DECISION SUPPORT SYSTEM OF VENDOR SELECTION AT PT. MESHINDO JAYATAMA

Ahsan Malik

Information Engineering - University Computer Indonesia
Jl. Dipatiukur 112-114 Bandung
Email : sann.lix@gmail.com

ABSTRACT

PT. Meshindo Jayatama as a company engages in trade make product sale as daily activity that should always stand by. Inverter and Servopack Yaskawa brands become main product sold by PT. Meshindo Jayatama, while KEB product is made as service center. Product out of Yaskawa and KEB brands, the company has collaboration with other vendor such as Scheneider Electric. Collaboration with other vendor performed by company with selecting related vendor. Many offers aren't success bring out order from customer and only one or two items are ordered form many offred items so sale target that has been assigned is not reached, because manager is hard to choose vendor to be recommended.

Comparing vendor is very important to be done by PT.Meshindo Jayatama before trade with end customer happened. Consequently need to be built a computerized decision support system that will help to determine the best vendor that can be accountable. Then ANP(Analytic Network Process) model is the right model to help decision support system development able to solve vendor selection problem occurred in company. Hopefully next time the developed system is fit in selecting vendor so it helps to ease PT. Meshindo determine which vendor that should be choosen.

Research result can be conclude that the developed system can ease decision maker to recommend the best vendor, with the establishment of decision support system, it's expected can help vendor selection evaluation process that done by decision maker so it can elaborate complex problem and unstructured.

Keywords : vendor selection, decision support system, ANP (Analytic Network Process), PT. Meshindo Jayatama.

1. INTRODUCTION

PT. Meshindo Jayatama is a company engaged in trade marketing that focuses on industrial automation and general supplier for industrial machinery. Based in Jakarta, in early 2014 the company opened a regional office in Singapore with the aim of expanding the market network. In addition to being general suppliers to meet customer needs, the company also cooperates with electronics manufacturers. Currently, PT. Meshindo Jayatama working with Yaskawa Indonesia as an authorized distributor in Indonesia and in collaboration with KEB as a service center for inverters in Indonesia [1]. As for items outside the brand Yaskawa and KEB, the company cooperated with select vendors concerned.

Company engaged in the sale of prioritizing sales activities as an absolute thing. Sales received a request from the customer item, while purchasing makes a request to multiple vendors. After getting quotes from multiple vendors, purchasing and stock price comparisons provide some vendors to sales, while the manager to get a comparison offers a complete multiple vendors. From multiple vendors, provide recommendations to the sales manager to make offers to customers. Based on the interview with the manager of PT. Meshindo Jayatama, that sales of items contactor brands Schneider Electric is not comparable with the bids submitted, many bargains that are not managed to generate bookings from customers and only one or two items you ordered from the many items offered so that there is a sales target has been set not achieved. For example if the targets for the overall sales of 350 million, the sales for Schneider Electric brand item is allocated 15% of the overall targets, but 15% do not always achieved because of the difficulty in choosing a vendor manager to be recommended to the sales. Contactor itself is an electrical component that serves to connect or disconnect the AC power outlet. Of the 10 vendors who have the authority to sell the item contactor Schneider Electric brand, can not fully guarantee that the items offered by the PT. Meshindo Jayatama succeed. Occurs because vendors who bid for PT. Meshindo Jayatama seen

from the price offered, availability of items offered, appropriate or not the quality of the items, and the reputation of the vendor itself.

Decision Support Systems (DSS) is a system capable of providing problem-solving ability and the ability of communicating to problems with the condition of semi-structured and unstructured. With this CMS system can assist decision-making in situations of semi-structured and unstructured situations, where no one knows for sure how the decision should be made [2]. So from an explanation of the problem, need to build a system of decision-making to facilitate the work of managers in recommending a vendor to the sales.

1.1 Problem Formulation

Based on the background of the problems that have been described, the problems that occur in the selection of vendors PT. Meshindo Jayatama namely the recommendations given by the manager is not always achieved success, because of the difficulty in choosing a vendor.

1.2 Purpose and Objectives

The purpose of the development of a decision support system is to help managers select a vendor to take decisions through a decision support system.

While the objectives to be achieved in the development of decision support systems, namely the existence of a decision support system to facilitate managers in choosing a vendor.

1.3 Research Methods

1.3.1 Data Collection Methods

Methods of data collection obtained directly in the development of this system, such as:

a. Study of literature
   With this method the data are collected by collecting the results of the literature, journals, books or readings as well as internet-related decision support system development.
b. Interview
   With this method the data are collected by conducting a question and answer directly to the company as a resource on issues taken.
c. Observation
   With this method of data collection by conducting research and direct observation of the existing problems.

1.3.2 Software Development Methods

Software development model that is used in the construction of a decision support system that uses Waterfall Model [4] which can be seen in Figure 1.1. Reasons for using the waterfall model, because reflects the practicality of engineering that makes the software quality is maintained because the development of structured and supervised. Besides each stage is done with the full and clear and excellent documentation, so that the maintenance can be done easily.

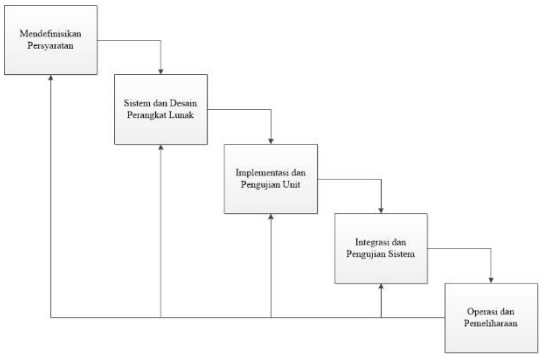


Figure 1.1 Waterfall Model [4]

1. **Defining Requirements**
   This initial stage mendefinikan service system, constraints, and goals set in consultation with the users of the system, is then defined in detail and serves as a system specification.
2. **System and Software Design**
   System design process by allocating the requirements of both hardware and software system to establish the overall system architecture. Software design involves identifying and describing the abstraction of the underlying software systems and related.
3. **Implementation and Testing Unit**
   Software design is realized as a series of programs or program units. Unit testing program involves verifying that each unit meets its specifications.
4. **Integration and Testing System**
   Unit testing phase program or a program that is integrated and tested as a complete system to ensure that the software requirements have been met. After testing, the software system is delivered to the customer.
5. **Operation and Maintenance**
   The system is installed and put into practical use. Maintenance involves correcting errors found in the early stages of the life cycle, improve the implementation of the system unit

and improve the service system as new requirements.

1.4 Decision Support System

Decision Support Systems (DSS) is a system capable of providing problem-solving ability and the ability of communicating to problems with the condition of semi-structured and unstructured. This system is used to assist decision-making in situations of semi-structured and unstructured situations, where no one knows for sure how the decision should be made.

Decision Support Systems (DSS) as the system has five main characteristics [2]:

1. The computer-based system.
2. Used to help decision-makers.
3. To solve the complex problems that is impossible to do the calculations manually.
4. By way of interactive simulations.
5. Where the data and models sebaai principal component analysis.

1.5 *Analytic Network Process* (ANP)

As a development method of AHP, ANP still using the Pairwise Comparison Matrices Judgement (PCJM) between similar elements. ANP conducted pairwise comparisons between elements within the component / cluster for each interaction in the network.

Analytic Network Process (ANP) is also a mathematical theory that is able to analyze the effect of the assumptions approach to solve the problem form. This method is used in the form of a settlement with the consideration of the adjustment of the complexity of the problem of decomposition of the synthesis with the priorities that produces the effect of greatest priority. ANP is also able to explain the model factors dependence and its feedback systematically.

In the implementation of problem solving, ANP rely on alternative alternatives and criteria, also explains the technical analysis of ANP by using pairwise comparisons (pairwase comparison) on alternatives and project criteria [3]. On AHP networks are level objectives, criteria, sub-criteria, and alternative, each level has elements. While on the network ANP levels in AHP called clusters that can have criteria and alternatives therein. Differences AHP and ANP started from the third axiom of the hierarchical structure that is not applicable to the ANP. This axiom states that judgments (assessment), or the priority of elements does not depend on the elements at a lower level. This axiom requires the application of a hierarchical structure. Invalidity of this axiom to the ANP has implications on several things, among others, can be seen in Table 1.2.

Table 1.2 Difference Modeling of ANP and AHP

NO	PERBEDAAN	AHP	ANP
1	Kerangka	Hierarki	Jaringan
2	Hubungan	Dependensi	Dependensi dan Feedback
3	Prediksi	Kurang Akurat	Lebih Akurat
4	Komparasi	Preferensi/Kepentingan	Pengaruh
		Lebih Subjektif	Lebih Objektif
5	Hasil	Matriks, Eigenvector	Supermatriks
		Kurang Stabil	Lebih Stabil
6	Cakupan	Sempit/Terbatas	Luas

Supermatrix ANP will automatically generate the appropriate weights for criteria and alternatives if the data used is the priority vectors in supermatrix. This is a simple method because it does not require thought per section on the user. Just knowing the data and supermatrix will produce a priority at any point in the model [3]. According to [3] with the feedback, an alternative not only depend on the criteria, but also can be hung between an alternative to other alternatives. Criteria itself can depend on alternatives, and other factors. To represent feedback on ANP method would require large matrix called as supermatrix consisting of several sub-matrices.

1.5.1 Super Matrix and Weighting

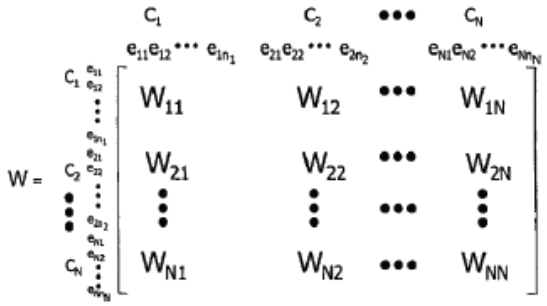
Comparison of the level of interest in each element and the cluster represented in a matrix by giving scale ratio of the pairwise comparisons. Each scale ratio shows the ratio of interest between elements within a component by component elements outside (outer dependence) or also in the element of the element itself which is a component in the (inner dependence). Not every element to give effect to the elements on the other components.

1.5.2 Platform ANP (Analytic Network Process)

The combined weights obtained through the development of supermatriks. In a system with N components consisting of C elements interacting, denoted Ch where h = 1, 2, 3, ... N. Element owned by the component will be symbolized by eh1, EH2, ... ehn.

The value of supermatriks given as the assessment of priorities derived from pairwise comparisons such as the AHP. Matrix arranged to

depict the flow of interest between components of both inner and outer dependence dependence. In general, the relationship between the interests of elements with other elements in the network can be represented following the supermatriks, as follows:



Each column in Wij is eigen vectors that show the importance of the elements in the i-th component of the network on an element on the component to j. If the value Wijj = 0 showed no interest in such elements. If this happens then the element is not used in pairwise comparisons to lower the eigen vector. So used are the elements that generate the interest is not zero.

Preparation of super matrix consists of 3 phases :

a. Phase super matrix without weights (unweighted supermatrix)
b. Phase super matrix weighted (weighted supermatrix)
c. Super matrix phase boundary (limit supermatrix)

2. CONTENTS RESEARCH

2.1 Analysis Systems

Analysis system is a stage of understanding of the electoral system vendors that are currently running in the PT. Meshindo Jayatama or will be built. Stages of analysis aims to determine the mechanism or work procedures of running processes and to be built. This system analysis stage is a stage that is very critical and very important, because a mistake in this stage will cause errors as well in the next stage. The aim of these stages is to identify the elements and the value of vendor selection, system constraints and relationships between system components. In the analysis phase will involve the limit of three vendors, namely: PT. Izzati Hasanah, PT. Pelita Abadi, and Shenzhen Haiyue Machine & Electronic Equipment Co., Ltd. The final results of the analysis system vendor selection is to determine the highest value of the three vendors and has the highest score is the best vendor and can be recommended by manaje based modeling calculations ANP (Analytic Network Process).

2.2 Problem Analysis

From the results of research conducted there is a problem that occurs in vendor selection is done by the manager, where the ease to get the best vendor is still difficult and sometimes less targeted so the vendor recommended not always be a goal in customers. With a number of criteria established by managers in recommending a vendor to make managers must learn one by one vendor is selected.

2.3 Analysis Vendor Selection of Alternatives

Based on vendor data contained in PT. Meshindo Jayatama, the company has several vendors to supply the required items with a particular brand. In the construction of this SPK, the items that will be used as a case study is an item in the form of a contactor with Schneider Electric brand, in Indonesia a lot of vendors who holds the official products from Schneider Electric's own. However, vendors that will be an alternative vendor in the development of decision support systems is limited to three vendors. Vendor specifications can be seen in Table 2.1.

Table 2.1 Specifications vendor

Vendor Name	Regional
PT. Izzati Hasanah	Jakarta
PT. Pelita Abadi	Bandung
Shenzhen Haiyue Machine & Electronic Equipment Co.,Ltd	Tiongkok

The steps in the selection of vendors that can be recommended in the development of decision support systems. In Figure 2.1 are steps in the selection of alternative vendors.

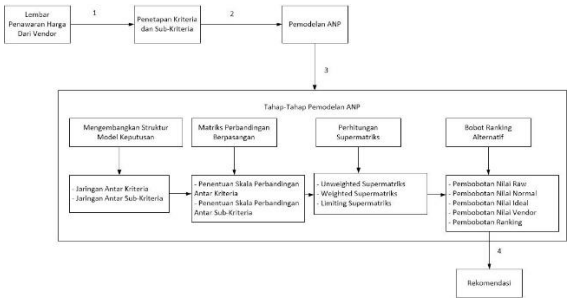


Figure 2.1 Stages Alternative Vendor Selection

2.4 Modeling of ANP (Analytic Network Process)

After knowing and studying the offerings of vendors, we then how to apply modeling ANP into the system. ANP itself is modeling the development of AHP (Analytic Hierarchy Process) as the solution of complex decision-making. ANP solution process has four main steps, namely:

1. Develop a model structure decisions

NP network model that will be built between the nodes (sub-criteria) can be seen in Figure 2.2 and explanations of the relationship between each of its nodes.

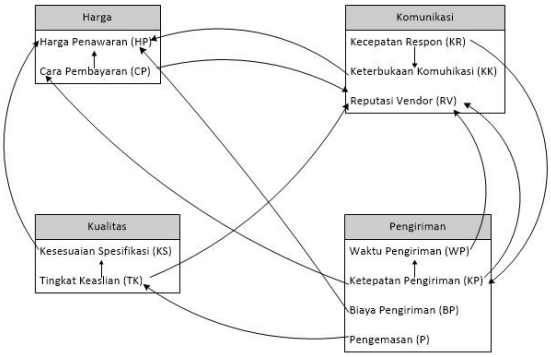


Figure 2.2 The structure of a network between nodes

Relationships that occur in table 2.2 has a dependency relationship both within the criteria itself (dependence on) and among the criteria (external dependency).

2. Pairwise Comparison Matrix

Numerical comparison is needed to determine the value scale comparison matrix for each criteria and sub-criteria.

3. Calculation Super Matrix

a. Unweighted Super Matrix

Unweighted super matrix is the value of eigen vectors that do not take into account the pairwise comparison criteria. Sub-criteria that form the line means the influence while the sub-criteria columned means affected. If the meeting of the sub-criterion has no value then filled with a zero (0), which means no relationship between the sub-criteria.

b. Weighted Super Matrix

To obtain a limiting matrix with a stable weighting the nature of the super matrix must be stochastic, which is a weighted sum of each column must be equal to one. To get this stochastic matrix needs to be weighted between the existing criteria based on relationship or influence.

c. Limiting Super Matrix

After the super matrix weighted or weighted supermatriks formed, then to get the super matrix limiting value is to raise to itself of value weighted super matrix.

4. Weight Alternative Rankings

To calculate the ranking of alternative weighting calculation is the value of each sub-criterion multiplied by the value of the ideal weight, for example, to calculate vendors PT. Izzati Hasanah. Calculate weighted ranking on PT. Izzati Hasanah are:

Ranking = (2 X 0,99992428) + (3 X 0,9965363) + (2 X 0,99990118) + (2 X 0,99976598) + (2 X 0,99979476) + (1 X 0,99975399) + (2 X 0,99938974) + (2 X 0,9998013) + (2 X 0,99986849) + (1 X 0,99981248) + (1 X 1) = 19,98607.

Weighting ranking alternatives complete vendor selection can be seen in Table 2.2.

Table 2.2 Weighting alternative vendor rankings

No	Nama Vendor	Harga		Kualitas		Komunikasi			Pengiriman				Rata2	Nilai ANP	Peringkat
		HP	CP	KS	TK	KR	KK	RV	WP	KP	BP	p			
1	PT. Izzati Hasanah	2	3	2	2	2	1	2	2	2	1	1	1,818182	19,986077	1
2	PT. Pelita Abadi	3	1	1	1	2	2	2	1	2	2	1	1,636364	17,993022	3
3	Shenzhen Haiyue Machine & Electronic	1	2	3	2	1	1	2	1	3	1	2	1,727273	18,989778	2

	Equip ment														

From the calculation of weighted ranking of alternatives in the vendor selection modeling menngunakan Analytic Network Process (ANP), it can be concluded that PT. Izzati Harikusumo having the highest total score compared to Shenzhen Haiyue Machine & Electronic Equipment Co., Ltd. and PT. Pelita Abadi. Because the decision was taken with the highest total value, PT. Izzati Harikusumo can be recommended by the manager at the top.

2.5 Functional Needs Analysis

2.5.1 Diagram Context

Diagram context is a general model to explain how the data is used and transformed to process or describe the flow of data into and out of the system. Yag context diagram proposed in decision support systems PT. Meshindo Jayatama can be seen in Figure 2.3.

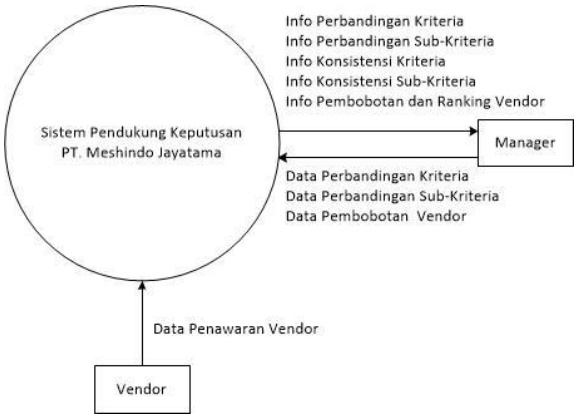


Figure 2.3 Diagram Context DSS Vendor Selection PT. Meshindo Jayatama

2.5.2. *Data Flow Diagram* (DFD)

Data flow diagram (DFD) shows how the flow of data and outlines the processes that occur in the system to process more detail. In the context diagram Figure 2.3 sistempendukung such decisions can be broken down into several DFD.

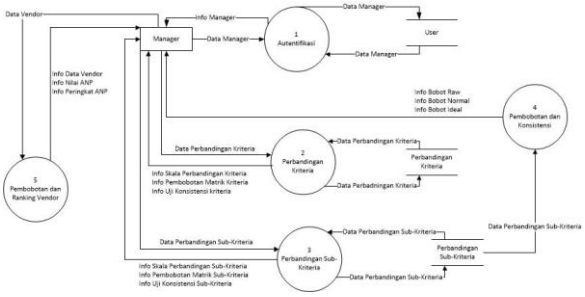


Figure 2.4 DFD Level 1 DSS Vendor Selection PT. Meshindo Jayama

2.6 Interface Design

1. Comparison Between Interface Design Criteria

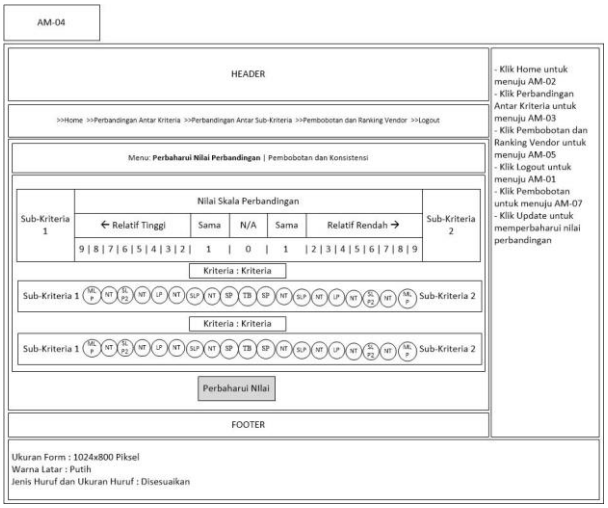


Figure 2.4 Comparison Between criteria Interface Design

2. Design Interface Weighting and Ranking Vendors

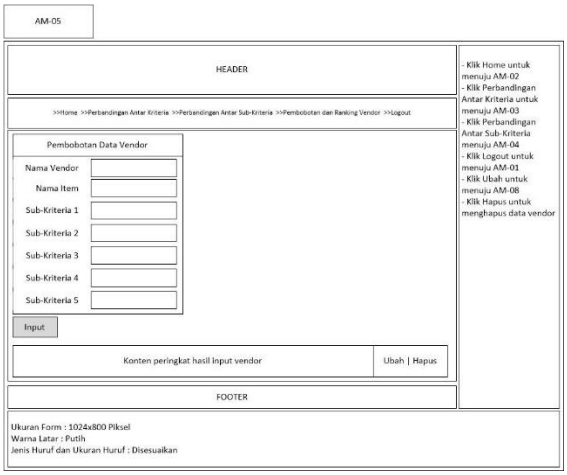


Figure 2.5 Design Interface Vendor Ranking

2.7 Interface Implementation

1. Implementation Interface Comparison Criteria



Figure 2.6 Comparison of Implementation Criteria

2. Implementation Weighting Data Interface Vendor

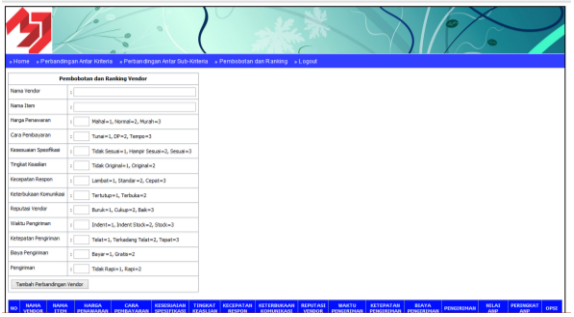


Figure 2.7 Implementation Weighting Data Vendor

3. Ranking of Vendor Interface Implementation



Figure 2.8 Ranking of Vendor Implementation

2.8 Testing Black Box

Blackbox testing is testing conducted only observe the execution results through the test data and functional check of the software. Blackbox testing, evaluating only from the outside look and functionality. Without knowing what actually happens in the process details. Black box testing performed on Vendor Selection Decision Support System in PT.Meshindo Jayatama divided into two parts, namely the blackbox test plans, cases and blackbox testing results.

Based on test results blackbox with test cases above it can be concluded that in the development of decision support system is not there fault and functionally process is running as expected.

2.9 Beta Testing

Beta testing is done in the user's environment without the presence of the builder application. This test is a test that is directly in the actual environment. Users undertake an assessment of the application by using the media interview. From the interviews, it can be concluded whether the application is built in accordance with the purpose or not.

Interview given to the DSS is manager of PT. Meshindo Jayatama. Users will provide information through interviews. Interviews were conducted by one user ie: manager, and the results of these interviews will be used as the test results.

3 CLOSING

3.1 Conclusion

After going through the process of analysis, design, and testing, it can then be concluded that the decision support system being developed could make it easier for managers in choosing a vendor.

3.2 Suggestion

In the construction of Decision Support Systems are still many things that can be developed, such as:

1. This Decision Support Systems need to be made multiple items, so that the items to be recommended is not limited by the particular item.
2. Decision Support System can be developed further, so that the information presented more clearly, more and more detail in order to become a decision support system that can provide solutions to problems that are more complex and unstructured.

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