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Research Article

Decision Making with Ahp Approach (Analytical Hierarchy Process)

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Abstract

According to J. Salusu (1996) that the decision-making role in an organization, including organizational principles will ensure that decisions are made correctly, and must include principles for effective action. Based on the opinion above, decision making is one of the most decisive factors in the success of achieving a goal. The ability to make decisions is one of the competencies that must be possessed by a manager. The higher a person's position in the organization, the greater the impact of the decisions he makes on the organization. This study investigates on the decision making using the AHP (Analytical Hierarchy Process) approach to ensure the organization is being controlled and monitored with better decision making by the higher level of management.

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Introduction

Background

According to J. Salusu (1996) that the decision-making role in an organization, including organizational principles will ensure that decisions are made correctly, and must include principles for effective action. Based on the opinion above, decision making is one of the most decisive factors in the success of achieving a goal. The ability to make decisions is one of the competencies that must be possessed by a manager. The higher a person's position in the organization, the greater the impact of the decisions he makes on the organization.
J. Salusu (1996) states that the future of an organization is largely determined by current decision-making, therefore decision-making has an important meaning for the progress of an organization. According to Santrock (2008) Decision making is an individual's thought process in evaluating various options and making choices from various choices. A similar opinion is also stated by Hansen and Mowen (2006) that the decision-making process is the process of choosing an alternative from various alternatives, the quality of decisions can be improved if alternative information is collected and presented to managers.
The role of managers in decision making is stated by Simon (1986) that most managers work to decide and solving problems is a work of choosing that requires attention, setting goals, finding or designing appropriate courses of action, evaluating and choosing among alternative courses of action. A common phenomenon related to decision making and has caused losses as stated by the Director of Corporate Valuation of the IDX, I Gede Nyoman Yetna (2020) said that Jiwasraya's losses were caused by poor decision making. Therefore, he requested that the IDX not be involved because it had already carried out its duties such as giving warnings.

Literature Review

Decision Making Concept

J. Salusu (1996) says that in general the word decision is a choice "a conclusion reached after consideration that occurs after one possibility is selected, while others are ruled out". What is meant by consideration is to analyze several possibilities or alternatives, then choose one alternative.
Furthermore, according to Santrock (2008) decision making is a person's thinking in evaluate various options and make a choice from many options. In line with the statement of Jackson, Sawyers and Jenkin (2009) which states that the decision-making process is the process of identifying different courses of action and selecting the appropriate decision for a given situation. The same thing was conveyed by Hansen and Mowen (2006) that the decision-making process is the process of choosing among existing alternatives.
According to Harrison in Teale et al. (2003) The decision-making process is an ongoing process of evaluating alternatives to meet goals, with expectations about certain actions by the decision maker to make the most likely choice tobe expected to achieve the goal. According to Stoner, et al., (1999) and Schwalbe (2010) identify criteria in assessing decisions, namely:

- Work results are in accordance with the problems at hand,
- Low cost per output
- Fast time required.

The criteria for assessing manager's decision making are seen from the outcome side, The same opinion was expressed by Kadarsah (1998) that decision making is a result achieved by consideration, and one possibility is selected, while the others are ruled out. McLeod & Schell (2007) stated that a decision is an action that is chosen specifically. According to Suryadi (2007) there are three dimensions in decision making, namely:

States of Nature

That is, there are things that are beyond the control of the decision maker.

Act / Available Alternative

That is, there are several options available, the decision is taken by choosing one option that benefits the company

Outcome / Payoff

That is, there are results, which are the measure of decision making. Outcome/payoff is a combination of alternative with state of nature
According to Teale et al. (2003) states about the cause of difficulty in decisions is ambiguity. Uncertainty and doubt will always interfere with managerial decision making unless clarified through improved communication and risk assessment. Furthermore, related to the results of the decisions stated by Teale et al. (2003) that some outcomes of decisions are not always certain to occur, so it can be categorized that the results are predictable or unpredictable. There is a payoff for each combination of decisions, be it price, cost, profit or minimize loss or maximized according to the decision-making objective.

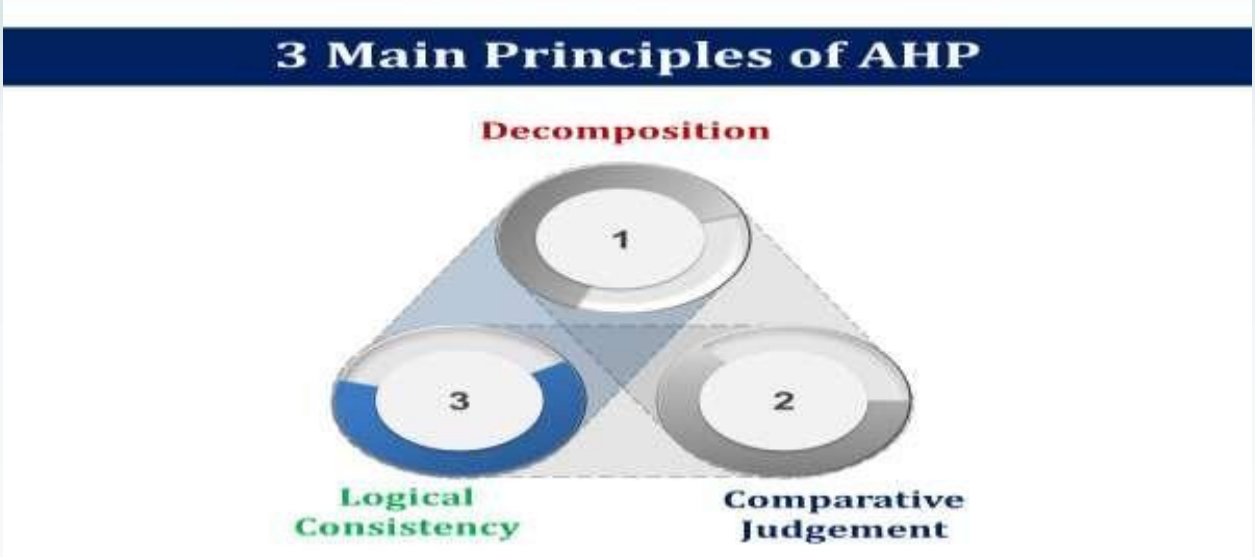
Analytical Hierarchy Process

Analytical Hierarchy Process is a method of making decisions through paired comparisons between the selection criteria and also pairwise comparisons between the options provided. Decision-making problems with the Analytical Hierarchy Process generally consist of criteria, and alternatives. Analytical Hierarchy Process as a model of decision making popularized by Thomas L. Saaty by describing multifactor or multicriteria problems into a hierarchical form. Analytical Hierarchy Process is used to solve a complex problem where there is very little data and statistical information on the problem at hand.
Hierarchy is representation of a complex problem with a multilevel structure, namely the first level of the goal, followed by the level of factors, criteria, sub-criteria, and so on until the last level is an alternative (Saaty; 2008)

Uses of AHP

AHP is a method of solving problems that is used more often than other methods because it has the following advantages:

1. Has a hierarchical structure, from the consequences of the selected criteria, to the deepest sub-criteria.
2. Validity to the tolerance limit of the inconsistency of various criteria and alternatives chosen by the decision maker is considered.
3. The durability of the decision-making sensitivity analysis output is always considered.



Decomposition

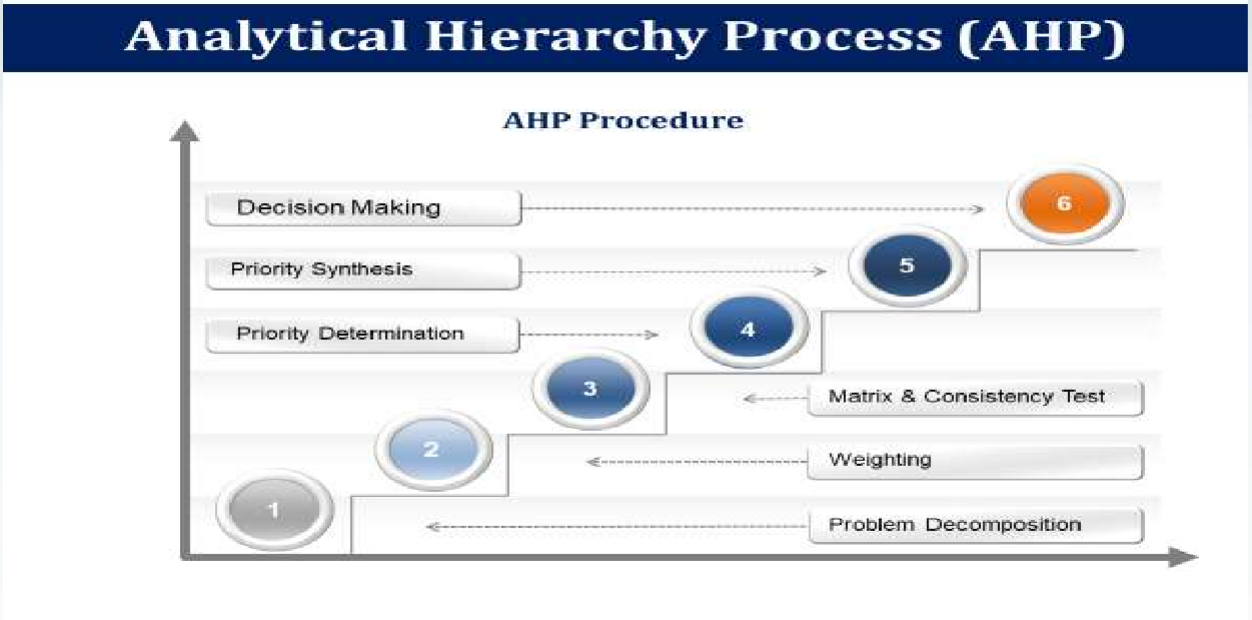
With this principle, a complex problem structure is divided into parts hierarchically. Define goals from general to specific. In the simplest form possible, the structure includes objectives, criteria, and alternative levels. Each set of alternatives is further subdivided into more detailed levels, covering more criteria. The top level of the hierarchy is a goal that consists of one element. The next level may contain several elements, where the elements can be compared, have almost the same importance and do not have too marked differences. If the difference is too big a new level should be created.

Comparative Judgments

Through this principle, a pairwise comparison of all the elements is built with the aim of producing a scale of relative importance of the elements. The assessment produces a rating scale in the form of numbers. Pairwise comparisons in the form of a matrix if combined will produce priority.

Priority Synthesis

Priority synthesis is multiplying the local priority by the priority of the relevant criteria at the top level and adding it to each element at the level that is affected by that criterion. Generates a combination of global priority which is used for local priority weighting of the elements at the lowest level according to these criteria.



Weighting

Weighting in each hierarchy based on their relative importance. Criteria Weighting and Alternative Weighting for Each Criterion

Research Methods

Applied research is carried out by first studying theories and previous research (library research), followed by making decision support systems and surveys (survey research), namely filling out questionnaires to collect sample data at a certain time (cross-sectional survey).) from all management master students who are taking problem solving and decision-making courses. The type of research is exploratory, namely extracting facts on the alternative process of choice in the strategy for selecting class leaders in the management master's program of problem solving and decision-making courses.

Intensity of Interest	Definition
1	Both elements/alternatives are equally important (equal)
3	Element A is less essential than element B (moderate)
5	Element A is more essential than element B (strong)
7	Element A is clearly more essential than element B (very strong)
9	Element A is absolutely more essential than element B (very strong)
2,4,6,8	The values between two adjacent consideration values

Research Instruments

The main research instrument used in this study was a questionnaire. The following criteria used in this research questionnaire can be explained in the following table:

No.	Criteria	Criteria

1	Leadership (L)	Able to give positive influence
2	Communication (C)	Have good communication skills
3	Examplary (E)	Conformity between action and speech
4	Team Work (T)	Have the ability to work in a team
5	Responsible (R)	Take responsibility for actions taken
6	Intelletual (I)	Intelligence to state a truth

The alternative class leaders are: Class A (KA), Class B (KB) and C Class (KC) leaders.

Technical Data Analysis

In this research technical data analysis through the following steps:

Develop AHP Hierarchy Diagram

Entering Matrix data

Before proceeding to the iteration stage for setting priorities on alternative choices or determining the level of importance of criteria, consistency tests were carried out first. Consistency test was carried out on each questionnaire/expert who assessed or gave weighting. Questionnaires or experts who do not meet the consistent requirements can be disallowed or pending for improvement. The basic principle in this consistency test is that if A is more important than B, then B is more important than C, then it is impossible for C to be more important than A.

Examples: Matriks Pairwise Comparison

Criteria / Alternative	1	2	3	n
1		.../...	.../...	.../...
2			.../...	.../...
3				.../...
n				

The benchmark used is CI (Consistency Index) versus RI (Ratio Index) or CR (Consistency Ratio).

Matrix Order	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

Finding Priority Weights

Consistency test is performed by compiling the relative importance of each criterion or alternative which is expressed as a normalized relative weight. Furthermore, the normalized eigen factors can be calculated by averaging the sum of each row in the matrix

Consistency Index

$$CI = \frac{\lambda\, maksimum - n}{n-1}$$

Eigen Value Maximum

$$\lambda maksimum = \left(\sum GM_{11-n1} \times \bar{X}1\right) + \cdots + \left(\sum GM_{1n-ni} \times \bar{X}n\right)$$

Finding the Consistency Ratio

This measurement is intended to determine the consistency of the answers that will affect the validity of the results. If the CI value is zero (0) it means the matrix is consistent. If the CI value obtained is greater than 0 (CI> 0) then the inconsistency limit applied by Saaty is tested. The test is measured using the Consistency Ratio (CR), which is the index value, or the comparison between CI and RI:

$$CR = \frac{CI}{RI}$$

The RI value used corresponds to the order of the n matrix. If the CR matrix is less than 10% (0.1), it means that the inconsistency of opinion is still considered acceptable.

Prioritization

Priority setting in each hierarchy is carried out through the iteration process (matrix multiplication)

Priority Synthesis

Analyzing and sorting alternative priorities from the one with the largest weight to the smallest

Decision Making

Choose the alternative that has the greatest weight

Discussion

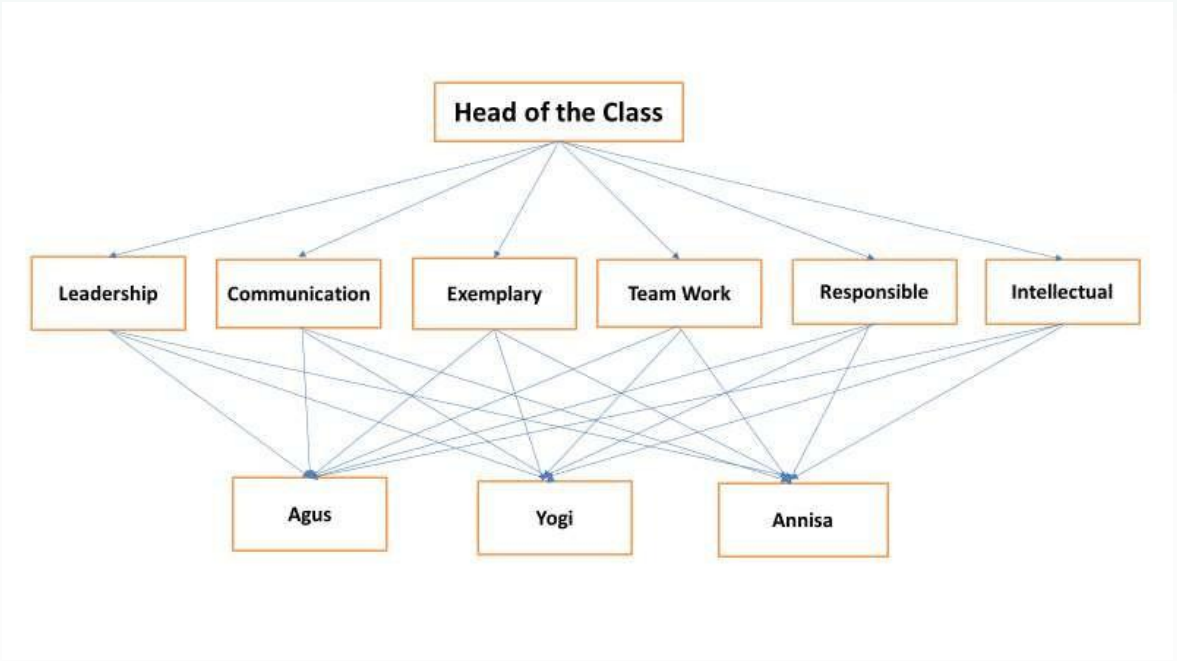
Basically, AHP can be used to process data from only one respondent. For more than one respondent, to get the calculation results, they must be combined using the geometric average with the following formula (Marimin, 2005)

$$GM = \sqrt[n]{(X_1)(X_2)\ldots..(X_n)}$$

Dimana:

GM = Geometric Mean
X1 = Pakar ke-1
X2 = Pakar ke-2
Xn = Pakar ke-n

Compiling AHP Hierarchy Diagram



Entering Criteria Matrix data

Cr	L	C	E	T	R	I
L	1	5	2	3	3	2
C	1/5	1	1/3	2	1/3	2
E	1/2	3	1	5	1/2	3
T	1/3	1/2	1/5	1	1/2	1
R	1/3	3	2	2	1	5
I	1/2	1/2	1/3	1	1/5	1

Finding Priority Weights

Cr	L	C	E	T	R	I	Σ
L	0.35	0.38	0.34	0.21	0.54	0.14	0.33

C	0.07	0.08	0.06	0.14	0.06	0.14	0.09
E	0.17	0.23	0.17	0.36	0.09	0.21	0.21
T	0.12	0.04	0.03	0.07	0.09	0.07	0.07
R	0.12	0.23	0.34	0.14	0.18	0.36	0.23
I	0.17	0.04	0.06	0.07	0.04	0.07	0.07
Σ	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Cr	**L**	**C**	**E**	**T**	**R**	**I**			**PW**
L	1	5	2	3	3	2		0.33	2.24
C	1/5	1	1/3	2	1/3	2		0.09	0.59
E	1/2	3	1	5	1/2	3	X	0.21	= 1.34
T	1/3	1/2	1/5	1	1/2	1		0.07	0.46
R	1/3	3	2	2	1	5		0.23	1.54
I	1/2	1/2	1/3	1	1/5	1		0.07	0.47

Based on the matrix multiplication through the iteration process, priorities can be set in each hierarchy as well as analyzing and sorting alternative priorities from the one with the largest weight to the smallest. So based on the iteration process, it can be seen that the highest weight is the leadership criterion (L) which is considered the most priority criterion for a class leader, followed by other criteria priorities.

The iteration process and priority analysis can be carried out if the CR matrix is less than 10% (0.1) meaning that the inconsistency of opinion is still considered acceptable.

Looking for Consistency Ratio

Eigen Value Maximum

$$\lambda maksimum = \left(\sum GM_{11-n1} \times \bar{X}1\right) + \cdots + \left(\sum GM_{1n-ni} \times \bar{X}n\right)$$

= 6,55

Consistency Index

$$CI = \frac{\lambda\, maksimum - n}{n-1}$$

CI = 6,55 - 6
6 – 1
= 0,55 / 5
= 0,1093

Consistency Ratio (CR)

$$CR = \frac{CI}{RI}$$

CR = 0,1093 / 1,24
= 0,08

Conclusion CR = 0.08 10% smaller (0.1) means that the inconsistency of opinion is still considered acceptable so that it can be continued in the next step, namely carrying out the iteration process and priority analysis as explained by the results of the previous iteration process and priority analysis. The same is done for alternative choices based on each criterion, for example setting alternatives based on Communication (C) criteria as follows:

Entering Alternative Matrix data based on Criteria

Communication (C)			
Alternative	**Agus**	**Yogi**	**Annisa**
Agus	1	6	4
Yogi	1/6	1	1
Annisa	1/4	1	1
Σ	1.42	8	6

Finding Priority Weights

Communication (C)				
Alt	**Agus**	**Yogi**	**Annisa**	**Σ**
Agus	0.71	0.75	0.67	0.71
Yogi	0.12	0.13	0.17	0.14
Annisa	0.18	0.13	0.17	0.16
Σ	1.00	1.00	1.00	1.00

Communication (C)							
Alt	**Agus**	**Yogi**	**Annisa**				**PW**
Agus	1	6	4		0.71		2,15
Yogi	1/6	1	1	X	0.14	=	0,41
Annisa	1/4	1	1		0.16		0,47

Based on the iteration process, it can be seen that the highest weight is Agus' Alternative for the Communication criteria (C) which is considered a candidate for class president who has the criteria of good communication skills compared to other alternative class president candidates. The iteration process and priority analysis can be carried out if the CR matrix is less than 10% (0.1) meaning that the inconsistency of opinion is still considered acceptable.

Looking for Consistency Ratio

Eigen Value Maximum

$$\lambda maksimum = \left(\sum GM_{11-n1} \times \bar{X}1\right) + \cdots + \left(\sum GM_{1n-ni} \times \bar{X}n\right)$$

= 3,02

Consistency Index

$$CI = \frac{\lambda\, maksimum - n}{n - 1}$$

CI = 3,02 - 3
3 – 1
= 0,02 / 2
= 0,0092

Consistency Ratio (CR)

CR = 0,0092 / 0,58
= 0,016

Conclusion CR = 0.016 10% smaller (0.1) means that the inconsistency of opinion is still considered acceptable so that it can be continued in the next step, namely carrying out the iteration process and priority analysis as explained by the results of the previous iteration process and priority analysis. Furthermore, the same data analysis steps are carried out on other alternatives for other criteria other than the communication criteria.

Decision Making

Decision making is the last step, namely choosing the alternative that has the greatest weight. Based on the final results of the iteration process, determining the consistency of the ratio up to the analysis of priority alternatives based on each criterion, the following results are obtained:

Criteria	L	C	E	T	R	I	Global
Weight	0.33	0.09	0.21	0.07	0.23	0.07	**Priority**
Agus	0.33	0.71	0.70	0.51	0.25	0.17	**0.42**
Yogi	0.33	0.14	0.06	0.07	0.50	0.44	0.29
Annisa	0.33	0.16	0.24	0.42	0.25	0.39	0.29

Based on the data above, it can be concluded that the alternative that has the greatest weight for the criteria that have been set to be selected as class leader is Mr. Agus, because Agus's brother has the biggest weight, which is 0.42 compared to the other class president candidates, namely Yogi and Annisa.

Conclusions And Recommendations

Conclusions

The following are the conclusions from this research is that in the decision-making process we are faced with various alternative choices. The decision-making process using the AHP approach describes a multifactor or multicriteria problem into a hierarchy. AHP is used to solve a complex problem where there is very little data and statistical information on the problem at hand.

Based on this approach, it is hoped that it can help the decision-making process to be more objective by unifying the opinions of several questionnaires filled out by experts or respondents who understand alternatives based on predetermined criteria, in this case students of the management master class learn to make decisions about selecting class leaders more objectively.

Recommendation

Suggestions from the results of this study are to try using other methods because the AHP method has several drawbacks including:

1. The main input is still the perception of an expert and this concerns the subjectivity of the expert, the model also becomes meaningless if the expert gives a wrong assessment.
2. The AHP method is a mathematical method so there is no confidence limit for the correctness of the model that is formed as is the case with statistical tests

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