

## How Air Charter Companies In Indonesia Choose The Most Effective Aircraft Maintenance Program

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### **Abstract:**

*This research aims to develop an analytical concept for selecting an effective aircraft maintenance program. A maintenance program selection analysis is carried out to obtain the best alternative maintenance program for the company to get a corporate advantage in providing air transportation services in the air charter market.*

*The research was conducted on air charter companies that have more than 20 years of operating experience by taking the case of the T Air Service. This research was carried out uses qualitative methods with a quantitative approach. The selection of a maintenance program is carried out based on criterion determined by the needs of air charter customers need's and the company's needs. The analytical tool used in this research is the Analytic Network Process (ANP).*

*From the research results obtained, the Standard/Single Task inspection check maintenance program alternative is the best type of maintenance program for aircraft operations in the air charter market. The effectiveness criterion is a criterion that has the main priority in selecting a maintenance program at T Air Service. Meanwhile, the flexibility in planning is the sub-criterion with the highest priority for participants in determining the best alternative maintenance program.*

**Background:** *Competition in providing air transportation services in Indonesia, especially in the air charter market, is quite competitive nowadays. In order to provide a competitive advantage to companies, aircraft as the main production asset need to be operated safely, smoothly and efficiently so that it can always provide the best service to customers. To operate an aircraft safely, smoothly and efficiently is determined by many factors, one of which is aircraft maintenance.*

*Carrying out aircraft maintenance by selecting the right maintenance program greatly contributes to supporting optimalimization of the aircraft operations to provide the needs of special air charter market customers. How to make conceptual model to choose the right aircraft program by accommodating the needs of the air charter market and the company need's, and how to determine the most appropriate alternative maintenance program for the aircharter market served by T Air Service is the topic discussed in this research.*

**Materials and Methods:** *This research was carried out by a case study at the company T Air Service uses qualitative methods with a quantitative approach. The selection of a maintenance program is carried out based on criterion determined by the needs of air charter customers need's and the company's needs. The analytical tool used in this research is the Analytic Network Process (ANP).*

**Results:** *From the research results obtained, the Standard/Single Task inspection check maintenance program alternative is the best type of maintenance program for aircraft operations in the air charter market. The effectiveness criterion is a criterion that has the main priority in selecting a maintenance program at T Air Service. Meanwhile, the flexibility in planning is the sub-criterion with the highest priority for participants in determining the best alternative maintenance program.*

**Conclusion:** *The conceptual analysis model for selecting an effective maintenance program for aircraft operations in the aircharter market can be carried out by identifying the types of existing aircraft maintenance programs, identifying the needs of aircraft operating companies, and identifying the needs of aircharter customers. Next, criterion and sub-criterion are determined based on operator and customer needs and then analyzed with ANP to obtain the most effective maintenance program.*

**Key Word:** *Aircraft Maintenance Program Selection, Aircharter, ANP.*

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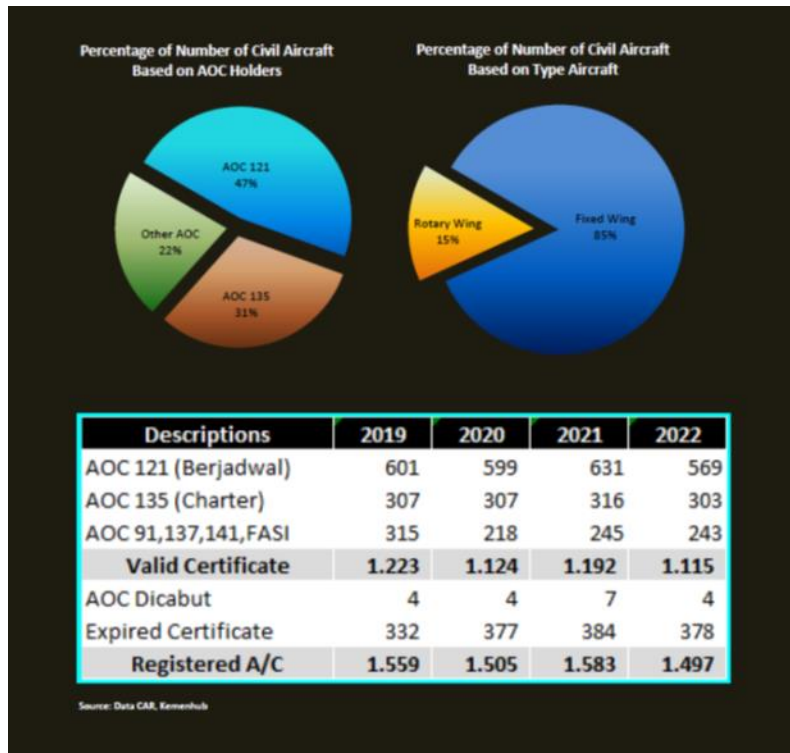
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### **I. Introduction**

The aircraft operating business is one part that contributes significantly to the creation of an air transportation service provision. Based on research conducted by Majid [1], the level of attractiveness of the Indonesian aviation market is considered attractive by air transportation service business players. The large number of companies that participate in providing air transportation services creates competitive competition

among airlines to dominate the market and survive in this industry. The fare war involves all airlines including air charter airline companies. The difficulty of charter companies obtaining orders and strict requirements and contracts working with oil companies created the aviation industry at a dilemma point [2].



**Figure 1. Civil aircraft operating in Indonesia [3]**

Refers to aviation laws of the Republic of Indonesia [4], commercial airlines are divided into two categories, namely scheduled airlines and unscheduled airlines. Even though they have the same similarities in their operations, scheduled airlines, and unscheduled airlines have their unique characteristics. This uniqueness includes meeting customer needs. Scheduled airline customers tend to have general needs, while unscheduled airline customers have special needs that cannot be found on scheduled airlines. From data from the Indonesian Ministry of Transportation for 2023, there are 18 scheduled commercial air transportation business entities and 54 unscheduled commercial air transportation business entities registered [5].

A charter flight is one of the airline's industry models provided by unscheduled airlines. In Indonesia, customers in the air charter market consist of three large groups, namely individuals, corporate and government organizations. It serves various missions such as VIP transportation for government and company executives, tourism transport, crew rotation of mining to oil and gas companies, medical evacuation (medevac), pioneering air transport for passengers and cargo, or any other missions as requested by customer [6]. High flexibility is one of the main reasons for customers to use air charter transportation services [7].



**Figure 2. Quantity of Airlines in Indonesia [8]**

For corporate customers, air transportation services are used to support the company's business activities. They use the services for a long period (average over one year), and the procurement of air transportation services is carried out through a tender process. The winner of the tender is determined by several important factors, one of which is the contract price factor.

For company T Air Service, to meet specific customer needs at competitive prices, a strategy formulation is needed that involves all organizations within the company. The maintenance department is the part of the organization that is responsible for carrying out aircraft maintenance management. Maintenance is carried out to ensure the airworthiness of an aircraft following the regulations set by the international civil aviation organization, namely the International Civil Aviation Organization (ICAO) as outlined in Annex 8 as an aircraft airworthiness standard.

Airworthy is defined as an aircraft that is maintained according to design specifications and is in a safe condition to fly. Aircraft operators are also required to carry out aircraft maintenance in accordance with the Civil Aviation Safety Regulations of the Republic of Indonesia, abbreviated as CASR, so that aircraft operations can run safely and securely.

The interrelationship of safety and reliability issues makes aircraft maintenance management a complex and difficult process. Apart from being a complex and difficult process, aircraft maintenance costs have a fairly high portion, namely around 20% of the total aircraft operating costs [9]. Maintenance costs can be divided into Direct Maintenance Costs (DMC) and Indirect Maintenance Costs (IMC) [10]. DMC is defined as the labor and material costs incurred in aircraft maintenance, while IMC is influenced by the management method of the aircraft operator regarding the design and use of the aircraft.

To meet the needs of the air charter market, aircraft operation missions are adjusted to customer needs which will be directly related to the way the aircraft operator carries out aircraft maintenance management so that the aircraft can operate optimally at the lowest possible cost. According to Buderath [11] maintenance management is defined as all management activities to determine goals, strategies, and responsibilities. The implementation of management functions such as maintenance planning, maintenance control and supervision, and improving methods in an organization is included in the economic aspect.

One of the main implementations of maintenance planning in maintenance management for aircraft operators is determining the appropriate maintenance program for an aircraft operational mission. The obligation of aircraft operators to have a maintenance program is regulated in ICAO Annex 6 which regulates aircraft operations.

As a member of ICAO, the Government of the Republic of Indonesia, namely the Ministry of Transportation, adopted these regulations and outlined them in the CASR Civil Aviation Safety Regulations Part 121 and 135. The maintenance program referred to in this research is a maintenance program known by several terms such as Continuous Airworthiness Maintenance Program (CAMP), or Operator Approved Maintenance Program (OAMP) where this maintenance program is a guide for aircraft operators in carrying out maintenance on an aircraft [12]. OAMP contains maintenance programs required by aircraft manufacturers which have been stated in the Maintenance Planning Document (MPD). MPD also provides several alternative ways for operators to carry out aircraft maintenance programs in accordance with the aircraft operator's own needs.

Due to the special mission of flight operations, it is very important for operators to choose the most effective alternative maintenance program to meet operator needs in the process of providing optimal air transportation for air charter market customers. Currently, T Air Service uses different maintenance programs for the several types of aircraft it operates. In the implementation process, each maintenance program has its own advantages and disadvantages.

No	Manufacturer	Type	Wing Type	Maintenance Program	Operation periode
1	Gulf Stream	G550	Fixed Wing	Standard/Single Task	2019 untill now
		G450	Fixed Wing	Standard/Single Task	2005 untill now
2	Cessna	C208	Fixed Wing	Blok/Progressive	2008 untill now
3	Viking/Dehavilland	DHC6-400	Fixed Wing	Standard/Single Task	2021 untill now
4	Beechcraft	B1900 D	Fixed Wing	Blok/Progressive	1999 untill now
		King Air 350I	Fixed Wing	Blok/Progressive	2001 untill now
5	Airbus	ATR 42 - 600	Fixed Wing	Standard/Single Task	2015 untill now
		ATR 72 - 600	Fixed Wing	Standard/Single Task	2014 untill now
		H-145	Rotary wing	Blok/Progressive	2018 untill now
6	Sikorsky	S 76 C++	Rotary wing	Blok/Progressive	2010 untill now
7	Bell Helicopter	412 EP	Rotary wing	Blok/Progressive	2008 untill 2023
8	Agusta Westland	AW 139	Rotary wing	Blok/Progressive	2014 untill now
		AW 169	Rotary wing	Standard/Single Task	2023 untill now

**Table 1. Maintenance program used by T Air Service (source : primary data)**

In the experience of operating aircraft at T Air Service, the selection of a maintenance program will influence the smooth operation of the aircraft in meeting the needs of air charter market customers. Flexible maintenance methods are also needed to provide an aircraft's level of availability [11]. Quality aspects in implementing maintenance programs in the field also need to be considered

Choosing an inappropriate maintenance program can create difficulties in implementing aircraft maintenance programs, such as the need for more frequent use of maintenance facilities, the number of working hours, the amount of downtime and other things, where these things can result in increased maintenance costs and disruption of flight operations.

So the main problem in this research is how to develop a conceptual analysis to choosing an effective maintenance program for an air charter company so that it can provide an advantage for the company in the competitive air charter market and what is the most appropriate maintenance program solution to use at this time.

## **II. Material And Methods**

This research was carried out by a case study at the company T Air Service uses qualitative methods with a quantitative approach. Several stages in conducting the research include the following:

**Study Design:** Qualitative methods with a quantitative approach

**Study Location:** T Air Service

**Study Duration:** October 2023 - December 2023.

Informan : 4 Participants

**Sample size:** 3 Participants

**Subjects & selection method:** The selected participants are experts at the T Air Service with middle management level positions with chief engineer level positions who have more than 10 years of experience in aircraft maintenance and have a minimum of two types of aircraft maintenance license ratings.

The participants above are practitioners who are directly related to the maintenance program application in the field. Each participant has different skills when viewed from the part of the aircraft being maintained. Since Analytic Network Process (ANP) is used for data analysis, there is no maximum or minimum quotes to choose participants, the most important things to be considered is they must have good ability and good understanding about aircraft maintenance program. Some of the respondents determined are as follows:

- a. Chief Engineer of fixed wing
- b. Chief Engineer of rotary wing
- c. Chief Avionic.

### **Procedure methodology**

This research uses primary data obtained from four informants consisting of two practitioners and management of the company T Air Service, one informant from an external company, and one of the regulatory officers from the Indonesian Ministry of Transportation. In-depth interviews were conducted to gain an overall understanding of the problem and structure it into a network structure. Next, a survey was carried out to fill in the pairwise comparison questionnaire to determine priorities [13]. The population was chosen based on non-probability as well as a purposive sampling technique.

### **Analysis**

#### **Analytic Network Process (ANP)**

Analytic Network Process (ANP) is an algorithm method used in solving problems and making decisions with many criteria (Multi Criteria Decision Making). ANP is a general measurement theory that obtains priority on an absolute scale from pairwise comparisons of related and unrelated data in a multilevel hierarchical structure and network [14]

According to Ascarya [15], ANP is a new approach to qualitative studies that is non-parametric or non-Bayesian. The ANP method is used with an approach where the data that will be used as material for analysis is not available, so researchers have to look for primary data.

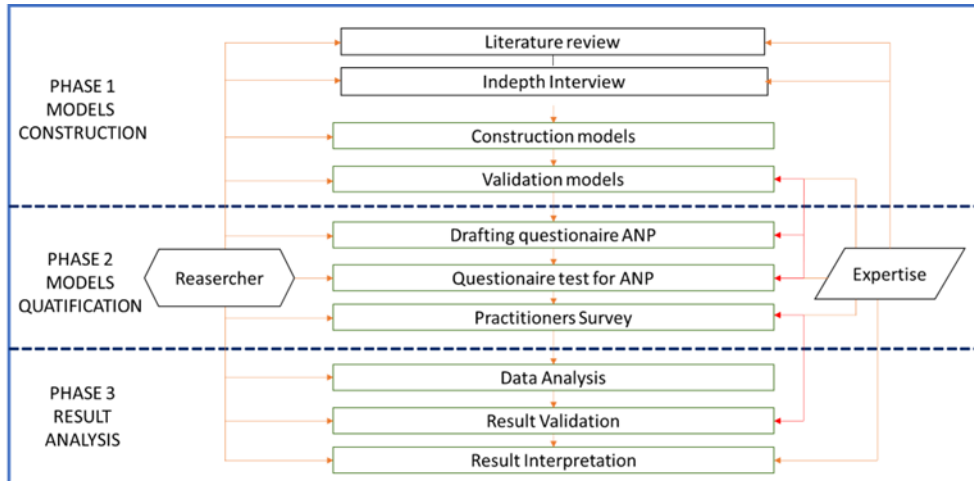


Figure 3. Step of Research [16]

**Models Construction**

The construction of the ANP model in the form of a network hierarchy is based on theoretical and empirical references from practitioners' perceptions and views through focused interviews to examine actual problems related to the implementation of aircraft maintenance and operation programs in the air charter market.

**Models Quantification**

The model quantification stage uses questions in the ANP questionnaire in the form of pairwise comparisons between elements in a cluster to find out which of the two has a greater influence (more dominant) and how big the difference is using a numerical scale of 1-9. The assessment data is then collected and input through super decision software for processing to produce an output in the form of a supermatrix. The results of each participant will be input into a separate ANP network.

Strength of Importance	Description	Justification
1	Likely significant	Two activities equally influence the objective
3	Relatively significant	Experience and judgment prefer one activity more than the other
5	Solidly significant	Ability and assessment strongly support one activity over the other
7	Precisely significant	Very strong activity, proven by practice
9	Excessively significant	Evidence favors one activity over the other

Table 2. The Fundamental Scale of Absolute Numbers [17]

**Sintesis dan Analisis.**

In phase three, the results or synthesis of the ANP network in the super decisions software. The Analytical Network Process (ANP) is the tool for analysis, and the process utilizes Super Decisions tools. After inputting the questionnaire into the super decision software, the data will then be analyzed. The results of the analysis are in the form of priority numbers for each participant.

**Geometric Mean**

According to Saaty and Vargas [14], in order to find out the results of individual assessments from participants and determine the results of opinions in a group, research is carried out by calculating the geometric mean. The geometric mean is an average calculation that shows a certain tendency or value. The geometric mean is calculated using the formula below:

$n = \text{Respondent 1.} \quad N$   
 $i = \text{Pairwise 1.} \dots \dots \dots i$

$$(\prod_i^n = 1 a_i)^{1/n} = \sqrt[n]{a_1 a_2 \dots a_n}$$

### **Rater Agreement**

Rater agreement is a measure that shows the level of agreement of participants regarding a problem in one cluster. The tool used to measure rater agreement is Kendall's Coefficient of Concordance ( $W; 0 < W \leq 1$ ).

If the  $W$  test value is 1, it can be concluded that the assessments or opinions of the participants have perfect agreement, whereas when the  $W$  value is 0 or close to 0, it indicates there is disagreement between participants' answers or the answers vary [18]. To calculate Kendall's ( $W$ ), the first step is to give a rank for every answer and sum it. Here are the formulas [19]:

Suppose that object  $i$  is given the rank  $r_{ij}$  by judge number  $j$ , where there are in total  $n$  objects and  $m$  judges. Then the total rank given to object  $i$  is:

$$R_i = \sum_j^m r_{ij} = 1r_{i,j}$$

Mean result from total ranking is:

$$R = \frac{1}{2}m(n + 1)$$

The sum of deviation quadratic ( $S$ ) is calculated by the formula:

$$S = \sum_i^n = 1(R_i - \bar{R})^2$$
$$W = \frac{12S}{m^2(n^2 - n)}$$

And then, Kendall's  $W$  is defined as:

### **III. Result**

#### **Models Construction**

##### **Alternatif of Maintenance Program**

Data obtained from internal informants at T AIR SERVICE explains that each OAMP document must be prepared based on the Maintenance Planning Document (MPD) issued by the factory. Even though most of them come from the same MPD document, the method of implementation can have quite significant differences between one operator and another. These differences are based on the needs of the customer and the company operating the aircraft.

To accommodate the two needs mentioned above, an aircraft operator T Air Service needs to plan the selected maintenance program carefully. Based on facts in the field, maintenance programs owned by operators mostly contain maintenance programs that are almost the same, but different when viewed from the way they are grouped and packaged. From the method of implementing grouping and packaging, the maintenance program is broadly divided into three categories, namely:

##### **Standard/Single task inspection check**

This inspection is carried out by carrying out each inspection individually based on the respective intervals, both in flight hours, take-off and landing cycles, as well as day, month, and calendar year intervals. There is no grouping and packaging in this category.

##### **Blok/Progressive inspection check**

This inspection is carried out in installments from the smallest to the largest work group. This inspection groups jobs that have the same interval into one work package to be carried out at one time.

In fixed-wing aircraft, for example, the Twin Otter DHC6-400 aircraft, this type of inspection is known as a letter check such as A, B, C, D. For rotary-wing aircraft, for example, the Sikorsky S-76 Helicopter, it is usually known as 100, 200, 300, 600, 1200 and 1500 hour inspections. The sequence of mentioning inspections A, B, C, and D on fixed-wing aircraft sequentially shows the size of the interval and also the type of inspection that needs to be carried out,

From the lightest inspection in the form of visual inspection, operational test, and functional test to the most serious, namely overhaul. The duration required also varies, from quite a short time (one day) for an A check, to months for a D check.

Likewise, the inspection sequence on rotary-wing aircraft basically has the same concept as fixed-wing. A 100 hour inspection on a rotary wing type aircraft can be equated to an A check inspection on a fixed wing. Likewise, a 1500-hour inspection on a rotary aircraft can be equivalent to a D check for a fixed-wing aircraft.

##### **Equalize inspection check**

In this categories, work is also grouped based on the same intervals in work packages. In general, work packages consist of small inspection work packages such as A, B checks added with the largest work packages (such as D check) which have been divided into smaller parts.

This is to distribute the entire care package into chunks of nearly equal size for the time and workload. Each equalized package will contain inspection work items A, A and B plus an equalized package in which the largest portion of the work inspection has been previously divided.

### **Criterion and Sub Criterion**

The information obtained regarding customer and company needs is used by researchers to determine the criterion and sub-criterion needed to select the best alternative maintenance program. Criterion and sub-criterion are grouped by researchers with the following description:

#### **Efficiency Criterion**

Low costs, high operational productivity enable efficiency. Effective use of resources will increase output which is the key to productivity. The following are the efficiency sub-criterion obtained as elements of the efficiency criterion, namely:

1)Facility

Hangars and facilities used to maintain aircraft.

2)Man hour

The number of man-hours required to perform maintenance work.

3)Management

The need for several personnel in planning and monitoring the maintenance schedule.

4)Material

Materials include consumables such as lubricants, corrosion preventatives, etc., fastening tools such as screws and spare parts.

5)Equipment

Tools used for the maintenance process, such as general tools, special tools, and other tools.

6)Skill

Some of the skills required for aircraft maintenance are the availability of expertise in the maintenance of aircraft frames and engines, as well as expertise in avionics systems which include instrument systems, electricity, radio, and navigation systems.

#### **Effectiveness Criterion**

In the context of the air charter market, effectiveness is the way a company can meet specific customer needs in an aircraft operation. Specific customer requirements in contracts such as:

1)Downtime

Minimum now time is preferred by most of the customers to use the aircraft anytime.

2)Remote area operation

Most of the aircraft chartered by the cooperate is operated in the remote area.

3)Utilization

High utilization of the aircraft is require by customer to support customer mission with busy operation.

c)Quality criterion

A maintenance program is a product that must have quality, where quality is the fulfillment of the best results for the product in accordance with the organization's expectations. In the context of a maintenance program, the elements used as quality sub-criterion are as follows:

1)Easy to use

2)Reliability

Reliability, namely the product maintenance program is expected not to cause problems when used.

3)Durability

Durability means that the maintenance program can still survive even if the type of contract changes.

d)Flexibility Criterion

Flexibility in the maintenance program is important in continuing to carry out aircraft maintenance while still prioritizing aircraft operations. The elements that are used as sub-criterion aspects of flexibility are as follows:

1)Plan flexibility (Plan)

Flexible in planning work.

2)Time execution flexibility (When)

Flexibility in time to work.

3)Load of task flexibility (Load)

Flexibility in taking on portions of work.

From the results of the description above, the criterion and sub-criterion can be simplified in the following table:

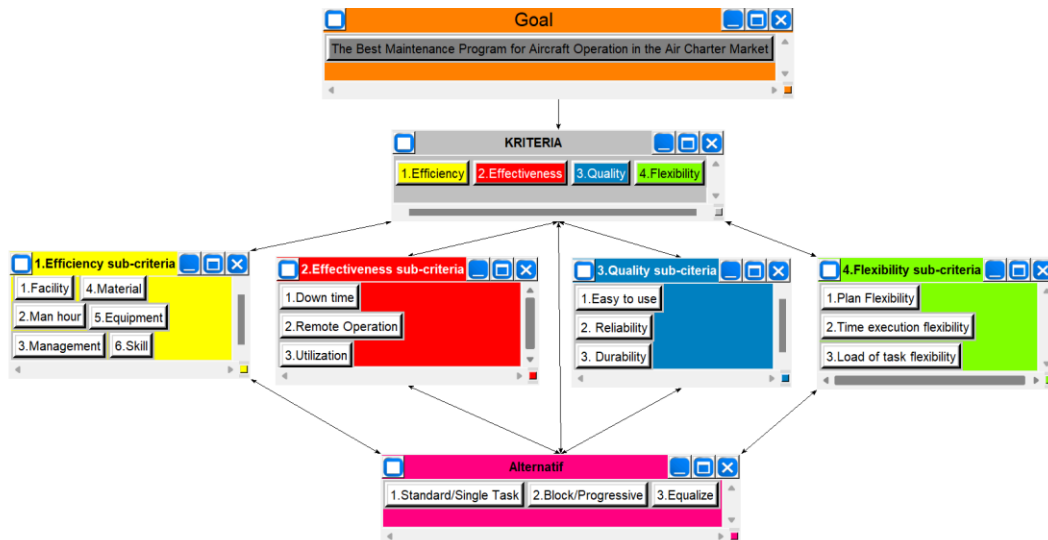


Cluster	Element
Goal	The best Aircraft Maintenance Program for aircraft operations in the aircharter market
Criteria	Efficiency
	Effectiveness
	Quality
	Flexibility
Efficiency sub-criteria	Facility
	Man hour
	Management
	Material
	Equipment
	Skill
Effectiveness sub-criteria	Downtime
	Remote are operation
	Utilization
Quality sub-criteria	Easy to use
	Reliability
	Durability
Flexibility sub-criteria	Plan flexibility (plan)
	Time execution flexibility (when)
	Load of task flexibility (load)
Alternatif	Standard/Single Task check
	Blok/ Progressive check
	Equalize/Phase check

**Table 3. Summary of all findings for building the ANP network**

**ANP'S Network**

From all the alternative information and required criterion and sub-criterion, the researcher built a general ANP network model using super decision software with relationship patterns between clusters and elements that had been discussed with the informant first. Researchers have re-confirmed the model construction built by informants for the ANP model network which was formed as depicted in the figure below:



**Figure 4. ANP model network in super decision software**

**Models Quantification**

After carrying out the ANP network model, a questionnaire was then prepared based on the relationship pattern between clusters and elements. All questionnaires will be tested on the informants. Next, a survey was conducted to select a maintenance program for the participants who had been determined previously. The questionnaire results are then input into super decision software for further analysis.



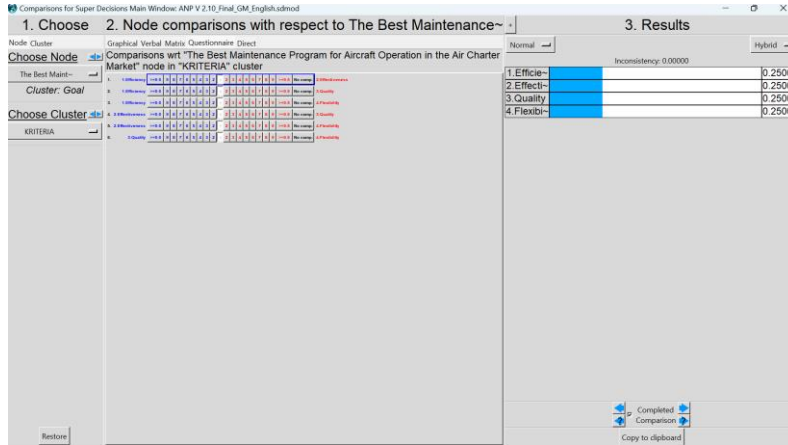


Figure 5. Questionnaire input into super decision software

**Sintesis dan Analisis**

After quantifying the model with analysis using super decision software. The symbols P1, P2, P3 are the participant symbols. Priority values were obtained from participants whose opinions were asked. Meanwhile, GM (geometric mean) is an average value that shows a tendency towards an assessment. The W value shows the level of agreement for all participants. From the results of synthesis and analysis, the following results were obtained:

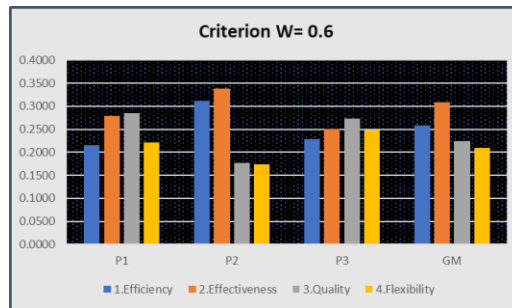


Figure 6. Criterion cluster priority result.

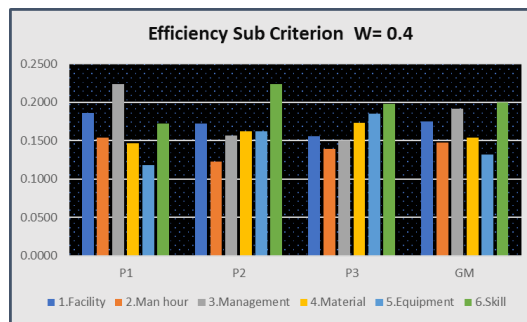


Figure 7. Efficiency sub criterion priority result

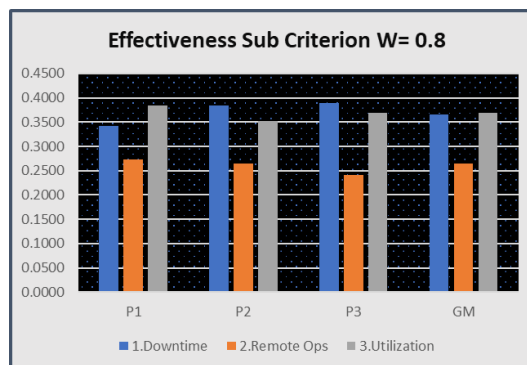


Figure 8. Effectiveness sub criterion result

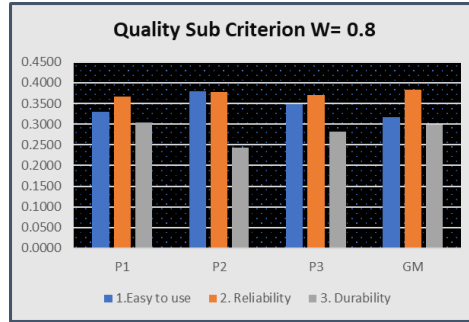


Figure 9. Quality sub criterion priority result.

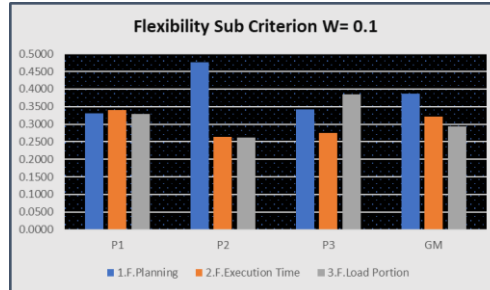


Figure 10. Flexibility sub criterion priority result.

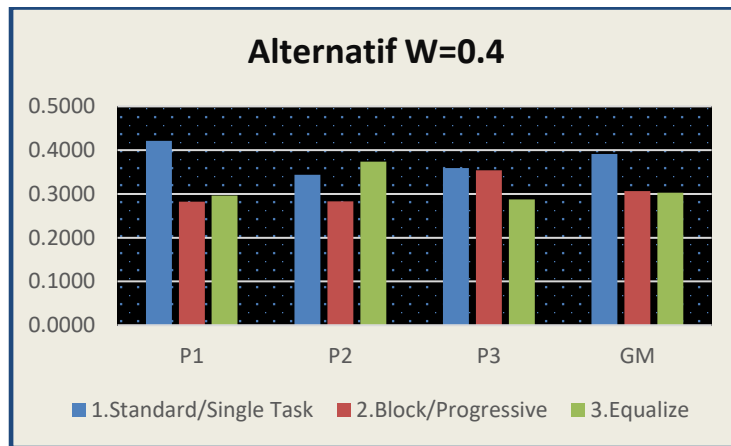


Figure 11. Alternatif priority result

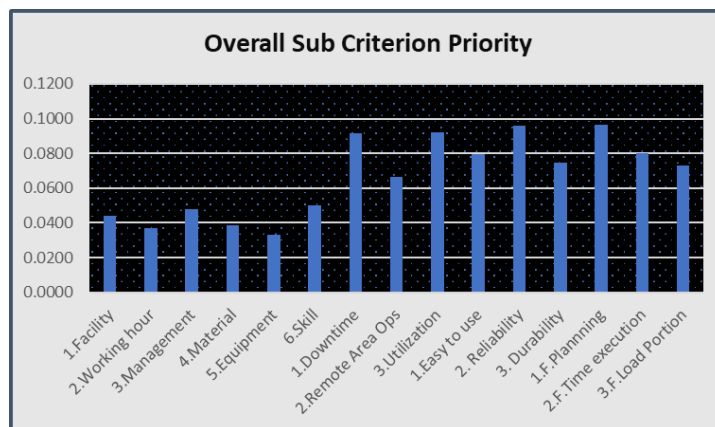


Figure 12. Overall Sub Criterion Priority.

#### IV. Discussion

Results of the analysis for all criteria, there was quite a large agreement with a W value of 0.6 between all participants. In determining the best maintenance program, the effectiveness criterion receive the highest

priority. Orientation towards meeting customer needs is the most important thing in determining the maintenance program.

In the efficiency sub-criterion, excellence in the aspect of using minimum expertise is the highest priority. W value 0.4 indicates that the agreement between the participants is slightly weak. Each participant has a different perspective on the priority of efficiency sub-criterion for selecting the best maintenance program.

For the effectiveness sub-criterion, the highest priority is obtained for excellence in the utilization element (use of flying hours). There is a very small difference in value with a minimum downtime element. For the participants, these two elements have a very large level of importance for meeting customer needs. Operations for remote areas have the lowest priority value. With 0.8 W value means that there is strong agreement between participants.

In the quality sub-criterion, to choose the best maintenance program the participants have very high agreement with a W value of 0.8. Participants agreed that reliability is the highest priority for quality criterion in selecting the best maintenance program.

For the flexibility sub-criterion, the flexible element in planning is the highest priority in selecting the best maintenance program. However, a W value of 0.1 means that the level of agreement between all participants is very weak.

Overall Priority of Sub-Criterion Elements shows that the flexible sub-criterion in planning (plan) and the reliability sub-criterion are the most influential priorities for selecting the best maintenance program. This is then followed by utilization sub-criterion and downtime sub-criterion which are elements of the specific needs of air charter market customers.

From several specified criteria and sub-criterion, participants thought that the best alternative maintenance program to support aircraft operations in the charter aircraft market is alternative number 1, namely Standard/Single task inspection check. But with a W value of 0.4 shows that there was a slight agreement between all the participants.

Even though the agreement value is slightly low, the analysis results show that a standard/single-task maintenance program is the best concept to use in the current air charter market.

In recent times, several corporate customers have used the consortium contract method. This method is considered very effective in reducing their operational costs when using air transportation services. In addition, the charter contract was carried out without a spare aircraft. They want the plane to be available 24 hours a week.

Contract requirements such as those mentioned above will cause challenges for operators to carry out maintenance. Flexibility in carrying out maintenance with minimum downtime is very necessary so that the contract continues to smoothly.

Even though it looks simpler in implementation, due to having quite a lot of work packages, it will be very difficult for operators to carry out maintenance if they use a maintenance program with blocks or phases that require longer downtime. Apart from that, the flexibility for these two maintenance programs is felt to be less flexible because the maintenance schedule times have been adjusted for simultaneous work packages.

However, using a Single Task/Standard maintenance program is still very possible, because it provides flexibility for operators to carry out maintenance. Maintenance can be carried out by paying maintenance work in installments every time the aircraft is on the ground. By carrying out aircraft maintenance with a program like this, aircraft operations can run optimally. This is in line with research conducted by Caner et al. This Standard/Single task maintenance program concept can reduce schedule downtime and have excellent flexibility in carrying out aircraft maintenance at any time while the air is on the ground [20]

Like the definition formulated by Mobley that maintenance is science, art and philosophy[21]. It is called science because its implementation relies on a large part of science. Art because problems look the same but require different approaches and actions. It is a philosophy because it must be carefully placed in a system or organization so that it is suitable for use and its effectiveness is determined by the perspective of its implementers. A different view was generated by research conducted by Tatang and Viona. They argue that aircraft maintenance can be optimized by using the Equalize maintenance program [22]. Differences in views of research results are normal, because they depend on the specific market served, the needs of the company and the research methods used.

## **V. Conclusion**

Based on the findings and analysis results that have been discussed, the researchers made the following conclusions:

1. The conceptual analysis model for selecting an effective maintenance program for aircraft operations in the air charter market can be carried out by identifying the types of existing aircraft maintenance programs, identifying the needs of aircraft operating companies, and identifying the needs of air charter customers. Next, criterion and sub-criterion are determined based on operator and customer needs and then analyzed to obtain the most effective maintenance program.

2. To determine the most appropriate alternative maintenance program for the air charter market served by T Air Service, this can be done in the following way:
  - a. Create structure for company and customer needs as well as existing maintenance program alternatives within the ANP network framework.
  - b. Company and customer needs are arranged into clusters of criterion and sub-criterion which are then arranged into clusters that have elements. Maintenance program alternatives are grouped into one cluster. All clusters and elements will be compared with each other based on the relationships that have been established in the ANP network. Comparisons were made by surveying predetermined participants.
  - c. The comparative value of each element obtained from all participants is then analyzed using super decision software which will produce alternative priorities for the existing maintenance program.
  - d. Next, the geometric mean was calculated to obtain the tendency value for all participants' answers. Calculations for the Kendall coefficient (W) values were also carried out to obtain agreement values between all participants (rater agreement).
  - e. The geometric mean value, rater agreement is the final value that will be used to determine the best alternative maintenance program method to choose. In this research, it was found that the most appropriate alternative maintenance program for the air charter market served by T Air Service is the Standard/Single Task inspection check.