**THE SELECTION OF THE SUPPLIER-BASED GO GREEN USING ANALITICAL HIERARCHY PROCESS (AHP)**

Bella Hadi Kuncoro1), Dr.Ir. Agus Purnomo, MT2)

The Course Industrial Engineering, Faculty Of Engineering, University Of Pasundan

1) Email: Hadiaxic@gmail.com

*ABSTRACT construction of the industrial sector in Indonesia has been running about 45 years calculated since the inception of the legislation of Foreign Investment (PMA) in 1967 and the legislation of domestic Investment (PMDN) in 1968. During the last 10 years, the industry contributes-25.45 28.96 percent against the gross domestic product (GDP) rising trend. with Indonesia. With a market share of over 50% PT AH still strives to always start bearing consistent quality products and affordable by the consumer sepedah motor in Indonsia. In addition to the more rapid growth of industries in Indonesia, causing many problems for the environment segingga we can not pungkiri again that industry in Indonesia being one of the largest pollution contributors anyway after vehicle motor. So at the moment a lot of industrial companies that are vying to reduce pollution created, where in pt. AH itself has been applying go green at his company, se ...*

*Keywords: the selection of Suppliers, Supplier of eco-friendly, industry-friendly Ligkungan*

--------------------------------------The Separator Section (Ongoing)---------------------------

1. **Introduction**

1.1 Background

Development of the industrial sector in Indonesia has been running about forty five years counted since the inception of the legislation of Foreign Investment (PMA) in 1967 and the legislation of domestic Investment (PMDN) in 1968. During the last 10 years, the industry contributes 25,45 28,96-percent against the gross domestic product (GDP) of Indonesia with a tendency to increase. This is in line with the Government's efforts to strengthen the revenue from non-oil and gas sector and the growth of the industrial sector are encouraged to reach 8.5 percent in 2014 and should continue to rise to an average of 9.75 percent in the period 2020-2025.

However to achieve the economic development targets is not easy. There are a variety of challenges for national industries to be more competitive power such as the problem of the availability of resources are depleting also dependency against imported raw materials until the problem timbulan waste. At the global level, the demands in order to be applied to the industry standard which focuses on efforts of efficiency of raw materials, water and energy, diversify energy, *eco-design* and low-carbon technologies with the goal of increased productivity and minimization of waste is increasingly high. Current environmental issue becomes one of trade barriers (*barriers to trade*) to the market penetration of a country. *Barrier* was performed by means of applying a wide range of standard, be it standards international (ISO, ecolabel) as well as the requirements of the buyer (*buyer requirement*). Therefore, the business world needs to anticipate barriers applied by some countries export products Indonesia.

To support the industrial sector of Indonesia beralihnya *u.s. Business Usual (BAU)* into *Green* *Business*steps have already begun to do. In September 2009 along with 20 other Asian countries, Indonesia signed a *Manila Declaration on Green Industry* in the Philippines. In the Declaration, Indonesia expressed the determination to set the policy, institutional and regulatory frameworks that encourage a shift towards efficient industries and low-carbon or known by the term green industry. The green industry is an industry that is in the process of its production efficiency and effectiveness efforts prioritize the use of resources in a sustainable way so that it is able to harmonize industrial development with the preservation of environmental functions and can benefit of the community. The application of green industry is done through the concept of clean production (*cleaner production*) through the application of 4R, i.e. *Reduce*(reducing waste at the source), *Reuse*(reuse of waste), and*Recycle*( recycling of waste), and *Recovery*(a separation of materials or energy from a waste). To further streamline the application of the principle of application of clean production, *Rethink*(initial thought on the concept of operational activities) can be added so be 5R. In addition, net production also involves efforts to improve the efficiency of the use of raw materials, ancillary materials and energy throughout the production stages. By applying the concept of cleaner production, expected natural resources can be better protected and exploited in a sustainable way. In short, clean production provide two advantages, **first**the efficiency in the production process; and **the second**is formation of meminimisasi waste, so as to protect the sustainability of the environment.

Various programs continue to be developed to support the attainment of the green industry, including:

1) devised a master plan of development of the green industry.

The master plan is the policy direction and guidance to all stakeholders in developing green industry in Indonesia. This document contains roadmap, vision, mission and action plans of green industrial development up to the year 2030.

2) energy conservation and reduction of CO2 emissions in the industrial sector.

The industrial sector is the largest energy user, of which 47% ± national energy consumption by industrial activity. Energy needs continue to rise, while the reserve source of energy is depleting.Therefore, conservation efforts must be increased and diversified energy so it can awake the sustainability of the industrial sector, in addition to fulfilling the commitment of the Government of Indonesia to decrease emissions of greenhouse gases (GRK). As it known to the Government of Indonesia at the G-20 year 2009 in Pittsburg has committed will lower emissions GRK of 26% in the year 2020 if carried out independently (without the help of international donors) and was 41% in assisted by international donors.

3) the use of environmentally friendly engines.

This program has been started by doing a restructuring of the machinery for the textile industry and textile products, footwear, and sugar. Machining conditions in some types of industries such as textiles, footwear, and sugar are old so wasteful in the use of resources and lower levels of production efficiency. To improve efficiency and productivity, the Ministry of industry restructuring programme machining with assistance to the industry to finance the purchase of new machines. The program started in 2007 has given a significant impact towards the enhancement of productivity, the efficiency of the use of resources (raw materials, energy and water) as well as being able to increase the absorption of labour.

4) setting up industry-standard green.

Preparation of green industry standards aimed at protecting the interests of the industry and consumers and to improve the competitiveness of national industry in global competition. This activity was started in the year 2012 by crafting a green industry standards for commodities of industrial ceramics and textile industry. The preparation of this standard will be carried out gradually to all the commodities industry. Industry standard green was originally going is voluntary (*voluntary*) but along with growing market demands in the future can also be enforced compulsorily (*mandatory*).

5) prepare a green industry certification agencies.

For industrial companies that have meet the standards of the green industry will be given a certificate by a certification agency that has been accredited. Currently the Ministry of industry is currently in the process of establishing the mechanisms and institutions that will be recognized both nationally and internationally.

6) setting up incentives for the green industry.

One important aspect in pushing green industry development is the need for the grant of a stimulus in the form of incentives (fiscal and non fiscal) for industry peers to encourage and promote the investment climate for the development of the green industry. Investment for the green industry is very large, one is because the necessary replacement of the engine production with environmentally friendly technology, therefore the necessary incentives from the Government so that the industry can grow and develop in Indonesian. Without the support of incentives, the industry feared would compete, especially in the domestic market.

7) application of clean production.

Application of clean production in industrial sectors have been started since the 1990s. Various programmes have been developed by the Ministry of industry to encourage industries to apply clean production, especially to encourage perpetrators of IKM so applying clean production. Programs that have been conducted include the drafting of technical guidelines on clean production for some commodities industry and provide technical assistance to a number of industries.

8) cataloging environment-friendly input materials

Preparation of this catalogue aims to provide information for industry peers in choosing raw materials and ingredients of the helper is more environmentally friendly. In the year 2012 has been compiled catalog for commodities in textiles, ceramics and food. Cataloging will continue to be done in order to encourage perpetrators of the industry towards green industry. The development of the early formation of the company, the overall components are still imported from Japan in the form of broken down or *CKD (Completely Knock Down)*. New beginning in 1974 in line with the provisions of the Government to do the localization program components component, gradually began to be made in the country. The number of production has increased gradually, from a total production of about 1500 units during the year 1971, meningakat be 30,000 units next year, until 30 years later (in 2000) production unit able to reach 150,000 per month .

Similarly, with these types of locally produced components, which are always increasing from year to year, the current local content for type underbones have reached 92%. This means that only 8% of the components that need to be imported from outside, where the number of the program only deals with part of the engine (the engine) only. Outside of it all was produced domestically. The amount of accumulated production of PT. AH is currently reaching more than 10juta units since its inception in 1971. With a market share of over 50% PT. AH still strives to always start bearing consistent quality products and affordable by the consumer sepedah motor in Indonsia.

One of the components are made locally iyalah tank on motor bikes, where the function of a Fuel system is the fuel system using kaburator or injection to perform mixing gasoline with air before being channeled into the combustion chamber. Most motorcycles are currently still using this system. The major components of the fuel system consists of: the tank and carburetor or injection.Motorcycle fuel system is generally not equipped with pumps because their system does not use pressure but by channeling his own based on the weight of gravity.

The tank is a great place to stock up on fuel. On sepedah the engine under the motor then the fuel tank placed above. Tank capacity varies from great made his little machine. The material of the tank made from steel plate with coated on the inside with a metal that doesn't corrode easily. However there is also a gas tank terubuat of aluminium. Dilengkap fuel tank with vest and a resistant slide for gauges the amount of oil that is in the tank.

****

Figure 1.1 structure of the tank on a motorcycle

1. Tank cap (tank cover) serves as the pit entry of gasoline, water and dust protector, air breathing holes, and keep the petrol doesn't spill if sepda motor in reverse.

2. Filler tube function keep the abundance of bensi on when there are shocks (if conditions heat, gasoline will expand)

3. Full cock (petrol tap) functions to open and close the flow of gasoline from the tank and as a filter of dirt/dust particles.

4. Locating the Damper (shock) in the form of rubber that serve to temper the tank in position while the bike is running.

1.2 Formulation Of The Problem

Formulation of the problem on PT. AH, there is on the part of the supplier, where the supplier is at the core of the quality of a product it manufactures. Where in earning a good *supplier* then it will have an impact both on the product to be produced, allowing for the selection of *suppliers* must be done carefully so that the company can choose *supplier*that became the main criteria and criteria both at the company. Because at PT. AH it's been applying *go green*, then the *supplier* chosen also must implement the *go green* anyway.

On problems arising in the process of the selection of the supplier PT. AH this is at:

a. How to choose a *supplier* who apply systems *Go Green* in the company?

1.3 Restriction Problems

In order for the question addressed in the study is not very widespread (more generally) and without prejudice to the purposes for which it is achieved, it is necessary the restricted scope of the issue was held, with the following limitations:

a. Research conducted at the PT. Ah, on the part of the Department of *Logistic* in control for *Coil supplier* /raw materials to make the tank on the vehicle.

b. Research done by disseminating a detailed questionnaire to all employees of the Department of *Logistics* at the raw material *Coil*.

1.4 Research Objectives

The purpose of the peneliitian is:

a. Choose a *supplier* that has already implemented the system of *Go Green* on the company.

1.5 The Benefits Of Research

The benefits of solving this case study are expected to be input for PT. Ah, a primarily on the selection *of suppliers* who have implemented system *go green* on her *supplier*companies

**2.** **The runway**

2.1 Logistics

We often hear the word logistics of television media or read from the media newspapers, tabloids, magazines, textbooks, articles, and journals. What exactly is the logistic understanding? To answer these questions, then this will be expressed in terms of understanding logistics according to the experts, among others as follows:

1) According to Yolanda m. Siagian (2005) logistics is defined as part of the process of the supply chain (supply chain) that serves to plan, execute, control effectively, efficient procurement, management, storage of goods, services and information ranging from the starting point (point of origin) to the point of consumption (point of consumption) with the aim of meeting the needs of consumers.

2) According to p. Siagian Sondang (2003), logistics is defined as the entirety of the materials, goods, tools and means are required and used by an organization in the achievement of the objectives and framework of various his target.

3) According to Christopher (1992), logistics is defined as a process of strategic management ranging from the procurement of goods, transfer of the goods to the storage of goods, raw materials and finished products (in which related also the flow of information) on the company and the marketing connections for the benefit of maximum profit with efficient cost and in order fulfillment of consumer needs.

4) According to Luke Dwiantara and Rumsari h. S (2004), logistics is defined as all things or objects that are tangible and can be treated physically (tangible), both used to staple or organizes activitiesancillary activities (Administration).

2.1.1 The Theory Of Purchasing

the production activities of membutuhan staple ingredients to support passage of the activity of production, will be handled by the purchasing department, and also has a system of purchase order (PO) where if the material is increasing production of Staples out of stock then we will be booking the staple ingredients to where the booking was made a partner in the company, the next Indonesia keihin if the material is over booked then proceed to the section that handles the payment voucher or perform calculations over all the orders that have been diorder.

2.1.2 Purchasing

Understanding *Purchasing* namely, the purchase is one of the functions that are important in the successful operation of an enterprise. This function is vested with the responsibility to get the quantity and quality of the materials that were available at the time needed with prices to suit the prevailing price. Supervision needs to be done to the execution of this function, since it concerned the purchase of investment funds in the preparation and smooth flow of materials into the factory. (Sofjan Assauri 2008, p. 223)

While according to Mulyadi (2007, p. 711) activity in the process of purchasing the goods are:

1) purchase request

supplier Selection 2)

3) placement of purchase order

4) the receipt of the goods, and

5) Recording a purchase transaction

2.2 GreenPurchasing

   Green purchasing adalah metode dimana lingkungan dan pertimbangan sosial yang diambil dengan bobot yang sama dengan harga, ketersediaan, dan kriteria kinerja yang digunakan untuk membuat keputusan pembelian. Green purchasing adalah pertimbangan serius manajemen rantai pasokan. Pembelian hijau juga dikenal sebagai "lingkungan pembelian disukai (EPP), pengadaan hijau, pengadaan afirmatif, eco-procurement, dan lingkungan pembelian yang bertanggung jawab, "terutama dalam lembaga pemerintah federal. Green purchasing meminimalkan negatif lingkungan dan efek sosial melalui penggunaan produk ramah lingkungan, untuk mengidentifikasi dan mengurangi dampak lingkungan dan memaksimalkan efisiensi sumber daya.

Peter and Olson (1999:162) suggested that the purchasing decision is a process of integration that combining the knowledge to evaluate two or more alternative behavior and choose one of them.There are seven components of the structure of purchase i.e. a decision about the type of products, forms, branding, sales, number of products, time of purchase, and the method of payment (Swastha, 2008:118). *Green purchasing* is purchasing decisions based on the principle of the environment. *Green purchasing* is the practice of applying environmental criteria into the selection of products or services that want to purchase. Environmental factors are fast emerging as an important issue for business and management to consider. Legal and public pressure on achieving good environmental practice installation. A significant proportion of this pressure has been directed at the business which is often identified as a major source of pollution. Organizations trying to respond by developing a product/service for example, use packaging to reduce pollution, reduce or lower the energy consumption. Although business has been blamed for many of the environmental problems, there is still a little guide on how it can reduce this risk. Potentially effective way of managing the company's environmental policy is to closely link the purchase function activities. Spreading environmental management techniques throughout the supply chain can be a proper method of improving the environmental performance of an industry.

2.3 AHP

Analitycal Hierarchy Process (AHP) is to solve a complex situation that is not structured into several components in the order of the hierarchy, with the subjective value of the importance of each variable on a relative basis, and setting which variables have the highest priority in order to influence the outcome in those situations.

The decision-making process is essentially choosing a best alternative. Like doing a penstrukturan issue, the determination of alternatives, likely value for penenetapan variable aleatori, apart from the values, preferences with respect to time, requirements and specifications of the top risks. However melebarnya may be set or alternatives are likely value assessments, limitations that remain include benchmarking is the base form. The main equipment Analitycal Hierarchy Process (AHP) is to have a functional hierarchy with the main input of human perception. With a hierarchy, a complex and unstructured problems solved into the Group and arranged-has become a form of hierarchy. AHP is often used as a method of problem solving compared to other methods as follows:

1) Struktur the hierarchical structure, as the konsekuesi of the selected criteria, until the ultimate in subkriteria.

2) takes into account validity up to the limit of tolerance for alternative criteria and various inconsistencies that are selected by the decision makers.

3) takes into account the durability of the output sensitivity analysis decision making.

2.3.1 Dekomposisis Problem/Compose The Hierarchy

The decomposition of the problem is the step where an objective (Goal) that have been set systematically elaborated further into structures that make up the set of the system until the goal can be achieved rationally. In other words, the sutu goals (goal), decomposed (broken) to the elements constituting. When the item is selected criteria should cover all important aspects related to the objectives to be achieved. Yet we must still consider the criteria so that dipulih actually has significance for decision making and have no meaning or understanding of the same, or even though the criteria option just a little but has a deeper meaning the objectives to be achieved. After the criteria set, next adalahmenentukan alternative or choice of problem resolution. So in a hierarchical chart shape into described as shown in



Figure 2.2 the chart Hierarchy

The main hierarchy (Hierarchy) is the purpose/focus/goals to be accomplished or the completion of the persoalah/problems are examined. The second hierarchy (Hierarchy II) are criteria, any criteria that must be met by all of the alternatives (settlement) in order to be eligible to be the most ideal option, and a hierarchy of alternative aatau III is the choice of problem resolution. Hierarchical assignment is something that is very relative and relies heavily of the matter at hand. In cases that are more complex, you can just compile some of the hierarchy (not just three), depending on the results of the decomposition that has you do, consider the following example of a hierarchy.



Figure 2.3 hierarchy of AHP

2.3.2 Assessment/Comparison Element

Assessment or weighting on Hierarchy II, intended to compare a value to each of the criteria in order to achieve the goal. So that will be retrieved weighting the importance of each criteria to achieve the goals that have been set. Comparison of paired assessment procedure in AHP, referring to score assessment has been developed by Thomas l. Saaty, as follows:

Table 2.1 Weighting Hierarchy



In the weighting or importance assessment paired comparison applies legal axiom reciprocal, meaning that if an essential element of A more valued (5) compared to element B, then B more 1/5 essential dibandingakan with elements of A. When A element is as important as B then each value = 1.

In data retrieval, for example by using a detailed questionnaire, procedures of multiple proportions can be done by using the questionnaire in the form of a matrix or semantic difrensial.

Table 2.2 Sample Questionnaire matrix



The number of cells that must be filled out is n (n-1)/2 because the matrix elements of the reciprocal value diagonalnya = 1, so there is no need to discipline. On the conoth in the top 4 (4-1)/2 = 6, so the part that just filled outih.

Table 2.3 examples of semantic difrensial Questionnaire



On the type of this questionnaire, the trend of cross breeding circled his weight based/, if the left side is more important than the right side then circled numbers is 9-1 on the left segment and vice versa.

2.3.3 Preparation of the test matrix and Consistency

In the process of weighting or "filling questionnaire" has been completed, the next step is the preparation of matrix pairs to perform normalization of weighting the importance level on each element in each of their hierarchy. At this stage of the analysis can be done manually or by using a computer program like CDPlus or [Expert Choice](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Fwww.4shared.com%2Frar%2FhcJtUz3M%2FExpert_Choice_11_-_portable.html). This time we will continue discussing on the procedure the analysis manually. The values obtained subsequently arranged into a matrix pair is similar to the matrix used in the above matrix questionnaire. It's just that in drafting the matrices for analysis of this data, all boxes must be filled out.

**The first step**: is bringing together the opinions of some of the detailed questionnaire, if a detailed questionnaire filled out by the experts, then we will bring together the opinions of experts kedangan use geometrical average equation:



**The second step**: comparison matrix, compiled as follows:



Before stepping away lebh ketahapan iterations to the determination of priority on alternative options or setting of the importance criteria, then the previously done in advance of the test of consistency. Consistency test is performed on each questionnaire/experts who assess or provide weighting. Questionnaire or experts who do not meet the terms consistent can be ex or dipending for repair. The basic principle on this consistency test is when A more important than B, then B is more important than C, then a is not possible C is more important than A benchmark used is the CI (Consistency Index) in relation to RI (Ratio Index) or CR (Consistency Ratio).

Ratio index (RI) are commonly used for each of the order of the matrix is as follows:

Table 2.5 Matrix



**The third step:**test the consistency of the first done by arranging a relative importance to each of the criteria or alternatively stated as relative weights ternormalisasi (normalized relative weight). The relative weights are normalized weights is a relative value for each of the elements in each column are compared with the amount of each element:



Then the relative weights of the ternormalisasi are:

Can then be calculated **Eigenvalues factor** results normalization with the merata-ratakan sums each row in the matrix above.

Next specify the value CI (*consistency Index*) with the equation:



Where CI is the consistency index and maximum Lambda value is the largest eigenvalues of matrix berordo n.

Eigen value is the largest number of results time multiplication number of columns with eigen vaktor main family tourism. So it can be obtained with the equation:



After acquiring the value of *lambda* maksismum next dapoat determined the value of CI. If the value of CI is zero (0) means that the matrix is consistent. If the value of CI yag obtained is greater than 0 (CI > 0) further tested the limits of inconsistent state applied by the Saaty. Testing Consistency measured using Ratio (CR), which is the value of an index, or a comparison between CI and RI:



The value of RI being used in accordance with the order of n matrices. In CR matrix smaller 10% (0.1) means that an inconsistent state of each opinion is considered acceptable.

2.3.4 The setting of priorities in each hierarchy

The setting of priorities in each hierarchy is done through a process of Iteration (matrix multiplication). The first step is to change the form of the fraction pembiobotan values into a decimal form.To make it more easily understood, we use one of the sample data the results of the assessment of one of the experts like the following example:



Data Matrix above was changed from the form of the fraction into decimal form (**Matrix 1**):



Squaring the matrix 1 (number of rows x columns) (**Iteration I**):



Next total the numbers in a matrix according to the row:



The next step is processing the form **2 Matrix** with the same roads with **Matrix 1**(Iteration), then total the return results of cross product matrix based on line:



Calculated difference between the Matrix Vector 1 and 2 in the iteration II



Angled back iterations for the matrix 3. This step is repeated until the value difference between iteration does not suffer changes (= 0), the value of the acquired the selanjutan iteration becomes the order of priority as follows:



The same method was continued on the next level of the hierarchy, or alternative options. As for an easier way of doing this is to use a weighting aid Criterium-like computer program Decision Plus (CD +) or Expert Choice.

**3.** **PROBLEM SOLVING FRAMEWORK**

Flowchart of the breaking of the masalahditunjukan in Figure 3.

On the stage of the research conducted that involved data collection process begins with the Division of the questionnaire to the staff and employees related to the production of the tank. Identify the existing problems in the image above, there is on the part of the supplier, the supplier selection process essentially can influence the outcome of a product that the company makes, in terms of results, the price, as well as the environment the company can be a reference made by the company, which at the moment the Government is already implementing an environmentally friendly system to any company that is in Indonesia, and there is also a legitimate act of construction company that requires that companies have implemented eco-friendly system. In section 21 of the ACT for industry, which reads:

1) industrial company is obligated to carry out the efforts of the balance and sustainability of natural resources and the prevention of the onset of damage and environmental pollution due to industrial activity does.

2) Government held a setting and coaching in the form of guidance and guidance regarding implementation of the prevention of damage and countermeasure against environmental pollution due to industrial activity.

3) Obligation of carrying out an effort referred to in paragraph (1) excluded for certain types of industry in the small industry group.



Figure 2. Problem Solving Framework

**4.** **THE RESULTS OF THE RESEARCH AND THE DISCUSSION**

4.1 Testing Uniformity And Adequacy Of Data

The collection of data and information for this research was conducted through the Department of logistics and the employees of PT. AH. Below is data that has been retrieved is divided into two types of data namely, primary data and Questionnaire data.

4.1.1 Primary Data

The following is a description of the selection of the *supplier* -based *go green* on election questionnaire level 1:

1. The quality of the

2. Technology

3. Price

4. Pengendalina Pollution

5. Environmental Management

6. Recycled Products

7. Eco-Friendly Raw Materials

The following is a description of the selection of the *supplier* -based *go green* on the selection of level 2: questionnaire

1. Green Materials

2. Certificate ISO 14001

3. Manual

4. Robotic/Machine

5. Discount Price

6. Competitive Price

7. Ways Of Payment

8. Certificate Of UKL/UPL-AMDAL

9. Management Of LB3

10. Certificate Of UKL/UPL-AMDAL

11. Environment/Environmental Permit Documents

12. Scrap

13. Recycle

14. Repair

15. Non B3

16. Material Recycle

The following is a description of the selection of the *supplier* -based *go green* on the selection of level 3: questionnaire

1. PT. JSSI

2. PT. HSSI

3. PT. POSCO

4. PT. MICS

4.1.2 Questionnaire Data

Below is the data *supplier*selection questionnaire-based *go green* at level 1:

Table 4.1 Sample Questionnaire on level 1

|  |  |
| --- | --- |
| **The criteria that influence the selection of *supplier*** | **The value of the** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| The quality of the |   |   |   |   |   |   |   |   |   |
| Technology |   |   |   |   |   |   |   |   |   |
| Price |   |   |   |   |   |   |   |   |   |
| Pollution Control |   |   |   |   |   |   |   |   |   |
| Environmental Management |   |   |   |   |   |   |   |   |   |
| Recycled Products |   |   |   |   |   |   |   |   |   |
| Eco-Friendly Raw Materials |   |   |   |   |   |   |   |   |   |

Below is the data *supplier*selection questionnaire-based *go green* at level 2:

Table 4.2 example of a detailed questionnaire on level 2

|  |  |
| --- | --- |
| **Sub-criteria that influence against the selection of*supplier*** | **The value of the** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| Green Materials |   |   |   |   |   |   |   |   |   |
| Certificate ISO 14001 |   |   |   |   |   |   |   |   |   |

Below is the data *supplier*selection questionnaire-based *go green* at level 3:

Table 4.3 Sample Questionnaire on level 3

|  |  |
| --- | --- |
| **Alternative supplier best against sub-criteria for Repair** | **The value of the** |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| PT. JSSI |   |   |   |   |   |   |   |   |   |
| PT. HSSI |   |   |   |   |   |   |   |   |   |
| PT. POSCO |   |   |   |   |   |   |   |   |   |
| PT. MICS |   |   |   |   |   |   |   |   |   |

4.2 The Test Of The Sufficiency Of The Data

The first step in the method of AHP is to identify the purpose of the issue. In this case, the problems will be solved and the objectives to be achieved, namely determining a *supplier*who has based *go green* and best at PT. AH

In this case there are 3 respondents who selected that originated at the head of the Department of logistics, logistics and staff who will control the raw material coil. The respondents were selected based on their expertise in their field, as well as the respondents did already know better the *supplier* that will be used as a comparison.

S truktur networkberfungsi for meneLoan pe n g aruh atau saling ketergantungan antar elements from different criteria màupun antar element in a set of other criteria.

1. Goal, is the goal to be achieved, namely to obtain the purpose of elections to the *supplier*.

2. The criteria, It is the criteria that form the basis of determining the selection of the *supplier*. On the criteria there are 7 selection criteria that must be done.

3. Sub-criteria, is the most important points contained in the criteria for the selection of the *supplier*. On sub-criteria there are 16 criteria that had to be done.

4. The alternative, is the alternatives of company suppliers. On the alternative there are 4 criteria to do the selection.

On the structure of the selection there are 27 criteria which have to be conducted to determine which companies will be the main supplier, and which ones will be a reliable supporter.

Figure 4.1 the hierarchical network Model

4.2.1 Calculation Of The Geometric Mean

**a.** **Paired Comparison Level 1**

Geometric Mean 4.85 Respondents table Level 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Goal | A | B | C | D | E | F | G | The Number Of Weights | Weights dinormalisasikan wrote |
| A | 1.00 | 1.05 | 1.11 | 1.12 | 1.00 | 1.00 | 1.00 | 1.04 | 0.15 |
| B | 0.94 | 1.00 | 1.06 | 1.08 | 1.00 | 1.00 | 1.00 | 1.01 | 0.14 |
| C | 0.72 | 0.75 | 1.00 | 0.91 | 1.00 | 1.00 | 1.00 | 0.91 | 0.13 |
| D | 0.85 | 0.91 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 | 0.96 | 0.14 |
| E | 0.91 | 0.97 | 1.03 | 1.05 | 1.00 | 1.00 | 1.00 | 1.00 | 0.14 |
| F | 1.04 | 1.09 | 1.14 | 1.15 | 1.00 | 1.00 | 1.00 | 1.06 | 0.15 |
| G | 0.97 | 1.02 | 1.08 | 1.10 | 1.00 | 1.00 | 1.00 | 1.02 | 0.15 |
| The total number of | 6.43 | 6.80 | 7.40 | 7.41 | 7.00 | 7.00 | 7.00 | 7.00 | 1.00 |
| λmaks: | 6.99 |   |   |   |   |   |   |   |   |   |   |
| CI: | 0.00 |   |   |   |   |   |   |   |   |   |   |
| CR: | 0.00 | CR < 10% |   |   |   |   |   |   |   |   |   |

Here is a sample calculation of paired comparison chart on levels 1:

         λMax=

λMax = ((6, 43x0, 15) + (6, 80x0, 14) + (7, 40x0, 13) + (7, 41x0, 14) + (7, 00x0, 14) + (7, 00x0, 15) + (00x0, 7, 15)) = 6.99

         CI =  =  = 0

         CR =  =  = 0

**b.** **Paired Comparison Level 2**

Table + 4.86 Geometric Mean Quality Level 2 Respondents

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| A. Quality |   |   |   |   |   |   |   |
| The quality of the | G. material | ISO SRTF | The Number Of Weights | Weight dinormalisasikan |
| G. Material | 1 | 1 | 1.00 | 0.50 |
| ISO SRTF | 1 | 1 | 1.00 | 0.50 |
| The total number of | 2 | 2 | 2.00 | 1.00 |
| λmaks: | 2 |   |   |   |   |   |   |
| CI: | 0 |   |   |   |   |   |   |
| CR: | 0 | CR < 10% |   |   |   |   |   |
| SUBKRITERIA | The quality of the | Weighted Sub Criteria Priority |   |
| 0.15 |   |
| G. Material | 0.50 | 0.07 |   |
| SRTF. ISO | 0.50 | 0.07 |   |
|  |  |  |  |  |  |  |  |  |  |  |

Here is a sample calculation of paired comparison table at Level 2:

         λMax=

λMax = ((2x0, 50) + (2x0 .50)) = 2

         CI =  =  = 0

         CR =  =  = 0

Weights subkriteria priority:

         Weighted Sub criteria priority = priority level Weights 2 x Weighted priority level 1 = 0.50 x 0.15 = 0.07

**c.** **The Results Of Calculation Of The Weighting Of The Normalization On The Geometric Mean**

4,109 Results table Geometric Mean Respondents

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Alternative | G. Material | SRTF.ISO | Manual | RBT/Machine | The Price Of The Disc. | Hrg. Competing | Ways Of Payment | SRTF.AMDAL | LB3 | SRTF.AMDAL | Dok. Environment | Scrap | Recycle | Repair |   | Non B3 | Material Recycle | Weighted Sub Criteria Priority | Rank |
| 0.07 | 0.07 | 0.07 | 0.07 | 0.03 | 0.04 | 0.05 | 0.07 | 0.07 | 0.07 | 0.08 | 0.05 | 0.05 | 0.05 |   | 0.07 | 0.08 |
| PT. JSSI | 0.30 | 0.28 | 0.32 | 0.32 | 0.30 | 0.26 | 0.26 | 0.31 | 0.28 | 0.30 | 0.29 | 0.26 | 0.26 | 0.25 |   | 0.26 | 0.23 | 0.28 | 1 |
| PT. HSSI | 0.28 | 0.23 | 0.24 | 0.24 | 0.28 | 0.28 | 0.24 | 0.21 | 0.26 | 0.24 | 0.22 | 0.28 | 0.28 | 0.30 |   | 0.26 | 0.28 | 0.26 | 2 |
| PT. POSCO | 0.20 | 0.25 | 0.23 | 0.21 | 0.24 | 0.24 | 0.23 | 0.22 | 0.26 | 0.26 | 0.25 | 0.23 | 0.22 | 0.22 |   | 0.25 | 0.29 | 0.24 | 3 |
| PT. MICS | 0.23 | 0.24 | 0.21 | 0.23 | 0.17 | 0.22 | 0.26 | 0.26 | 0.19 | 0.21 | 0.25 | 0.22 | 0.23 | 0.22 |   | 0.23 | 0.20 | 0.22 | 4 |

So the best decision from the 3rd Respondent i.e. JSSI is PT. with a score of 0.28



Figure 4.5 Results Network AHP On Geometric Mean

Table of precedence for 4,110 Per Hierarchy

|  |  |  |  |
| --- | --- | --- | --- |
| Level | Element | Weights | Priotitas |
| 1 | The quality of the | 0.1485 | 2 |
| 1 | Technology | 0.1444 | 4 |
| 1 | Price | 0.1296 | 7 |
| 1 | Pollution Control | 0.1374 | 6 |
| 1 | Environmental Management | 0.1422 | 5 |
| 1 | Recycled Products | 0.1516 | 1 |
| 1 | Eco-Friendly Raw Materials | 0.1462 | 3 |
| 2 | Green Materials | 0.07427 | 3 |
| 2 | Certificate ISO 14001 | 0.07427 | 4 |
| 2 | Manual | 0.07220 | 5 |
| 2 | Robotic/Machine | 0.07220 | 6 |
| 2 | Discount Price | 0.03267 | 16 |
| 2 | Competitive Price | 0.04435 | 15 |
| 2 | Ways Of Payment | 0.05258 | 12 |
| 2 | Certificate Of UKL/UPL-AMDAL | 0.06870 | 9 |
| 2 | Management Of LB3 | 0.06870 | 8 |
| 2 | Certificate Of UKL/UPL-AMDAL | 0.06714 | 10 |
| 2 | Environment/Environmental Permit Documents | 0.07507 | 2 |
| 2 | Scrap | 0.04890 | 13 |
| 2 | Recycle | 0.05382 | 11 |
| 2 | Repair | 0.04890 | 14 |
| 2 | Non B3 | 0.06979 | 7 |
| 2 | Material Recycle | 0.07645 | 1 |
| 3 | PT. JSSI | 0.2827 | 1 |
| 3 | PT. HSSI | 0.2552 | 2 |
| 3 | PT. POSCO | 0.2381 | 3 |
| 3 | PT. MICS | 0.2240 | 4 |

**5.** **CONCLUSION**

After the collection and processing of data needed in solving problems encountered so that the priority of a supplier can be sorted. Analysis of hierarchy process (AHP) is proposed, in this research aims to provide for the assessment criteria and sub criteria that influence the decisions of the selection of an alternative model of supplier selection in pt. AH. The selection of a methodology based on the characteristics of the problem, consideration of the advantages and drawbacks of the other methodologies.

Final results of the AHP is a rank or priority weighting of each alternative model, in this study focus on the formulation of a model-based AHP to assess four alternative suppliers model required by the company, the proposed and has the best feasibility among to empatnya. Fundamentally, there are three steps in the model of AHP, namely: establishing hierarchy, assessment, and priorities.

**5.1 analysis of the process of the formation of the Hierarchy**

Menstruktur issues in the form of hierarchy is an important initial step in the determination of the method of Analysis Hierarchy Process because it greatly affects the results that will be achieved, the structure of a good and complete hierarchy can reflect problems that will be solved. In addition, further troubleshooting steps can not be done before obtained a good hierarchy structure.

The structure of the hierarchy has made researchers can be seen in Figure 3.1, the first stage that is level 0 is the focus or the main goals to be achieved, i.e. to determine the priority of a supplier of *Coil* is best at PT. AH. At level 1 the structure of the hierarchy of criteria that affect the achievement of the desired goals. Level 2 on the structure of the hierarchy is the criteria that influence the criteria above.While level 3 is an alternative, namely, a company that will be selected as the best raw material suppliers of *coil* to PT. AH.

**5.2 Results Analysis against the criteria**

Based on the criteria selected will then be done matrix comparison between elemen0elemennya, so it will be retrieved the weighting for each criterion. The method to be used is the paired comparison scaling, this principle is berrati making judgments about the relative importance of two elements at a particular level in the kaitanya with the level above it.

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | The quality of the | 0.1485 | 2 |
| 2 | Technology | 0.1444 | 4 |
| 3 | Price | 0.1296 | 7 |
| 4 | Pollution Control | 0.1374 | 6 |
| 5 | Environmental Management | 0.1422 | 5 |
| 6 | Recycled Products | 0.1516 | 1 |
| 7 | Eco-Friendly Raw Materials | 0.1462 | 3 |

From the results of the data processing, the analysis will be done relative to weight the criteria. When sorted from largest to smallest, most results of the assessment are:

Table 5.1 results of weighting criteria

The results above show that the weighting of the criteria is a very influential criteria for recycled products. PT. AH automotive company is its use *of make to order*(make stuff because the order), many of the least amount of order vehicles from consumers affected by the environmental-friendly products, indirectly products eco-friendly is the most important factor in addition to other factors. PT. conclusion AH will give priority to products that can be recycled again, because the products or goods that may be in the back of sports will grow strongly once to reduce the pollution that would occur in a corporate environment and the surrounding communities.

According to the evaluation of the inkosistensi set by Thomas l. Saaty i.e. If inkosistensi an index of no more than 10% or < 0.1 then considered for acceptance.

**5.3 Analysis assessment of the Sub-Criteria**

Based on the selected criteria are then carried out a comparison between the matrix elements, so it will be retrieved weights for each sub-the following criteria:

|  |  |  |  |
| --- | --- | --- | --- |
| 2 | Green Materials | 0.07427 | 3 |
| 2 | Certificate ISO 14001 | 0.07427 | 4 |
| 2 | Manual | 0.07220 | 5 |
| 2 | Robotic/Machine | 0.07220 | 6 |
| 2 | Discount Price | 0.03267 | 16 |
| 2 | Competitive Price | 0.04435 | 15 |
| 2 | Ways Of Payment | 0.05258 | 12 |
| 2 | Certificate Of UKL/UPL-AMDAL | 0.06870 | 9 |
| 2 | Management Of LB3 | 0.06870 | 8 |
| 2 | Certificate Of UKL/UPL-AMDAL | 0.06714 | 10 |
| 2 | Environment/Environmental Permit Documents | 0.07507 | 2 |
| 2 | Scrap | 0.04890 | 13 |
| 2 | Recycle | 0.05382 | 11 |
| 2 | Repair | 0.04890 | 14 |
| 2 | Non B3 | 0.06979 | 7 |
| 2 | Material Recycle | 0.07645 | 1 |

Table 5.2 results weighted sub criteria

Table 5.2 Note the merger opinion involved using the method of AHP, sub-criteria for the size of the material *recycle*occupying priority 1 with weights 0.07645. This is due to the material *recycle*highly preferred to reduce the impacts of pollution that often occurs in large company-diperusahan. For sequence number 2 i.e. the document environment/environmental permit with weights 0.07507, environmental documents/izi environment of the surrounding area was very influential because of the resulting waste companies impacted many people environment the company. Order number 3 i.e. *green material* with 0.07427, *green materials* indispensable for as it is to get a good quality, should also be in use by an environmentally friendly material anyway. For the 4th ISO 14001 certificate, i.e. where this certificate is one of the main evidence where this company has implemented eco-friendly systems at the company. At no. 5 and 6, namely manual and robot equipment/machines with weights 0.07220, where equipment is needed to support the availability of the raw goods at requested by PT. AH. To # 7 that is *non* B3, B3 0.06979 with weights is the most dangerous waste produced by the company, the company that owns the waste B3 will not enter into the criteria. To # 9 and 10 is a certificate of UKL/UPL-AMDAL with weights 0.06870 AMDAL certificate is also very important for the company because the effect of this certificate is a certificate issued by the Minister of the environment for the establishment of the company the new one will stand. # 11 is *recycle*with weights 0.05382, no. 12 is a method of payment with weights 0.05258, no. 13 is the *scrap* with weights 0.04890, no. 14 is a *repair* with the weightlessness 0.04890, no. 15 is competitive price with weights 0.04435, and the last in a sequence of 16 was the discount price with weights 0.03267. Here we can see that the PT. AH choose *suppliers* based on the materials used by using materials that are environmentally friendly, and the company already based *go green* to be chosen as the main supplier, as for the price for PT. AH very disregarded because PT. AH more concerned with environment-friendly raw materials for the product and the environment in comparison with a cheaper price, because the environment is very valuable for survival around the company.



Figure 5.1 the supplier selection priority weighting PT. AH

**BIBLIOGRAPHY**

[http://rumahkerang.wordpress.com/2016/12/31/kontribusi-mengatasi-pemanasan-global/amp/](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Frumahkerang.wordpress.com%2F2016%2F12%2F31%2Fkontribusi-mengatasi-pemanasan-global%2Famp%2F)

[https://herdiset.wordpress.com/2015/01/16/metode-ahp-dan-cara-perhitungan-ahp/](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=https%3A%2F%2Fherdiset.wordpress.com%2F2015%2F01%2F16%2Fmetode-ahp-dan-cara-perhitungan-ahp%2F)

[http://aria.bapepam.go.id/reksadana/files/regulasi/UU%2040%202007%20Perseroan%20Terbatas.pdf](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Faria.bapepam.go.id%2Freksadana%2Ffiles%2Fregulasi%2FUU%252040%25202007%2520Perseroan%2520Terbatas.pdf)

[http://www.kompasiana.com/leginaasri/metode-anp-analytic-network-process-dalam-evaluasi\_553024556ea83496358b4567](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Fwww.kompasiana.com%2Fleginaasri%2Fmetode-anp-analytic-network-process-dalam-evaluasi_553024556ea83496358b4567)

[http://repository.upi.edu/2941/6/S\_MTK\_0901986\_CHAPTER3.pdf](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Frepository.upi.edu%2F2941%2F6%2FS_MTK_0901986_CHAPTER3.pdf)

[http://ilmumanajemenindustri.com/pengertian-purchasing-prosedur-dalam-proses-purchasing/](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Filmumanajemenindustri.com%2Fpengertian-purchasing-prosedur-dalam-proses-purchasing%2F)

[https://www.scribd.com/document/335743719/2321-4120-1-SM](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=https%3A%2F%2Fwww.scribd.com%2Fdocument%2F335743719%2F2321-4120-1-SM)

[http://cscmp.org/imis0/CSCMP/Educate/Online\_Courses/CSCMP/Educate/Online\_Courses.aspx?hkey=ba42e89e-5186-454f-aad8-421188a5cab6](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Fcscmp.org%2Fimis0%2FCSCMP%2FEducate%2FOnline_Courses%2FCSCMP%2FEducate%2FOnline_Courses.aspx%3Fhkey%3Dba42e89e-5186-454f-aad8-421188a5cab6)

[http://louisville.edu/purchasing/sustainability/greenpurchasingsupplychain](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Flouisville.edu%2Fpurchasing%2Fsustainability%2Fgreenpurchasingsupplychain)

[http://www.astra-honda.com/corporate-profile/?dealerpage=2#maindealer](http://www.microsofttranslator.com/bv.aspx?from=id&to=en&a=http%3A%2F%2Fwww.astra-honda.com%2Fcorporate-profile%2F%3Fdealerpage%3D2%23maindealer)



**Original**

PEMILIHAN SUPPLIER BERBASIS GO GREEN DENGAN MENGGUNAKAN ANALITICAL HIERARCHY PROCESS (AHP)