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Selection of pilot and flight attendant uniform suppliers in a private airline holding company using the Analytic Hierarchy Process (AHP) method

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ABSTRACT

The selection and assessment process of suppliers carried out by Private Airline Holding Company uses subjective assessment. It is not so transparent from the department's head with five criteria of suppliers and just enough sub-criteria. This matter inflicted a few problems, such as the goods received from suppliers not being by the amount ordered, the established quality standards, delays in estimated time delivered and received, and defects often found in the goods. Analytical Hierarchy Process (AHP) is a method that helps solve complex problems by structuring a hierarchy of criteria, stakeholders, and outcomes and by considering many things to develop values or priorities. This research aims to determine the priority criteria and sub-criteria of pilot and flight attendant uniform suppliers and the priority order of the best suppliers, Private Airline Holding Company. This research uses Expert Choice V.11 software to implement the AHP method. The overall evaluation obtained shows that five criteria and thirteen sub-criteria were used. The best supplier based on data processing is Supplier 1, with a value of 0.213.

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1. INTRODUCTION

Suppliers are an essential part of a company's supply chain management [1], [2]. Companies must collaborate with suppliers to ensure the availability of their needs [3], [4]. Several criteria that are usually considered in supplier selection are price, quality, timely delivery, etc., which are in accordance with the company's wishes and needs [3], [5].

In fulfilling the need for goods in the form of pilot and flight attendant uniforms, Private Airline Holding Company has several suppliers, and each supplier has its own advantages and disadvantages [6], [7]. Based

on information obtained while conducting research at Private Airline Holding Company, it was found that the supplier selection process uses five criteria with sufficient sub-criteria such as the price criteria which only considers the price factor offered is cheaper or not compared to others, the quality criteria which only considers the conformity factor specifications, flexibility criteria which only consider the factor of approving the submitted PO, as well as vendor communication criteria which only consider the speed of response to orders, complaint services, and ease of communication [8]. Therefore, the selection of suppliers is only based on sub-criteria, which often cause the goods received from suppliers to be inappropriate in terms of the number of orders, the quality standards of the goods received do not comply with the established standards, delays in estimated delivery and receipt times, defects in goods that are often found and so on [9], [10]. In addition, Private Airline Holding Company does not yet have a structured or systematic method or process for conducting supplier assessments because it relies only on subjective assessments from superiors.

Based on these problems Private Airline Holding Company needs a structured method in determining the criteria and sub-criteria for selecting the right supplier. It can help the process of determining the priority of pilot and flight attendant uniform suppliers. The Analytic Hierarchy Process (AHP) method can be used to overcome these problems [11]. The AHP method is a decision support model that can decompose complex multi-factor or multicriteria problems into a hierarchy [12]–[14]. The AHP method in compiling criteria and sub-criteria and determining priorities for selecting the best suppliers in this study was carried out using Expert Choice V.11 software[15], [16] . Apart from making it easier for Private Airline Holding Company in the process of compiling criteria and sub-criteria and determining the priority, it is also hoped that the AHP method used with the help of Expert Choice V.11 software will later be able to make the process of selecting the best priority suppliers can be carried out systematically, fairly, and objectively.

2. MATERIALS AND METHODS

A research framework is made so that the research carried out can be arranged systematically, focused and directed [17]. The following is Figure 1 Flowchart for the Selection of Pilot and Flight Attendant Uniforms at Private Airline Holding Company is the research framework in this study.

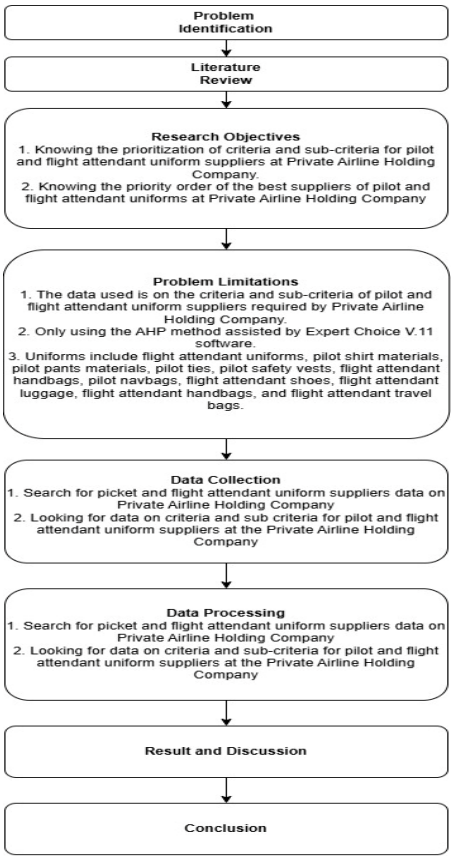

Figure 1. Flowchart for the selection of pilot and flight attendant uniform suppliers at private airline holding company

Based on Figure 1, it is known that several steps or stages will be carried out. The stages carried out start with problem identification, followed by a comprehensive research review, which includes literature exploration and field research. Research objectives, data collection, data processing, results and discussion, and finally, conclusions and suggestions mark the sequential progress of the research.

3. RESULTS

Based on the problems and methods used, the discussion will be carried out in several stages. The first stage starts with data collection and then data processing. In the data processing stage, the criteria and sub-criteria of supplier selection are determined, forming a supplier selection hierarchy, scoring criteria, and scoring suppliers.

3.1. Data Collection

Data collection aims to obtain the data needed to create a hierarchical table of the priorities of pilots and flight attendant uniform suppliers at Private Airline Holding Company [6]. In addition, data collection is also intended as input for data processing in Expert Choice V.11 [7]. The type of data used in making hierarchical tables and data processing using Expert Choice V.11 software is secondary data obtained in previous research. Those data include data on pilots and flight attendant uniform suppliers and data on interviews with supervisors in the procurement department as experts, which contain criteria and sub-criteria in the selection of pilots and flight attendant uniform suppliers owned by Private Airline Holding Company. Table 1 is a list of uniform suppliers of pilots and flight attendants who work together with Private Airline Holding Company.

Table 1. List of pilots and flight attendant's uniforms suppliers for private airline holding company

No.	Name	City	Item Type
1	Supplier 1	North Jakarta	Flight Attendant Uniform, Pilot Shirt Material and Pilot Pants Material for private airline holding company, First Airline Pilot Tie
2	Supplier 2	West Jakarta	Private airline holding company Flight Attendant Uniform, First Airline Pilot Tie, Second Airline Pilot Tie, Third Airline Pilot Tie
3	Supplier 3	South Tangerang	Third Airline Stewardess Uniform, Second Airline Stewardess Uniform, First Airline Stewardess Uniform
4	Supplier 4	Central Jakarta	Safety Vest, Flight Attendant Bag, Pilot Bag, Pilot Navbag for private airline holding company
5	Supplier 5	West Jakarta	Flight Attendant Shoes private airline holding company

No.	Name	City	Item Type
6	Supplier 6	Jakarta	Second Airline Stewardess Shoes, Third Airline Stewardess Shoes
7	Supplier 7	Jakarta	Flight Attendant Luggage, Flight Attendant Bag, Flight Attendant Bag, Flight Attendant Bag for Private Airline Holding Company

Table 1 shows the number of suppliers, supplier names, supplier addresses, and types of goods supplied by Private Airline Holding Company in fulfilling the needs of pilot and flight attendant uniforms. These suppliers come from around the work area of Private Airline Holding Company as well as from outside the area. The types of goods demanded by Private Airline Holding Company consist of flight attendant uniform, pilot shirt material, pilot pants material, pilot tie, pilot Safety Vest, flight attendant handbag, pilot Nav Bag, flight attendant shoes, flight attendant suitcase, flight attendant handbag, Travel Bag flight attendant.

3.2. Data Processing

Data processing contains the processing process of data that has been collected to produce output in the form of the best supplier priority of pilot and flight attendant uniforms at Private Airline Holding Company [8], [9]. The data processing carried out is the determination of criteria and sub-criteria based on the interviews results that have been done with supervisors from the directorate of human resource facilities (HRF), the preparation of the supplier selection hierarchy of pilot and flight attendant uniforms, data Processing using Expert Choice V.11 software, and scoring supplier to determine the rank of best supplier based on the AHP method [10].

3.2.1. Determination of the Criteria and Sub-Criteria of Supplier Selection

The criteria and sub-criteria made in the selection of the best priority supplier should reflect the supply chain strategy used by the company. The following are criteria and sub-criteria for uniform suppliers of pilots and flight attendants at Private Airline Holding Company obtained from interviews with experts, namely Supervisors at the directorate of human resource facilities (HRF) shows the criteria and sub-criteria for selecting uniform suppliers for pilots and flight attendants at Private Airline Holding Company. [11], [13]. The selection of criteria and sub-criteria of suppliers are based on standards from Private Airline Holding Company and information from experts who have been interviewed previously, namely Supervisors at the directorate of human resource facilities (HRF). The criteria considered by the company are price, quality, supplier communication, delivery, and flexibility criteria. Table 2 shows the first criterion in terms of the price offered by the supplier to the company and the terms of payment.

Table 2. Criteria and sub-criteria

No.	Criteria	Sub Criteria
1	Price	Offered Price
		Terms of Payment
		Discount Opportunities
2	Quality	Specification Conformity
		Level of Defect
3	Supplier Communications	Speed At Responding to Orders
		Ease of Communication
		Complaint Service
4	Delivery	Punctuality of Delivery

No.	Criteria	Sub Criteria
5	Flexibility	Accuracy of Delivered Amount *Packaging* SecurityDelivery Ability to Stock Up Ability to Agree On PO

Table 2 shows the first criterion in terms of the price offered by the supplier to the company and the terms of payment. The second criterion is quality. The quality in question is the material offered by the supplier. The quality of materials is one of the important aspects that is taken into consideration by the company because quality significantly affects consumer satisfaction. The third criterion is communication with suppliers. Communication refers to how the supplier communicates with the company. The fourth criterion is in terms of delivery. Delivery refers to how suppliers deliver the goods to the company. Delivery is important to consider because delivery greatly affects the company in ensuring smoothness and punctuality in meeting the company's need for pilot and flight attendant uniforms. The fifth criterion is in terms of flexibility. The flexibility in question is that suppliers are able to provide the number of materials requested by the company, and there can be changes in the amount of demand at any time.

3.2.2. The Creation of Supplier Selection Hierarchy

The initial step insolving the problem of selecting the pilotuniform and flight attendant supplier is the creation of a hierarchy based on predefined criteria and sub-criteria [12]. The first step in the preparation of theselection hierarchy of pilot and flight attendant uniform suppliers began withthe determination of goals or objectives. The objective is to select a pilotand flight attendant uniform supplier at Private Airline Holding Company. Then, the criteria are at the first level, and the sub-criteria are at the next level. There are suppliers at the bottom who will later score individually against the existing sub-criteria [4], [15], [17].

Figure 2 shows the hierarchical structure of the selection of pilot and flight attendant uniform suppliers to Private Airline Holding Company.

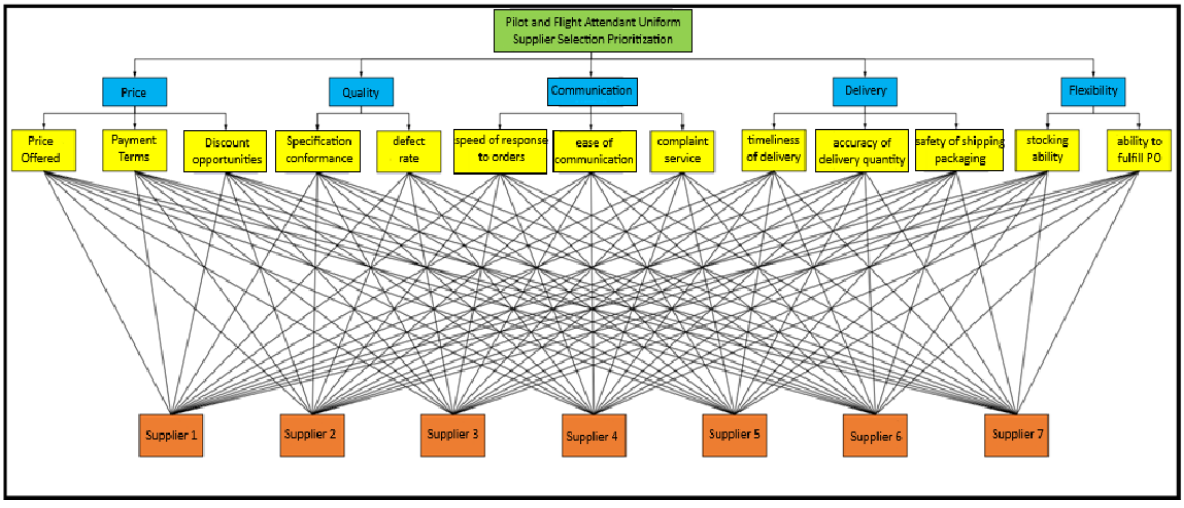

Figure 2. The hierarchical structure of the selection of pilot and flight attendant uniform suppliers to private airline holding company

Based on the hierarchical structure of the selection of pilot and flight attendant uniform suppliers in Figure 2 it is known that there are several levels. The first level in the green box is the goal, which indicates that the priority to be achieved here is the selection of uniform suppliers for pilots and flight attendants of Private Airline Holding Company. The second level in the blue box is the criteria used by Private Airline Holding Company in the selection of suppliers. Criteria for selecting suppliers include price, quality, communication by supplier, delivery, and flexibility.

The orange bottom of the hierarchical structure is suppliers and there is a relationship between each supplier and all sub-criteria. All seven suppliers are Supplier 1, Supplier 2, Supplier 3, Supplier 4, Supplier 5, Supplier 6 and Supplier 7. Then the supplier is assessed and compared with other suppliers based on existing sub-criteria.

3.2.3. Criterion Scoring

The scoring criteria from the selection of suppliers in this research used the help of a software program Expert Choice V.11. The selection of suppliers using the AHP method has several stages, including determining criteria, determining sub-criteria based on existing criteria, determining the score of each criterion and sub-criteria, calculating the score value of each supplier and sorting suppliers based on the highest score [18].

The predetermined criteria are then calculated using a pairwise comparison matrix. The fulfilment of the pairwise comparison matrix is based on the results of the questionnaire that has been distributed to the directorate of the Human Resource Facility of Private Airline Holding Company. The scoring calculation was carried out using Expert Choice V.11 software. The first step taken using Expert Choice V.11 software is to assign scores to the right and left columns depending on the level of importance for each criterion. Figure 3 shows a comparison for each criterion. The following is a questionnaire processing for criteria.

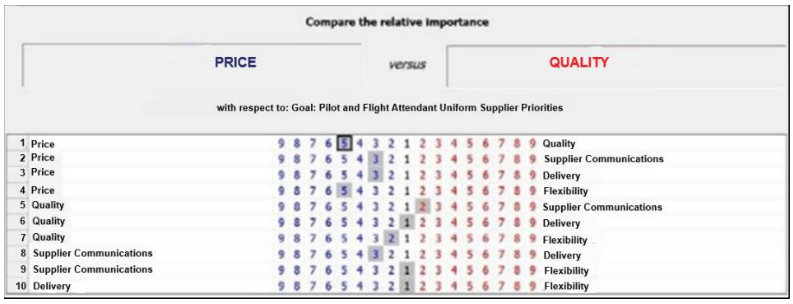

Figure 3. Questionnaire scoring for criteria

The price criterion has a value of 5 compared to the quality criterion. This shows that price criterion is more important than the quality criterion. The price criterion has a value of 3 compared to the supplier communication criterion. This shows that the price criterion is less important than the supplier communication criterion.

Giving score to the criteria needs to be done by processing the results of the respondent's questionnaire. These results were obtained after completing the questionnaire carried out by the supervisor of Expert Choice Resources. Figure 4 shows the result of criteria scoring generated using Expert Choice V.11 software.

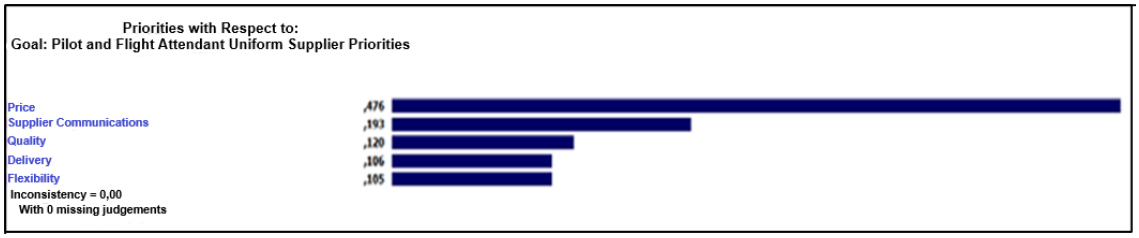

Figure 4. Results of criteria questionnaire scoring

According to Figure 4, it is known that the price criterion has a value of 0.476 and is the criterion with the highest value. The last position in the fifth position is the delivery criterion, with a value of 0.105. The Inconsistency Value on the scoring of supplier criterion is 0.06. According to Saaty, the inconsistency value less than 10% or 0.1 inconsistency of opinion is still considered acceptable. So, it can be concluded that the results of the processing can be accepted and continued by assigning a rank to an existing criterion. The scoring results are the results of data processing on uniform supplier criteria for pilots and flight attendants processed using Expert Choice V.11 software.

3.2.4. Supplier Scoring

The final stage to determine the best rank of pilot and flight attendant uniform supplier is to score each sub-criteria with all suppliers working with Expert Choice Resources. All suppliers were assigned a score using the Expert Choice V.11 software based on the scores provided by expert respondents. Table 3 is a table of the scoring assessment results of the pilot flight attendant uniform supplier at Expert Choice Resources.

Table 3. Supplier scoring

No.	Criterion	Sub Criteria	Supplier	Weight
1	Price (0.476)	Price Offered (0.476)	Supplier 1	0,284
			Supplier 5	0,18
			Supplier 2	0,136
			Supplier 3	0,129
			Supplier 4	0,128
			Supplier 6	0,087
			Supplier 7	0,057
		Payment Terms (0.179)	Supplier 1	0,241
			Supplier 2	0,178
			Supplier 3	0,162
			Supplier 5	0,124
			Supplier 4	0,113
			Supplier 7	0,101
			Supplier 6	0,082
		Discount Opportunities (0.113)	Supplier 2	0,275
			Supplier 3	0,168
			Supplier 1	0,161
			Supplier 4	0,11
			Supplier 5	0,097
			Supplier 6	0,097
			Supplier 7	0,094
2	Supplier Communication (0.193)	Ease of Communication (0.540)	Supplier 1	0,241
			Supplier 2	0,219
			Supplier 3	0,147
			Supplier 5	0,119
			Supplier 4	0,114
			Supplier 6	0,104
			Supplier 7	0,055
		Order Response Speed (0.297)	Supplier 2	0,233
			Supplier 1	0,196
			Supplier 5	0,146
			Supplier 3	0,142
			Supplier 4	0,131
			Supplier 7	0,078
			Supplier 6	0,075

No.	Criterion	Sub Criteria	Supplier	Weight
		Complaint Service (0.163)	Supplier 1	0,21
			Supplier 2	0,174
			Supplier 3	0,161
			Supplier 5	0,161
			Supplier 4	0,135
			Supplier 6	0,098
			Supplier 7	0,061
3	Quality (0.120)	Specification Compliance (0.833)	Supplier 2	0,175
			Supplier 7	0,171
			Supplier 5	0,163
			Supplier 4	0,144
			Supplier 1	0,135
			Supplier 6	0,124
			Supplier 7	0,087
		Disability Rate (0.167)	Supplier 2	0,233
			Supplier 5	0,179
			Supplier 7	0,179
			Supplier 4	0,167
			Supplier 6	0,091
			Supplier 3	0,088
			Supplier 1	0,064
4	Flexibility (0.106)	Stock Provisioning Ability (0.500)	Supplier 1	0,214
			Supplier 4	0,178
			Supplier 2	0,175
			Supplier 5	0,151
			Supplier 3	0,111
			Supplier 6	0,089
			Supplier 7	0,083
		PO Capability (0.500)	Supplier 1	0,231
			Supplier 5	0,185
			Supplier 2	0,172
			Supplier 4	0,159
			Supplier 3	0,094
			Supplier 6	0,088
			Supplier 7	0,071
5	Shipments (0.105)	Timeliness of Delivery (0.709)	Supplier 2	0,219
			Supplier 7	0,16
			Supplier 4	0,15
			Supplier 1	0,146
			Supplier 5	0,131
			Supplier 3	0,105
			Supplier 6	0,088

No.	Criterion	Sub Criteria	Supplier	Weight
			Supplier 2	0,19
			Supplier 5	0,178
		Accuracy of Shipment Quantity (0.179)	Supplier 7	0,178
			Supplier 4	0,163
			Supplier 6	0,106
			Supplier 1	0,097

Table 3 shows supplier scoring displays. The results of supplier scoring against all sub-criteria. In the price criteria with sub-criteria price offered, the first-ranked supplier is Supplier 1 with a value of 0.284, Supplier 5 with a value of 0.180, Supplier 2 with a value of 0.136, Supplier 3 with a value of 0.129, Supplier 4 with a value of 0.128, Supplier 6 with a value of 0.087, and Supplier 7 with a value of 0.057. In the payment terms sub-criteria, the supplier who gets the first rank is Supplier 1 with a value of 0.24, Supplier 2 with a value of 0.178, Supplier 5 with a value of 0.124, Supplier 4 with a value of 0.113, Supplier 7 with a value of 0.101, and Supplier 6 with a value of 0.082. In the sub-price discount opportunities, the first-ranked supplier is Supplier 2 with a value of 0.275, Supplier 3 with a value of 0.168, Supplier 1 with a value of 0.161, Supplier 4 with a value of 0.110, Supplier 5 with a value of 0.097, Supplier 6 with a value of 0.007, and Supplier 7 with a value of 0.094.

The results of the supplier assessment of all sub-criteria were then concluded and an overall supplier value was obtained. Table 4 shows the results of each supplier's assessment, which are sorted by rank.

Table 4. Rank of pilots and flight attendants' uniforms suppliers for private airline holding company

Suppliers	Value Weight	Rank
Supplier 1	0,213	1
Supplier 2	0,182	2
Supplier 5	0,154	3
Supplier 4	0,135	4
Supplier 3	0,125	5
Supplier 7	0,097	6
Supplier 6	0,094	7

Based on the supplier scoring results in Table 4 of Pilot and Flight Attendant Uniform Suppliers of Private Airline Holding Company Rankings, it is known that Supplier 1 gained a value of 0.213 and became the best supplier as they placed in the first rank. Supplier 2, with a value of 0.182, placed second; Supplier 5 is in the third position with a value of 0.154, and Supplier 4, placed fourth with a value of 0.154. Although Supplier 1 is the best supplier overall, Supplier 5 has an edge in the quality criteria. This suggests that Private Airline Holding Company may consider Supplier 5 if quality is a top priority, although there may be a slight price difference. The value of 0.213 obtained by Supplier 1 shows that they are significantly superior to other suppliers in meeting the criteria set by Private Airline Holding Company. Private Airline Holding Company is advised to establish a long-term strategic partnership with Supplier 1 while still conducting regular evaluations of the performance of all suppliers. Supplier 1's superiority in price and supplier communication criteria indicates that they can help Private Airline Holding Company save costs and ensure smooth communication in the uniform procurement process.

4. DISCUSSION

By using the Analytic Hierarchy Process (AHP) method, information on the priority order of suppliers to Private Airline Holding Companies is obtained. This can help Private Airline Holding Company to find out the best suppliers based on five supporting factors, including Price, Supplier Communication, Quality,

Flexibility and Shipment. In a paper entitled Decision Making in Supplier Selection with the AHP Method and Technique For Other Reference by Similarity to Ideal Solution (TOPSIS) (Case Study: M-Merchandise Mulawarman University). The journal produces prioritization based on six factors [19]. In this journal, the discussion can still be developed by adding the use of methods in processing, such as the Technique for Order Preference By Similarity to Ideal Solution (TOPSIS) method [20] − [22] or Supply Chain Operation Reference (SCOR) [23] − [25] to support the determination of the value of AHP results.

5. CONCLUSION

Based on the results and discussions that have been carried out, conclusions can be drawn to answer the objectives of the research. The following are the conclusions:

1. The criteria and sub-criteria priorities obtained are five criteria and thirteen sub-criteria. Consists of price criteria with the sub-criteria price offered, terms of payment, and discount opportunities. Supplier's communication criteria with sub-criteria the speed of responding to orders, complaint services, and ease of communication. Quality criteria with sub-criteria specifications conformity and level of defects. Flexibility criteria with sub-criteria of ability to stock up and ability to undertake purchasing orders (PO). Delivery criteria with sub-criterion include delivery punctuality, the accuracy of the amount delivered, and the security of the shipped package.
2. Best supplier priority, which was obtained from data processing using Expert Choice V.11 software with criteria and sub-criteria, resulted in the best supplier, Supplier 1. They got a score of 0.213 and became the best supplier in the first place. Supplier 2, with a value of 0.182, came second, Supplier 5 placed third with a value of 0.154, Supplier 4 with a value of 0.154, on the fourth position, Supplier 3 with a value of 0.125 placed fifth, Supplier 7 with value of 0.097 in on the sixth position, and Supplier 6 with a value of 0.094 placed seventh.

Based on the conclusions that have been obtained, some suggestions for future research are obtained. The following suggestions are given:

1. For further research, it is recommended to use other methods besides AHP, such as TOPSIS or SCOR, to compare the results and see the consistency of the supplier selection.
2. It is also recommended that more experts be involved in the assessment process to obtain more comprehensive and objective results.
3. In addition, it is necessary to conduct research by considering other criteria and sub-criteria that may be relevant to the selection of suppliers of pilot and flight attendant uniforms at Private Airline Holding Company.
4. One of the limitations of this research is the limited number of expert respondents. Future research can involve more expert respondents from various departments in Private Airline Holding Company to get a broader perspective. In addition, future research can combine the AHP method with other methods such as TOPSIS to get more comprehensive results.

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