	-0,032	-0,026	1	-0,032	-0,042	-0,042	-0,032	-0,032	-0,037	-0,047	-0,047	-0,047	-0,016	-0,037	-0,032
B11	-0,026	-0,032	-0,026	-0,016	-0,016	-0,016	-0,016	-0,021	-0,032	-0,042	1	-0,032	-0,032	-0,032	-0,037	-0,037	-0,047	-0,053	-0,047	-0,026	-0,037	-0,037
B12	-0,026	-0,026	-0,021	-0,016	-0,011	-0,021	-0,026	-0,021	-0,021	-0,042	-0,042	1	-0,042	-0,042	-0,037	-0,047	-0,047	-0,047	-0,047	-0,026	-0,037	-0,037
B13	-0,026	-0,021	-0,021	-0,032	-0,016	-0,026	-0,011	-0,021	-0,021	-0,047	-0,047	-0,042	1	-0,047	-0,042	-0,058	-0,058	-0,053	-0,053	-0,026	-0,032	-0,037
B14	-0,021	-0,021	-0,026	-0,021	-0,016	-0,016	-0,021	-0,021	-0,037	-0,037	-0,037	-0,042	-0,047	1	-0,042	-0,042	-0,053	-0,053	-0,047	-0,026	-0,037	-0,037
B15	-0,047	-0,042	-0,047	-0,037	-0,037	-0,032	-0,037	-0,037	-0,042	-0,037	-0,037	-0,032	-0,037	-0,042	1	-0,037	-0,047	-0,047	-0,042	-0,026	-0,042	-0,032
B16	-0,026	-0,026	-0,021	-0,032	-0,032	-0,026	-0,032	-0,026	-0,026	-0,047	-0,047	-0,042	-0,047	-0,047	-0,042	1	-0,053	-0,053	-0,053	-0,032	-0,032	-0,032
B17	-0,026	-0,026	-0,021	-0,026	-0,026	-0,026	-0,026	-0,026	-0,026	-0,037	-0,037	-0,037	-0,042	-0,037	-0,037	-0,042	1	-0,058	-0,058	-0,037	-0,032	-0,032
B18	-0,037	-0,032	-0,026	-0,032	-0,032	-0,032	-0,032	-0,032	-0,032	-0,042	-0,042	-0,042	-0,053	-0,042	-0,047	-0,042	-0,047	1	-0,053	-0,026	-0,042	-0,053
B19	-0,037	-0,037	-0,037	-0,037	-0,037	-0,037	-0,021	-0,021	-0,026	-0,047	-0,047	-0,047	-0,053	-0,053	-0,053	-0,053	-0,058	-0,058	1	-0,032	-0,047	-0,047
B20	-0,032	-0,032	-0,026	-0,026	-0,026	-0,026	-0,032	-0,021	-0,026	-0,032	-0,032	-0,037	-0,032	-0,032	-0,032	-0,032	-0,042	-0,042	-0,037	1	-0,032	-0,037
B21	-0,042	-0,042	-0,042	-0,021	-0,026	-0,026	-0,042	-0,032	-0,042	-0,032	-0,032	-0,026	-0,037	-0,042	-0,042	-0,037	-0,042	-0,042	-0,042	-0,032	1	-0,037
B22	-0,053	-0,053	-0,037	-0,042	-0,042	-0,047	-0,042	-0,037	-0,032	-0,037	-0,037	-0,037	-0,032	-0,032	-0,032	-0,026	-0,047	-0,053	-0,053	-0,032	-0,032	1

Table 7. $(I - D)^{-1}$ Matrix

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22
B1	1,115	0,169	0,144	0,119	0,123	0,110	0,145	0,123	0,140	0,177	0,163	0,129	0,126	0,122	0,137	0,121	0,184	0,189	0,167	0,103	0,157	0,164
B2	0,168	1,104	0,129	0,109	0,108	0,105	0,139	0,118	0,126	0,170	0,157	0,129	0,125	0,122	0,132	0,111	0,177	0,182	0,160	0,094	0,147	0,154
B3	0,144	0,131	1,086	0,112	0,107	0,103	0,117	0,116	0,138	0,155	0,138	0,110	0,112	0,119	0,123	0,103	0,147	0,160	0,140	0,088	0,142	0,130
B4	0,126	0,117	0,099	1,082	0,136	0,113	0,115	0,114	0,110	0,144	0,132	0,110	0,116	0,113	0,112	0,112	0,160	0,169	0,159	0,087	0,110	0,143
B5	0,115	0,110	0,111	0,139	1,083	0,115	0,122	0,112	0,118	0,152	0,139	0,118	0,124	0,111	0,110	0,115	0,174	0,178	0,158	0,095	0,123	0,146
B6	0,123	0,114	0,109	0,123	0,127	1,078	0,111	0,110	0,106	0,145	0,133	0,126	0,123	0,115	0,109	0,114	0,167	0,171	0,161	0,094	0,122	0,144
B7	0,174	0,169	0,138	0,139	0,143	0,134	1,104	0,137	0,150	0,182	0,168	0,138	0,125	0,121	0,146	0,120	0,185	0,191	0,168	0,097	0,161	0,175
B8	0,157	0,152	0,136	0,143	0,142	0,137	0,152	1,095	0,152	0,170	0,156	0,141	0,128	0,124	0,144	0,128	0,183	0,188	0,170	0,095	0,149	0,163
B9	0,178	0,173	0,156	0,143	0,142	0,137	0,158	0,145	1,109	0,177	0,163	0,137	0,143	0,140	0,150	0,133	0,191	0,196	0,172	0,104	0,161	0,174
B10	0,141	0,132	0,127	0,099	0,097	0,095	0,113	0,112	0,114	1,113	0,136	0,133	0,135	0,123	0,127	0,126	0,170	0,174	0,163	0,085	0,135	0,136
B11	0,121	0,122	0,108	0,095	0,093	0,091	0,098	0,098	0,114	0,147	1,100	0,119	0,122	0,118	0,127	0,122	0,164	0,172	0,157	0,092	0,130	0,136
B12	0,124	0,120	0,106	0,097	0,091	0,098	0,110	0,100	0,107	0,151	0,144	1,092	0,135	0,132	0,131	0,136	0,168	0,172	0,162	0,094	0,133	0,139
B13	0,130	0,120	0,111	0,117	0,101	0,108	0,101	0,105	0,113	0,163	0,156	0,139	1,102	0,143	0,142	0,152	0,187	0,186	0,175	0,099	0,134	0,146
B14	0,121	0,117	0,113	0,104	0,098	0,095	0,108	0,102	0,124	0,149	0,142	0,135	0,142	1,094	0,138	0,133	0,176	0,180	0,165	0,096	0,135	0,142
B15	0,162	0,152	0,146	0,133	0,132	0,123	0,138	0,130	0,144	0,167	0,158	0,138	0,145	0,146	1,111	0,140	0,190	0,195	0,177	0,106	0,156	0,154
B16	0,135	0,130	0,116	0,122	0,121	0,112	0,126	0,115	0,122	0,169	0,161	0,143	0,151	0,147	0,146	1,101	0,188	0,192	0,181	0,107	0,140	0,147
B17	0,128	0,124	0,109	0,112	0,110	0,107	0,115	0,109	0,116	0,151	0,144	0,132	0,139	0,130	0,134	0,135	1,129	0,187	0,176	0,107	0,132	0,140
B18	0,152	0,142	0,127	0,128	0,126	0,123	0,132	0,125	0,133	0,171	0,163	0,149	0,161	0,147	0,157	0,147	0,191	1,150	0,188	0,107	0,156	0,173
B19	0,160	0,154	0,143	0,139	0,138	0,134	0,129	0,122	0,136	0,186	0,177	0,162	0,169	0,165	0,170	0,164	0,211	0,216	1,148	0,118	0,169	0,177
B20	0,126	0,122	0,108	0,105	0,104	0,101	0,114	0,098	0,109	0,138	0,131	0,124	0,121	0,118	0,121	0,117	0,159	0,163	0,148	1,066	0,125	0,136
B21	0,150	0,146	0,135	0,112	0,116	0,112	0,136	0,119	0,137	0,153	0,145	0,126	0,138	0,140	0,144	0,133	0,176	0,180	0,168	0,106	1,108	0,151
B22	0,169	0,164	0,138	0,140	0,139	0,139	0,144	0,132	0,135	0,169	0,160	0,145	0,142	0,138	0,143	0,132	0,193	0,202	0,189	0,113	0,148	1,126

Finally, the total relationship matrix between the sub criteria (T_C) is obtained by multiplying the Matrix (D) by $(I - D)^{-1}$ as can be seen in the Table 8. Sub criteria that are in one group of criteria in the total relationship matrix of sub criteria (T_C) are calculated for the average value to get a total relationship matrix between criteria as can be seen in Table 8-9.

Table 8. Total Influence Matrix for Sub-criteria (T_C)

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	Total (R)
B1	0,115	0,169	0,144	0,119	0,123	0,110	0,145	0,123	0,140	0,177	0,163	0,129	0,126	0,122	0,137	0,121	0,184	0,189	0,167	0,103	0,157	0,164	3,126
B2	0,168	0,104	0,129	0,109	0,108	0,105	0,139	0,118	0,126	0,170	0,157	0,129	0,125	0,122	0,132	0,111	0,177	0,182	0,160	0,094	0,147	0,154	2,968
B3	0,144	0,131	0,086	0,112	0,107	0,103	0,117	0,116	0,138	0,155	0,138	0,110	0,112	0,119	0,123	0,103	0,147	0,160	0,140	0,088	0,142	0,130	2,720
B4	0,126	0,117	0,099	0,082	0,136	0,113	0,115	0,114	0,110	0,144	0,132	0,110	0,116	0,113	0,112	0,112	0,160	0,169	0,159	0,087	0,110	0,143	2,679
B5	0,115	0,110	0,111	0,139	0,083	0,115	0,122	0,112	0,118	0,152	0,139	0,118	0,124	0,111	0,110	0,115	0,174	0,178	0,158	0,095	0,123	0,146	2,767
B6	0,123	0,114	0,109	0,123	0,127	0,078	0,111	0,110	0,106	0,145	0,133	0,126	0,123	0,115	0,109	0,114	0,167	0,171	0,161	0,094	0,122	0,144	2,725
B7	0,174	0,169	0,138	0,139	0,143	0,134	0,104	0,137	0,150	0,182	0,168	0,138	0,125	0,121	0,146	0,120	0,185	0,191	0,168	0,097	0,161	0,175	3,264
B8	0,157	0,152	0,136	0,143	0,142	0,137	0,152	0,095	0,152	0,170	0,156	0,141	0,128	0,124	0,144	0,128	0,183	0,188	0,170	0,095	0,149	0,163	3,206
B9	0,178	0,173	0,156	0,143	0,142	0,137	0,158	0,145	0,109	0,177	0,163	0,137	0,143	0,140	0,150	0,133	0,191	0,196	0,172	0,104	0,161	0,174	3,384
B10	0,141	0,132	0,127	0,099	0,097	0,095	0,113	0,112	0,114	0,113	0,136	0,133	0,135	0,123	0,127	0,126	0,170	0,174	0,163	0,085	0,135	0,136	2,788
B11	0,121	0,122	0,108	0,095	0,093	0,091	0,098	0,098	0,114	0,147	0,100	0,119	0,122	0,118	0,127	0,122	0,164	0,172	0,157	0,092	0,130	0,136	2,646
B12	0,124	0,120	0,106	0,097	0,091	0,098	0,110	0,100	0,107	0,151	0,144	0,092	0,135	0,132	0,131	0,136	0,168	0,172	0,162	0,094	0,133	0,139	2,742
B13	0,130	0,120	0,111	0,117	0,101	0,108	0,101	0,105	0,113	0,163	0,156	0,139	0,102	0,143	0,142	0,152	0,187	0,186	0,175	0,099	0,134	0,146	2,932
B14	0,121	0,117	0,113	0,104	0,098	0,095	0,108	0,102	0,124	0,149	0,142	0,135	0,142	0,094	0,138	0,133	0,176	0,180	0,165	0,096	0,135	0,142	2,807
B15	0,162	0,152	0,146	0,133	0,132	0,123	0,138	0,130	0,144	0,167	0,158	0,138	0,145	0,146	0,111	0,140	0,190	0,195	0,177	0,106	0,156	0,154	3,241
B16	0,135	0,130	0,116	0,122	0,121	0,112	0,126	0,115	0,122	0,169	0,161	0,143	0,151	0,147	0,146	0,101	0,188	0,192	0,181	0,107	0,140	0,147	3,074
B17	0,128	0,124	0,109	0,112	0,110	0,107	0,115	0,109	0,116	0,151	0,144	0,132	0,139	0,130	0,134	0,135	0,129	0,187	0,176	0,107	0,132	0,140	2,865
B18	0,152	0,142	0,127	0,128	0,126	0,123	0,132	0,125	0,133	0,171	0,163	0,149	0,161	0,147	0,157	0,147	0,191	0,150	0,188	0,107	0,156	0,173	3,247
B19	0,160	0,154	0,143	0,139	0,138	0,134	0,129	0,122	0,136	0,186	0,177	0,162	0,169	0,165	0,170	0,164	0,211	0,216	0,148	0,118	0,169	0,177	3,486
B20	0,126	0,122	0,108	0,105	0,104	0,101	0,114	0,098	0,109	0,138	0,131	0,124	0,121	0,118	0,121	0,117	0,159	0,163	0,148	0,066	0,125	0,136	2,652
B21	0,150	0,146	0,135	0,112	0,116	0,112	0,136	0,119	0,137	0,153	0,145	0,126	0,138	0,140	0,144	0,133	0,176	0,180	0,168	0,106	0,108	0,151	3,033
B22	0,169	0,164	0,138	0,140	0,139	0,139	0,144	0,132	0,135	0,169	0,160	0,145	0,142	0,138	0,143	0,132	0,193	0,202	0,189	0,113	0,148	0,126	3,300
Total (S)	3,118	2,982	2,695	2,614	2,576	2,468	2,725	2,535	2,754	3,499	3,266	2,876	2,924	2,828	2,954	2,795	3,868	3,995	3,651	2,155	3,074	3,299	

Tabel 9. Total Influence Matrix for Criteria (T_D)

A	A1	A2	A3	A4	A5	A6	A7	Total (R)
A1	0,139	0,136	0,112	0,132	0,154	0,136	0,152	0,961
A2	0,138	0,086	0,107	0,124	0,134	0,121	0,132	0,841
A3	0,117	0,106	0,111	0,113	0,133	0,125	0,137	0,843
A4	0,167	0,143	0,140	0,134	0,159	0,144	0,158	1,045
A5	0,126	0,114	0,095	0,107	0,126	0,136	0,139	0,843
A6	0,132	0,119	0,113	0,118	0,150	0,142	0,150	0,923
A7	0,148	0,130	0,124	0,127	0,153	0,152	0,149	0,983
Total (S)	0,968	0,835	0,802	0,854	1,010	0,955	1,017	

The total relationship matrix will be used to form the unweighted supermatrix for criteria and sub-criteria. The unweighted supermatrix is obtained through the calculation of Equation 7. The first step to form the unweighted supermatrix is to normalize the total relationship matrix of criteria (T_D) and sub criteria (T_C). Normalization is done by summing each row in the matrix of total sub-criteria relationship with the same criteria to form T_C^{α} and summing each row in the matrix of total criteria relationship to form T_D^{α}. Next, divide the total relationship value elements of the criteria and sub criteria with the total sum that has been calculated previously. T_D^{α} and T_C^{α} matrices can be seen at Table 10 and Table 11.

Table 10. Normalized Total Relationship Matrix between Criteria (T_D^{α})

A	A1	A2	A3	A4	A5	A6	A7
A1	0,145	0,142	0,117	0,137	0,160	0,141	0,158
A2	0,163	0,102	0,128	0,147	0,160	0,143	0,157
A3	0,139	0,126	0,131	0,134	0,158	0,148	0,163
A4	0,160	0,137	0,134	0,128	0,152	0,138	0,151
A5	0,150	0,135	0,113	0,127	0,150	0,161	0,165
A6	0,143	0,129	0,122	0,128	0,162	0,153	0,163
A7	0,151	0,132	0,126	0,129	0,156	0,154	0,152

Table 11. Normalized Total Relationship Matrix between Sub-criteria (T_C^{α})

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22
B1	0,404	0,596	0,408	0,339	0,350	0,311	0,354	0,301	0,345	0,377	0,348	0,275	0,182	0,177	0,199	0,175	0,267	0,242	0,214	0,132	0,201	0,211
B2	0,617	0,383	0,400	0,339	0,336	0,325	0,364	0,308	0,329	0,373	0,345	0,282	0,188	0,183	0,198	0,166	0,265	0,247	0,217	0,128	0,199	0,208
B3	0,525	0,475	0,267	0,349	0,331	0,320	0,316	0,313	0,371	0,385	0,342	0,274	0,186	0,197	0,204	0,170	0,243	0,243	0,212	0,133	0,216	0,196
B4	0,518	0,482	0,299	0,248	0,411	0,341	0,339	0,336	0,325	0,373	0,341	0,286	0,190	0,184	0,182	0,183	0,261	0,253	0,237	0,131	0,165	0,214
B5	0,510	0,490	0,328	0,412	0,247	0,341	0,347	0,318	0,335	0,371	0,341	0,288	0,196	0,175	0,173	0,182	0,273	0,254	0,226	0,135	0,176	0,209
B6	0,519	0,481	0,334	0,376	0,386	0,238	0,338	0,336	0,326	0,359	0,329	0,312	0,196	0,183	0,173	0,182	0,266	0,248	0,232	0,135	0,176	0,209
B7	0,507	0,493	0,333	0,334	0,344	0,322	0,267	0,350	0,383	0,373	0,344	0,283	0,179	0,174	0,209	0,172	0,266	0,241	0,212	0,122	0,204	0,221
B8	0,508	0,492	0,322	0,338	0,336	0,326	0,381	0,238	0,382	0,364	0,334	0,302	0,181	0,176	0,204	0,181	0,259	0,246	0,222	0,124	0,195	0,213
B9	0,508	0,492	0,371	0,339	0,336	0,325	0,383	0,353	0,264	0,371	0,341	0,287	0,189	0,184	0,198	0,176	0,252	0,242	0,213	0,129	0,199	0,216
B10	0,517	0,483	0,438	0,340	0,335	0,325	0,333	0,329	0,337	0,295	0,356	0,349	0,199	0,180	0,186	0,186	0,249	0,251	0,235	0,123	0,195	0,197
B11	0,499	0,501	0,388	0,340	0,335	0,325	0,317	0,315	0,368	0,401	0,273	0,326	0,186	0,181	0,195	0,187	0,251	0,251	0,229	0,134	0,189	0,198
B12	0,509	0,491	0,370	0,340	0,318	0,342	0,348	0,315	0,337	0,390	0,372	0,238	0,192	0,188	0,186	0,194	0,240	0,246	0,231	0,135	0,190	0,199
B13	0,519	0,481	0,339	0,359	0,310	0,330	0,317	0,330	0,353	0,356	0,340	0,304	0,140	0,197	0,195	0,210	0,257	0,251	0,236	0,134	0,181	0,197
B14	0,509	0,491	0,378	0,351	0,329	0,320	0,323	0,306	0,371	0,350	0,333	0,317	0,208	0,137	0,202	0,195	0,258	0,251	0,229	0,134	0,189	0,198
B15	0,516	0,484	0,378	0,343	0,340	0,317	0,334	0,317	0,349	0,360	0,341	0,298	0,198	0,200	0,152	0,191	0,259	0,247	0,224	0,135	0,198	0,196
B16	0,509	0,491	0,325	0,344	0,339	0,316	0,346	0,316	0,338	0,357	0,340	0,303	0,206	0,200	0,199	0,138	0,256	0,251	0,235	0,140	0,182	0,192
B17	0,509	0,491	0,333	0,340	0,335	0,325	0,338	0,320	0,342	0,354	0,337	0,309	0,208	0,196	0,201	0,202	0,193	0,252	0,237	0,144	0,178	0,188
B18	0,517	0,483	0,335	0,339	0,335	0,326	0,338	0,321	0,341	0,355	0,337	0,308	0,200	0,184	0,195	0,183	0,238	0,194	0,243	0,138	0,201	0,224
B19	0,509	0,491	0,348	0,340	0,335	0,325	0,334	0,315	0,351	0,354	0,337	0,309	0,193	0,188	0,193	0,187	0,240	0,261	0,179	0,142	0,204	0,214
B20	0,508	0,492	0,348	0,339	0,335	0,325	0,354	0,305	0,341	0,351	0,333	0,316	0,190	0,185	0,191	0,184	0,250	0,255	0,231	0,104	0,196	0,214
B21	0,508	0,492	0,399	0,330	0,340	0,330	0,346	0,304	0,350	0,361	0,342	0,297	0,189	0,191	0,198	0,182	0,240	0,252	0,235	0,149	0,152	0,212
B22	0,508	0,492	0,330	0,335	0,332	0,333	0,351	0,321	0,329	0,357	0,338	0,306	0,190	0,185	0,191	0,176	0,258	0,260	0,243	0,145	0,190	0,162

The next step is to form the unweighted supermatrix for criteria and sub-criteria. The unweighted supermatrix aims to obtain the local weights of criteria and sub-criteria within the same criteria. The unweighted supermatrix is formed by transposing each block in the normalized total relationship matrix for both criteria T_D^α and sub-criteria T_C^α. The unweighted supermatrices for T_D^α and T_C^α can be seen in Table 12 and Table 13.

Tabel 12. Unweighted Supermatrix Criteria

A	A1	A2	A3	A4	A5	A6	A7	Rata-Rata
A1	0,145	0,163	0,139	0,160	0,150	0,143	0,151	0,150
A2	0,142	0,102	0,126	0,137	0,135	0,129	0,132	0,129
A3	0,117	0,128	0,131	0,134	0,113	0,122	0,126	0,124
A4	0,137	0,147	0,134	0,128	0,127	0,128	0,129	0,133
A5	0,160	0,160	0,158	0,152	0,150	0,162	0,156	0,157
A6	0,141	0,143	0,148	0,138	0,161	0,153	0,154	0,149
A7	0,158	0,157	0,163	0,151	0,165	0,163	0,152	0,158
Jumlah	1	1	1	1	1	1	1	1

After obtaining the local weights of criteria and sub-criteria, the next step is to form a weighted supermatrix to calculate the global weights of the sub criteria. If the sum of all elements with the same column in the unweighted supermatrix is already one, then there is no need to form the weighted supermatrix. The calculation results show that the sum of all elements with the same column in the unweighted supermatrix of sub-criteria is more than one, so it is necessary to form a weighted supermatrix. The weighted supermatrix is obtained by multiplying each element in the unweighted supermatrix of criteria T_D^α by the unweighted supermatrix of the corresponding sub-criteria T_C^α. The The sub-criteria weighted supermatrix of sub-criteria is obtained using Equation 12. The results of calculating the weighted supermatrix values are presented in Table 14.

Table 13. Unweighted Supermatrix Sub-criteria

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	Rata-Rata
B1	0,404	0,617	0,525	0,518	0,510	0,519	0,507	0,508	0,508	0,517	0,499	0,509	0,519	0,509	0,516	0,509	0,509	0,517	0,509	0,508	0,508	0,508	0,511
B2	0,596	0,383	0,475	0,482	0,490	0,481	0,493	0,492	0,492	0,483	0,501	0,491	0,481	0,491	0,484	0,491	0,491	0,483	0,491	0,492	0,492	0,492	0,489
B3	0,408	0,400	0,267	0,299	0,328	0,334	0,333	0,322	0,371	0,438	0,388	0,370	0,339	0,378	0,378	0,325	0,333	0,335	0,348	0,348	0,399	0,330	0,353
B4	0,339	0,339	0,349	0,248	0,412	0,376	0,334	0,338	0,339	0,340	0,340	0,340	0,359	0,351	0,343	0,344	0,340	0,339	0,340	0,339	0,330	0,335	0,342
B5	0,350	0,336	0,331	0,411	0,247	0,386	0,344	0,336	0,336	0,335	0,335	0,318	0,310	0,329	0,340	0,339	0,335	0,335	0,335	0,335	0,340	0,332	0,336
B6	0,311	0,325	0,320	0,341	0,341	0,238	0,322	0,326	0,325	0,325	0,325	0,342	0,330	0,320	0,317	0,316	0,325	0,326	0,325	0,325	0,330	0,333	0,322
B7	0,354	0,364	0,316	0,339	0,347	0,338	0,267	0,381	0,383	0,333	0,317	0,348	0,317	0,323	0,334	0,346	0,338	0,338	0,334	0,354	0,346	0,351	0,339
B8	0,301	0,308	0,313	0,336	0,318	0,336	0,350	0,238	0,353	0,329	0,315	0,315	0,330	0,306	0,317	0,316	0,320	0,321	0,315	0,305	0,304	0,321	0,317
B9	0,345	0,329	0,371	0,325	0,335	0,326	0,383	0,382	0,264	0,337	0,368	0,337	0,353	0,371	0,349	0,338	0,342	0,341	0,351	0,341	0,350	0,329	0,344
B10	0,377	0,373	0,385	0,373	0,371	0,359	0,373	0,364	0,371	0,295	0,401	0,390	0,356	0,350	0,360	0,357	0,354	0,355	0,354	0,351	0,361	0,357	0,363
B11	0,348	0,345	0,342	0,341	0,341	0,329	0,344	0,334	0,341	0,356	0,273	0,372	0,340	0,333	0,341	0,340	0,337	0,337	0,337	0,333	0,342	0,338	0,338
B12	0,275	0,282	0,274	0,286	0,288	0,312	0,283	0,302	0,287	0,349	0,326	0,238	0,304	0,317	0,298	0,303	0,309	0,308	0,309	0,316	0,297	0,306	0,299
B13	0,182	0,188	0,186	0,190	0,196	0,196	0,179	0,181	0,189	0,199	0,186	0,192	0,140	0,208	0,198	0,206	0,208	0,200	0,193	0,190	0,189	0,190	0,190
B14	0,177	0,183	0,197	0,184	0,175	0,183	0,174	0,176	0,184	0,180	0,181	0,188	0,197	0,137	0,200	0,200	0,196	0,184	0,188	0,185	0,191	0,185	0,184
B15	0,199	0,198	0,204	0,182	0,173	0,173	0,209	0,204	0,198	0,186	0,195	0,186	0,195	0,202	0,152	0,199	0,201	0,195	0,193	0,191	0,198	0,191	0,192
B16	0,175	0,166	0,170	0,183	0,182	0,182	0,172	0,181	0,176	0,186	0,187	0,194	0,210	0,195	0,191	0,138	0,202	0,183	0,187	0,184	0,182	0,176	0,182
B17	0,267	0,265	0,243	0,261	0,273	0,266	0,266	0,259	0,252	0,249	0,251	0,240	0,257	0,258	0,259	0,256	0,193	0,238	0,240	0,250	0,240	0,258	0,252
B18	0,242	0,247	0,243	0,253	0,254	0,248	0,241	0,246	0,242	0,251	0,251	0,246	0,251	0,251	0,247	0,251	0,252	0,194	0,261	0,255	0,252	0,260	0,247
B19	0,214	0,217	0,212	0,237	0,226	0,232	0,212	0,222	0,213	0,235	0,229	0,231	0,236	0,229	0,224	0,235	0,237	0,243	0,179	0,231	0,235	0,243	0,226
B20	0,132	0,128	0,133	0,131	0,135	0,135	0,122	0,124	0,129	0,123	0,134	0,135	0,134	0,134	0,135	0,140	0,144	0,138	0,142	0,104	0,149	0,145	0,133
B21	0,201	0,199	0,216	0,165	0,176	0,176	0,204	0,195	0,199	0,195	0,189	0,190	0,181	0,189	0,198	0,182	0,178	0,201	0,204	0,196	0,152	0,190	0,190
B22	0,211	0,208	0,196	0,214	0,209	0,209	0,221	0,213	0,216	0,197	0,198	0,199	0,197	0,198	0,196	0,192	0,188	0,224	0,214	0,214	0,212	0,162	0,204
Jumlah	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Table 14. Weighted Supermatrix of Sub-criteria

		A1		A2	A3			A4			A5			A6					A7				
	B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22
A1	B1	0,058	0,089	0,086	0,072	0,071	0,072	0,081	0,081	0,081	0,077	0,075	0,076	0,074	0,073	0,074	0,073	0,073	0,078	0,077	0,077	0,077	0,077
	B2	0,086	0,055	0,078	0,067	0,068	0,067	0,079	0,079	0,079	0,072	0,075	0,074	0,069	0,070	0,069	0,070	0,070	0,073	0,074	0,074	0,074	0,074
A2	B3	0,058	0,057	0,027	0,038	0,041	0,042	0,046	0,044	0,051	0,059	0,052	0,050	0,044	0,049	0,049	0,042	0,043	0,044	0,046	0,046	0,053	0,044
A3	B4	0,040	0,040	0,044	0,033	0,054	0,049	0,045	0,045	0,045	0,038	0,038	0,038	0,044	0,043	0,042	0,042	0,042	0,043	0,043	0,043	0,042	0,042
	B5	0,041	0,039	0,042	0,054	0,032	0,051	0,046	0,045	0,045	0,038	0,038	0,036	0,038	0,040	0,042	0,042	0,041	0,042	0,042	0,042	0,043	0,042
	B6	0,036	0,038	0,041	0,045	0,045	0,031	0,043	0,044	0,044	0,037	0,037	0,039	0,040	0,039	0,039	0,039	0,040	0,041	0,041	0,041	0,041	0,042
A4	B7	0,049	0,050	0,046	0,045	0,046	0,045	0,034	0,049	0,049	0,042	0,040	0,044	0,040	0,041	0,043	0,044	0,043	0,044	0,043	0,046	0,045	0,045
	B8	0,041	0,042	0,046	0,045	0,043	0,045	0,045	0,030	0,045	0,042	0,040	0,040	0,042	0,039	0,040	0,040	0,041	0,041	0,041	0,039	0,039	0,041
	B9	0,047	0,045	0,054	0,044	0,045	0,044	0,049	0,049	0,034	0,043	0,047	0,043	0,045	0,047	0,045	0,043	0,044	0,044	0,045	0,044	0,045	0,042
A5	B10	0,060	0,060	0,061	0,059	0,059	0,057	0,057	0,055	0,057	0,044	0,060	0,058	0,058	0,057	0,058	0,058	0,057	0,055	0,055	0,055	0,056	0,056
	B11	0,056	0,055	0,055	0,054	0,054	0,052	0,052	0,051	0,052	0,053	0,041	0,056	0,055	0,054	0,055	0,055	0,055	0,053	0,053	0,052	0,053	0,053
	B12	0,044	0,045	0,044	0,045	0,046	0,049	0,043	0,046	0,044	0,052	0,049	0,036	0,049	0,051	0,048	0,049	0,050	0,048	0,048	0,049	0,046	0,048
A6	B13	0,026	0,027	0,027	0,028	0,029	0,029	0,025	0,025	0,026	0,032	0,030	0,031	0,021	0,032	0,030	0,032	0,032	0,031	0,030	0,029	0,029	0,029
	B14	0,025	0,026	0,028	0,027	0,026	0,027	0,024	0,024	0,025	0,029	0,029	0,030	0,030	0,021	0,031	0,031	0,030	0,028	0,029	0,029	0,029	0,028
	B15	0,028	0,028	0,029	0,027	0,026	0,026	0,029	0,028	0,027	0,030	0,031	0,030	0,030	0,031	0,023	0,031	0,031	0,030	0,030	0,030	0,031	0,030
	B16	0,025	0,024	0,024	0,027	0,027	0,027	0,024	0,025	0,024	0,030	0,030	0,031	0,032	0,030	0,029	0,021	0,031	0,028	0,029	0,028	0,028	0,027
	B17	0,038	0,037	0,035	0,039	0,041	0,039	0,037	0,036	0,035	0,040	0,040	0,039	0,039	0,040	0,040	0,039	0,030	0,037	0,037	0,039	0,037	0,040
A7	B18	0,038	0,039	0,038	0,041	0,041	0,040	0,036	0,037	0,037	0,041	0,041	0,040	0,041	0,041	0,040	0,041	0,041	0,029	0,040	0,039	0,038	0,039
	B19	0,034	0,034	0,033	0,039	0,037	0,038	0,032	0,034	0,032	0,039	0,038	0,038	0,038	0,037	0,037	0,038	0,039	0,037	0,027	0,035	0,036	0,037
	B20	0,021	0,020	0,021	0,021	0,022	0,022	0,018	0,019	0,019	0,020	0,022	0,022	0,022	0,022	0,022	0,023	0,023	0,021	0,022	0,016	0,023	0,022
	B21	0,032	0,031	0,034	0,027	0,029	0,029	0,031	0,029	0,030	0,032	0,031	0,031	0,030	0,031	0,032	0,030	0,029	0,031	0,031	0,030	0,023	0,029
	B22	0,033	0,033	0,031	0,035	0,034	0,034	0,033	0,032	0,033	0,032	0,033	0,033	0,032	0,032	0,032	0,031	0,031	0,034	0,032	0,032	0,032	0,025

Then, the last step is to calculate the limit supermatrix by making the weighted supermatrix rank until it reaches a stable supermatrix through Equation 13. The limit supermatrix formed can be seen in Table 15. The characteristic of a limit supermatrix has been stable, that is, the value of each sub-criterion that is on the same criterion has a uniform value. The result of the diagonal value in the limit supermatrix is the global weight for sub-criteria. The results obtained from the DEMATEL-Based ANP method are the local weights of each sub-criteria and criteria as well as the global weights for the sub-criteria. All weights generated through the DEMATEL-Based ANP method can be seen in Table 16.

Table 15. Limit Supermatrix of Sub-criteria

B	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22	Rata-Rata
B1	0,058	0,058	0,059	0,058	0,058	0,058	0,058	0,058	0,058	0,059	0,058	0,058	0,058	0,059	0,059	0,058	0,058	0,058	0,058	0,058	0,059	0,058	0,058
B2	0,056	0,056	0,056	0,056	0,056	0,056	0,055	0,055	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056	0,056
B3	0,037	0,036	0,037	0,036	0,036	0,036	0,036	0,036	0,036	0,037	0,037	0,036	0,036	0,037	0,037	0,036	0,036	0,036	0,036	0,036	0,037	0,036	0,036
B4	0,032	0,032	0,033	0,032	0,032	0,032	0,032	0,032	0,032	0,033	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,033	0,032	0,032
B5	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032
B6	0,031	0,031	0,031	0,030	0,031	0,031	0,030	0,030	0,030	0,031	0,031	0,031	0,030	0,031	0,031	0,030	0,030	0,030	0,030	0,030	0,031	0,030	0,031
B7	0,034	0,034	0,035	0,034	0,034	0,034	0,034	0,034	0,034	0,035	0,034	0,034	0,034	0,034	0,034	0,034	0,034	0,034	0,034	0,034	0,034	0,034	0,034
B8	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032	0,032
B9	0,035	0,035	0,035	0,034	0,035	0,035	0,034	0,034	0,034	0,035	0,035	0,035	0,035	0,035	0,035	0,034	0,034	0,034	0,034	0,034	0,035	0,034	0,035
B10	0,044	0,044	0,044	0,044	0,044	0,044	0,043	0,043	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044	0,044
B11	0,041	0,041	0,041	0,041	0,041	0,041	0,040	0,040	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041	0,041
B12	0,036	0,036	0,036	0,035	0,036	0,036	0,035	0,035	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,036	0,035	0,036	0,036	0,036	0,035	0,036
B13	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022
B14	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021
B15	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022	0,022
B16	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021	0,021
B17	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029	0,029
B18	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030	0,030
B19	0,027	0,027	0,028	0,027	0,027	0,027	0,027	0,027	0,027	0,028	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027	0,027
B20	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016	0,016
B21	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023	0,023
B22	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025

Table 16. Summary of Final Results of Local and Global Weights

Criteria	Criteria Local Weight	Sub-Criteria	Label	Sub-criteria Local Weight	Sub-criteria Local Weight Rank	Sub-criteria Global Weight	Sub-criteria Global Weight Rank
A1: Product Quality Capability	0,150	Quality	B1	0,511	1	0,058	1
		Product Reliability	B2	0,489	2	0,056	2
A2: Financial Capability	0,129	Cost Reduction Program	B3	0,353	1	0,036	5
A3: Delivery Capability	0,124	On-Time Delivery	B4	0,342	1	0,032	9
		Leadtime	B5	0,336	2	0,032	10
		Accuracy of Item Quantity	B6	0,322	3	0,031	12
A4: Technical Capability	0,133	Process Capability	B7	0,339	2	0,034	8
		Production Facilities and Capacity	B8	0,317	3	0,032	11
		Technology Development	B9	0,344	1	0,035	7
A5: Service Capabilty	0,157	Repair Service	B10	0,363	1	0,044	3
		After-Sales Service	B11	0,338	2	0,041	4
		Response to Claims and Warranty Policy	B12	0,299	3	0,036	6
A6: Willingness to Share Information and Communication Ethics	0,149	Respectful and Honest Communication	B13	0,190	3	0,022	19
		Information Disclosure	B14	0,184	4	0,021	20
		Willingness to Share Information, Ideas, Technology, and Cost Savings	B15	0,192	2	0,022	18
		Ethical Standards	B16	0,182	5	0,021	21
		Impression	B17	0,252	1	0,029	14
A7: Willingness to Engage in a Long-Term Relationship	0,158	Long-term Relationship	B18	0,247	1	0,030	13
		Closeness of Relationship	B19	0,226	2	0,027	15
		Previous Experience with Suppliers	B20	0,133	5	0,016	22
		Willingness to Design and Participate in Product Development	B21	0,190	4	0,023	17
		Consistency	B22	0,204	3	0,025	16

The last step in this research is to evaluate each supplier. The evaluation of each supplier is obtained from a value based on the weight of the sub-criteria obtained from the D-ANP method and a supplier assessment questionnaire by experts. Supplier assessment begins by determining which suppliers will be assessed based on 22 sub-criteria that have been obtained in the previous stage. Then, the assessment will be carried out by experts through filling out the stage III questionnaire, namely the supplier assessment questionnaire using four likert scales. There were 23 suppliers evaluated in the study for OPP, PET, Nylon, Aluminium Foil, CPP, and LLDPE materials from flexible packaging company. Table 17 shows the names of the suppliers, the type of material offered, along with the code to make it easier to understand.

Table 17. Supplier Code

Supplier	Material	Kode
PT. Trias Sentosa	OPP, PET	S1
PT. Argha Karya Prima Industry	OPP, PET	S2
PT. Indopoly Swakarsa Industry	OPP, PET	S3
PT. Lotte Packaging	OPP	S4
PT. Megasetia Agung Kimia	OPP, PET, Nylon, Alu Foil	S5
PT. Polyplex Films Indonesia	PET	S6
PT. Inamulti Intipack	PET, Nylon	S7
PT. Indoplast Makmur Fortuna	PET	S8
PT. Cipta Rama Kemasindo	PET, Nylon, Alu Foil	S9
PT. Cahaya Prisma Sentosa	PET, Nylon, Alu Foil	S10
PT. Toray International Indonesia	PET, Nylon, Alu Foil	S11
PT. Bersaudara Inti Corpora	Nylon, Alu Foil	S12
PT. Panverta Cakrakencana	CPP, LLDPE	S13
PT. Indonesia Pratama Multipack	CPP	S14
PT. Bhineka Tatamulya Industri	CPP	S15
PT. Wira Mustika Abadi	CPP	S16
PT. Kencar Sukses Investama	CPP	S17
PT. Nusa Eka Winapratama	LLDPE	S18
PT. Saka Indah Abadi	LLDPE	S19
PT. Blasfolie International Indonesia	LLDPE	S20
PT. AMG Plastic Industry	LLDPE	S21
PT. Modern Plastic Industry	LLDPE	S22
PT. Bina Inplasco	LLDPE	S23

The global weight of sub criteria that has been obtained from the previous D-ANP method will be used in the calculation process. The number of respondents who will assess the stage III questionnaire is one person, where the respondent is included in the procurement team at PT X so that in their daily work, they have a high intensity of communication and relationships with suppliers. The recapitulation of the results of the questionnaire that has been filled in by the respondents can be seen in Table 18.

Table 18. Stage III Questionnaire Results

Material	Kode Supplier	Sub Kriteria																					
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22
OPP	S1	3	3	2	2	2	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3
	S2	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3
	S4	3	2	3	2	3	3	3	3	3	3	3	3	3	2	2	3	3	2	3	3	2	3
	S5	3	3	2	2	3	3	3	3	3	3	3	3	3	2	2	3	3	2	3	3	2	3
PET	S1	3	3	2	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S2	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S5	3	3	2	2	3	3	3	3	3	3	3	3	3	2	2	3	3	2	3	3	2	3
	S6	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	1	2	2	2	2
	S7	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	3	3	3
	S8	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S10	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S11	3	3	2	3	3	2	3	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3
NYLON	S5	3	3	2	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2	2	3	2	3
	S7	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	3	3	3
	S9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S11	3	3	2	2	2	3	3	3	3	3	3	3	3	3	2	3	3	2	2	3	2	3
	S12	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
ALU	S5	3	3	2	2	2	3	3	3	3	3	3	3	3	2	2	3	3	2	2	3	2	3
	S9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S11	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2	2	3	2	3
	S12	3	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CPP	S13	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	3	4	3	3	4	3
	S14	3	3	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S15	3	3	2	2	2	3	3	3	3	3	3	3	3	2	3	3	3	2	2	3	3	3
	S16	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
	S17	2	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3
LLDPE	S13	3	3	2	3	3	3	3	3	3	3	3	3	3	4	4	3	3	4	3	3	4	3
	S18	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S19	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S20	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S21	3	3	4	1	2	2	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
	S22	3	3	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	S23	3	3	3	2	2	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3

From the recapitulation table of the results of the Phase III questionnaire assessment, then these values will be multiplied by the global weight of each sub-criterion obtained from the D-ANP method for each supplier. After the multiplication results are obtained, the summation will be done for each supplier so that the total value of supplier performance evaluation is obtained. From the total value, a ranking is then made for each supplier based on the type of material offered to the company. So, from this ranking it can be seen which suppliers have the highest to lowest scores and on which sub-criteria the supplier must make improvements. The results of the stage III questionnaire calculation can be seen in Table 19.

Table 19. Stage III Questionnaire Calculation Results

Material	Kode Supplier	Sub Kriteria																						Total	Rank
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20	B21	B22		
OPP	S1	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,088	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	1,965	3
	S2	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,009	2
	S3	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,088	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,131	1
	S4	0,174	0,112	0,108	0,064	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,044	0,063	0,087	0,06	0,081	0,048	0,046	0,075	1,925	5
	S5	0,174	0,168	0,072	0,064	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,044	0,063	0,087	0,06	0,081	0,048	0,046	0,075	1,945	4
PET	S1	0,174	0,168	0,072	0,064	0,096	0,062	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,010	5
	S2	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,009	6
	S3	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,109	1
	S5	0,174	0,168	0,072	0,064	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,044	0,063	0,087	0,06	0,081	0,048	0,046	0,075	1,945	8
	S6	0,058	0,112	0,072	0,064	0,064	0,062	0,068	0,064	0,07	0,088	0,082	0,072	0,044	0,021	0,044	0,042	0,058	0,03	0,054	0,032	0,046	0,05	1,297	10
	S7	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,042	0,058	0,06	0,054	0,048	0,069	0,075	1,902	9
	S8	0,174	0,168	0,072	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,073	3
	S9	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,109	1
	S10	0,174	0,168	0,072	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,073	3
	S11	0,174	0,168	0,072	0,096	0,096	0,062	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,044	0,063	0,087	0,09	0,054	0,048	0,069	0,075	1,993	7
NYLON	S5	0,174	0,168	0,072	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,044	0,063	0,087	0,06	0,054	0,048	0,046	0,075	1,950	4
	S7	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,042	0,058	0,06	0,054	0,048	0,069	0,075	1,902	6
	S9	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,109	1
	S10	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,109	1
	S11	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,044	0,063	0,087	0,06	0,054	0,048	0,046	0,075	1,907	5
	S12	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,009	3
ALU	S5	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,044	0,063	0,087	0,06	0,054	0,048	0,046	0,075	1,886	4
	S9	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,109	1
	S11	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,044	0,063	0,087	0,06	0,054	0,048	0,046	0,075	1,986	3
	S12	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,009	2
CPP	S13	0,174	0,168	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,084	0,088	0,084	0,087	0,12	0,081	0,048	0,092	0,075	2,226	1
	S14	0,174	0,168	0,072	0,064	0,064	0,062	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	1,978	4
	S15	0,174	0,168	0,072	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,066	0,063	0,087	0,06	0,054	0,048	0,069	0,075	1,931	5
	S16	0,174	0,168	0,108	0,064	0,096	0,062	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,054	0,048	0,069	0,075	2,019	2
	S17	0,116	0,168	0,072	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,016	0,069	0,075	1,983	3
LLDPE	S13	0,174	0,168	0,072	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,084	0,088	0,063	0,087	0,12	0,081	0,048	0,092	0,075	2,169	1
	S18	0,174	0,168	0,108	0,096	0,128	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,141	2
	S19	0,174	0,168	0,108	0,128	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,141	2
	S20	0,174	0,112	0,108	0,096	0,096	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,053	4
	S21	0,174	0,168	0,144	0,032	0,064	0,062	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,042	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	1,997	7
	S22	0,174	0,168	0,108	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,108	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,045	5
	S23	0,174	0,168	0,108	0,064	0,064	0,093	0,102	0,096	0,105	0,132	0,123	0,072	0,066	0,063	0,066	0,063	0,087	0,09	0,081	0,048	0,069	0,075	2,009	6

6. Conclusion

In this study, we have supplier performance measurement system that formed with DEMATEL and ANP methods, obtained as many as 22 sub-criteria from 7 criteria that have been selected by the experts. The 7 criteria are Product Quality Capability, Financial Capability, Delivery Capability, Technical Capability, Service Capabilty, Willingness to Share Information and Communication Ethics, and Willingness to Engage in a Long-Term Relationship. Meanwhile, the order of the 22 sub-criteria that have the largest to smallest global sub-criteria weights include Quality (0.058), Product Reliability (0.056), Repair Service (0.044), After-Sales Service (0.041), Cost Reduction Program (0.036), Response to Claims and Warranty Policy (0.036), Technology Development (0.035), Process Capability (0.034), On-Time Delivery (0.032), Leadtime (0.032), Production Facilities and Capacity (0.032), Accuracy of Item Quantity (0.031), Long-term Relationship (0.030), Impression (0.029), Closeness of Relationship (0.027), Consistency (0.025), Willingness to Design and Participate in Product Development (0.023), Willingness to Share Information, Ideas, Technology, and Cost Savings (0.022), Respectful and Honest Communication (0.022), Information Disclosure (0.021), Ethical Standards (0.021), and Previous Experience with Suppliers (0.016). Meanwhile, based on supplier performance measurement system, supplier performance was evaluated with the following result: the top 3 OPP suppliers included S3, S2, and S1; the top 3 PET suppliers included S3, S9, dan S8; the top 3 Nylon suppliers included S9, S10, dan S12; the top 3 Aluminium Foil suppliers included S9, S12, dan S11; the top 3 CPP suppliers included S13, 16, dan S17; and the top 3 LLDPE suppliers included S13, S18, dan S19.

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Biographies

Bonita is graduated from Universitas Katolik Parahyangan in 2016 and received her Bachelor's Degree in Industrial Engineering. Her research on bachelor study discussed about safety climate that is perceived value of safety in an organization at a particular point in time. She currently has her postgraduate study of Industrial Engineering in Universitas Indonesia starting from 2021 with interest in Logistics and Production System.

T Yuri M Zagloel is currently active a lecturer in Industrial Engineering Department in Universitas Indonesia. He received his Bachelor's Degree from Universitas Indonesia in 1987, then continue his Master's Degree from University of New South Wales in 1991, and his Doctoral's Degree from Universitas Indonesia in 2000. His research mainly focused in Quality Management and Production System.