Selection of 3PL Vendors for The Distribution of Garment Products Using The ANP: A Case at An Indonesia Garment Company

Wafi Hudaya [a,1,*], Anggi Widya Purnama [a,2], Syafrianita[a,3]

aFaculty of Logistics Technology and Business, International University of Logistics & Business, Bandung, Indonesia
[1] wafihudaya@gmail.com*; [2] anggiwp@ulbi.ac.id; [3] syafrianita@ulbi.ac.id
* corresponding author

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ABSTRACT

Third Party Logistics vendor selection decisions need to look at many factors, currently PT BASIL has not determined a vendor for new delivery routes as well as previously vendor selection based on price and fleet availability. This study uses the Analytical Network Process (ANP) method assisted by Super Decision which provides value information in the form of weight, alternatives that have high weight are recommended recommendations. The results of data processing from the highest order for the criteria are delivery 19%, service 16%, experience 15%, quality 14%, responsive 12%, performance 11%, insurance 7%, price 5%. For the sub-criteria, namely good complaint handling 9.47%, payment 8.92%, ability to fulfill the specified schedule when there is demand 8.68%, low prices 8.29%, good communication 6.52%, responsibility 6.47%, flexible 6.28%, vendor reputation car carrier availability when there is demand 5.23%, safety of goods 4.94%, vendor's ability to respond to defect and delay claims 3.86%, late goods insurance 3.78%, punctuality 3.76%, damaged goods insurance 3.39%, condition of goods 3.25%, lost goods insurance 2.78%, non-defective goods, accuracy of the quantity of units delivered and units received in good condition 2.59%, goods not lost 2.47%, fleet condition 2.07%, accurate 1.38%, documents 0.71%, paying attention to K3 in all operational activities 0.00%. For the alternative with the highest weight, Lion Parcel is 36.39%, because Lion Parcel is a vendor that matches the priority needs of the company.

1. INTRODUCTION

Currently, competition in the business world is getting tighter so that every organization or company must be able to meet the wishes of consumers so that customers do not feel disappointed or lose customers. Basically, companies have the same orientation, namely obtaining maximum profits and minimizing costs. Every company must have a distribution sector for the delivery of products to consumers and can be done effectively and efficiently. In distributing, a company can use a third party or partner to help distribute products. The existence of Third Party Logistics has the main goal of reducing costs incurred by the company over time not only reducing costs but also having other specific targets [5]. Vendors are companies that are chosen to meet the company's operational needs [16]. Vendor selection is a strategic activity if vendors are very important to the company [11].

PT. Besok Ada Hasil (BASIL) is a company engaged in the garment industry that produces everyday fashion clothing products from children to adults, uniforms, and clothes for heavy work. The company now has domestic customers within Java Island to outside Java. PT BASIL for the distribution of products to its customers does not work alone, PT BASIL collaborates with vendors for the distribution and fulfillment of customer demands. Currently, PT BASIL plans to distribute its products to its new destination outside Java, namely to the island of Sulawesi. But currently it is not possible to choose which Third Party Logistics vendor will be chosen by PT BASIL.

PT BASIL in the previous vendor selection only considered in terms of price and fleet availability, did not look at other factors or criteria and sub-criteria, and the selection of Third Party Logistics vendors had not used measurable scientific methods. This can potentially cause problems such as

uncertainty about the quality of the service. In identifying criteria for decision-making along with the right selection method is a driving factor that determines the growth and competitiveness of the company to be chosen, so criteria are very important in decision-making. The sole emphasis on price as the sole criterion for selection does not make decisions competitive and structured, so it is transformed into a more comprehensive multi-criteria approach [10]. In previous research, few researchers used the Analitycal Network Process method for the selection of Third Party Logistics vendors in the context of distributing the garment industry in Indonesia, therefore this study has an urgency to provide an alternative to the selection of Third Party Logistics vendors. Previous research related to the selection of Third Party Logistics vendors mostly used the Analytical Hierarchy Process method. However, there are still few studies that use the Analytical Network Process method, especially in the context of the garment industry in Indonesia.

By using a multi-criteria approach, the Analitycal Network Process method can describe the relationship between criteria and sub-criteria and also alternatives. In addition, this research can determine which vendors will be selected based on priority order according to the company's criteria, and can find out the advantages and weaknesses of each vendor with a broader approach. So that you can find out which vendors are good and can find out which vendors you want to prioritize to collaborate with the company. The Analytical Network Process method is one of the methods that can present the level of interest of various parties by considering the relationship between chiteria and the chosen sub-criteria and alternatives. This method is a development of the Analytical Hierarchy Process method so that the work and results are more complex than the Analytical Hierarchy Process [20].

2. METHOD

2.1. Research Stages
In a study, systematic steps are needed to help complete a study. The steps used can be seen in the following figure (Figure 1):
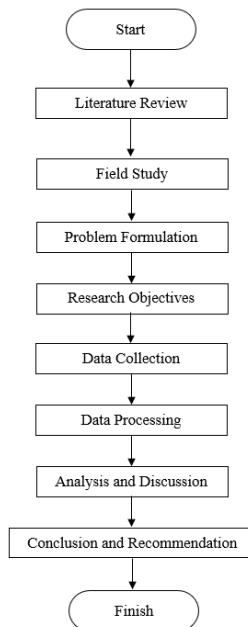

Fig. 1. Research Stages

2.2. Research Respondents

To collect the data, this research used some respondents. Table 1 shows the list of the respondents

Table 1. Respond to Research

No	Research Respondents
1	President Director
2	Head of Staff Warehouse

The respondents in this study are two people, this is based on the fact that in the company's organizational structure, the decision making of Third Party Logistics vendor selection only involves these parties. This is due to the fast nature of the garment industry's distribution flow, so decisions are centralized in a specific unit. Thus both respondents are seen as relevant sources of information.

2.3. Vendors

Third Party Logistics vendors included in the list of PT BASIL candidates based on the consideration that each has advantages that are in accordance with the company's distribution needs, for the following candidates (Table 2):

Table 2. List of Vendors

No	Vendor Name
1.	PT FM GLOBAL LOGISTIC
2.	INDAH CARGO
3.	JNE
4.	LION PARCEL

2.4. Table of Criteria and Sub-criteria of Previous Research

In collecting data, criteria and sub-criteria from previous research were taken before being given to the company to select which criteria and sub-criteria were desired by the company.

The following is a table of the criteria of previous research (Table 3):

Table 3. Criteria

Research	Achmad Andryianto, Eca Aulya Rahmat (2015) [1]	Rizka Hutami Putri P, Ali Mohamad Rezza (2018) [12]	Euis Yuliyani, S Suntoro, Irayanti Adriant (2022) [21]	Sicilya Wulandari, Anggi Widya P, Nurlaela Kumala Dewi (2023) [19]	D P Shabrina (2024) [17]	Writer
	Price	Price	Price	Price	Cost	Price
	Quality	Quality		Quality	Quality	Quality
	Service	Service		Service	Service	Service
Criteria	Delivery	Shipping			Delivery	Delivery
			Quality of service			Quality of service
			Experience			Experience
			Responsive	Responsive		Responsive
					Performance	Performance
Research	Achmad Andryianto, Eca Aulya Rahmat (2015)[1]	Rizka Hutami Putri P, Ali Mohamad Rezza (2018)[12]	Euis Yuliyani, S Suntoro, Irayanti Adriant (2022)[21]	Sicilya Wulandari, Anggi Widya P, Nurlaela Kumala Dewi (2023)[19]	D P Shabrina (2024)[17]	Writer
Criteria					Environment	Environment
				Insurance		Insurance

The following is a table of the sub-criteria of previous research (Table 4)

Table 4. Sub Criteria

Criteria	Achmad Andryianto, Eca Aulya Rahmat (2015)[1]	Rizka Hutami Putri P, Ali Mohamad Rezza (2018)[12]	Euis Yuliyani, S Suntoro, Irayanti Adriant (2022)[21]	Sicilya Wulandari, Anggi Widya P, Nurlaela Kumala Dewi (2023)[19]	D P Shabrina (2024)[17]	Writer
			Sub criteria			
Price	- Cheap - Payment	- Low price	- Vendor rate affordability - Price compatibility with quality - Affordability of rates with other vendors	- Cheap - Discount - Payment	- Low price - Variable costs that are not easily changed	- Low price - Payment - Discount - Price compatibility with quality - Variable costs that are not easily changed
Quality	- Insurance - Problem solving	- Goods safety - Container availability - Container conditions		- Goods condition - Goods safety - Timeliness - Precision of purpose	- Good asset management - Zero defects in the unit - The exterior of the unit is in accordance with the specifications - Paying attention to K3 in all operational activities	- Goods safety - Container availability - Container conditions - Goods condition - Timeliness - Precision of purpose - Good asset management - Zero defects in the unit - The exterior of the unit is in accordance with the specifications - Paying attention to K3 in all operational activities

Criteria	Achmad Andryianto, Eca Aulya Rahmat (2015)[1]	Rizka Hutami Putri P, Ali Mohamad Rezza (2018)[12]	Euis Yuliyani, S Suntoro, Irayanti Adriant (2022)[21]	Sicilya Wulandari, Anggi Widya P, Nurlaela Kumala Dewi (2023)[19]	D P Shabrina (2024)[17]	Writer
			Sub criteria			

Criteria	Achmad Andryianto, Eca Aulya Rahmat (2015)[1]	Rizka Hutami Putri P, Ali Mohamad Rezza (2018)[12]	Euis Yuliyani, S Suntoro, Irayanti Adriant (2022)[21]	Sicilya Wulandari, Anggi Widya P, Nurlaela Kumala Dewi (2023)[19]	D P Shabrina (2024)[17]	Writer
			Sub Criteria			
Service	- Document - Booking	- Delayed response - Complaint response		- Fleet condition - Fleet availability - Problem solving - Packaging - Flexible - Monitor shipments	- Operational reports and analysis - Work procedure - Complain good handling	- Document - Booking - Delayed response - Complaint response - Fleet condition - Fleet availability - Problem solving - Packaging - Flexible - Shipping Monitoring - Operational reports and analysis - Work procedure - Complain good handling
Delivery	- Accurate - Lead time	- Timeliness - Items are not lost - Non-defective goods			- Real-Time Monitoring - Delivery accuracy - Unit received in good condition - Accuracy of the quantity of units delivered	- Accurate - Lead time - Timeliness - Items are not lost - Non-defective goods - Real-time monitoring - Delivery accuracy - Unit received in good condition - Accuracy of the quantity of units delivered
Experience			- Ability to meet demand - Ability to meet specified schedules			- Ability to meet demand - Ability to meet specified schedules

Responsive	- Vendor ability to respond to requests - Vendor ability to respond to defect and delay claims - Vendor's ability to communicate with the company	- Responsibility - Quick response - Good communication	- Responsibility - Quick response - Good communication - Vendor ability to respond to requests - Vendor ability to respond to defect and delay claims - Vendor's ability to communicate with the company
Performance		- Vendor reputation of car carrier availability when there is demand - Adequate availability of man power	- Vendor reputation of car carrier availability when there is demand - Adequate availability of man power
Environment		- Planning the use of electrical vehicles - Use of operational vehicles with electric vehicles	- Planning the use of electrical vehicles - Use of operational vehicles with electric vehicles
Insurance		- Loose goods insurance - Lost goods insurance - Damaged goods insurance	- Loose goods insurance - Lost goods insurance - Damaged goods insurance

2.5. Operational Definition Table

Table 5 shows the operational definition of each variable in this research

Table 5. Operational Definition

Variable	Operational Definition	Reference	Indicators	Questionnaire
Price	Pricing is a value proposition to fit a company's budget	K A Gultom and M M Ulkhaq (2025)[6]	Low price	Pairwaise comparison
			Payment	Pairwaise comparison
Quality	Quality is a technical offer from the vendor	K A Gultom and M M Ulkhaq (2025)[6]	Goods safety	Pairwaise comparison
			Goods condition	Pairwaise comparison
			Paying attention to K3 in all operational activities	Pairwaise comparison
Service	Service is a facility offered in the delivery of goods from vendors	S Wulandari et al. (2023)[19]	Document	Pairwaise comparison
			Fleet condition	Pairwaise comparison
			Flexible	Pairwaise comparison
			Good handling	Pairwaise comparison
Delivery			Accurate	Pairwaise comparison

	Shipping is value in terms of service delivery of goods from origin to destination	S Wulandari et al. (2023)[19]	Timeliness	Pairwaise comparison
			Items are not lost	Pairwaise comparison
			Non-defective goods	Pairwaise comparison
			Unit received in good condition	Pairwaise comparison
			Accuracy of the quantity of units delivered	Pairwaise comparison
Responsive	Responsive is the ability of a vendor to respond well and responsibly to its customers	S Wulandari et al. (2023)[19]	Responsibility	Pairwaise comparison
			Good communication	Pairwaise comparison
			Vendor's ability to respond to defect and delay claims	Pairwaise comparison
Performance	Performance is the performance of the vendor as seen from the history during the collaboration	S Wulandari et al. (2023)[19]	Vendor reputation of car carrier availability when there is demand	Pairwaise comparison
Insurance	Insurance is a tool to protect goods from unexpected events during the delivery of goods	S Wulandari et al. (2023)[19]	Late goods insurance	Pairwaise comparison
			Lost goods insurance	Pairwaise comparison
			Damaged goods insurance	Pairwaise comparison
Experience	Experience is the ability of a vendor to solve project problems	J Hutahaean (2024)[7]	Ability to meet specified schedules	Pairwaise comparison

The questionnaire in the Analytical Network Process method is divided into 3 stages, namely:

a. Stage 1 Selection of criteria and sub-criteria carried out by the company.

With an example of a question format: "Based on the available criteria, which are the main criteria in assessing vendor selection"

b. Stage 2 determines the relationship between the effects of sub-criteria in the same criteria and sub-criteria in different criteria.

With an example of a question format: "Based on the selected criteria, is there a correlation between the selected criteria"

c. Stage 3 conducted a pairwaise comparison between criteria, between sub-criteria, between partners with sub-criteria and a comparison assessment with a Saaty scale (1–9) → 1 = equally important, 3 = slightly more important, 5 = more important, 7 = very important, 9 = absolutely more important.

With an example of the question format: "Which of the price criteria with quality is more important"

In Multi Criteria Decision Making research, decision-making is a process when there are a number of steps taken by evaluating alternatives to make a decision from all existing alternatives. Every decision-making is a system of actions because there are several components in it [8]. In order to facilitate decision-making, it is necessary to create stages that can lead to the creation of the desired results [4]. Using the Analytical Network Process method is a method of developing the Analytical Hierarchy Process which has a more general and broad network structure, by uniting feedback and interdependent relationships between attributes and alternative decisions [14]. Where shown on a straight line showing between the criteria is called outerdependence while the rotating line in the criterion is called innerdependence for a reciprocal line called feedback [16]. The basic principles of the Analytical Hierarchy Process and the Analytical Network Process are divided into three parts, namely decomposition, paired comparative assessment and hierarchical composition [19]. For the main functions there are three, namely structuring complexity, ratio scale measurement, compositing

synthesis [2]. For the theoretical foundation, there are 3, namely respirocal (paired comparison), homogeneity (comparative scale) and dependence [13].

The stages in decision-making using the Analitycal Network Process method are

a. Develop problem structures and develop linkage models.

b. Create a comparison matrix.

c. Calculating weights.

d. Calculating the consistency ratio.

e. Create a supermatrix.

f. Alternative rankings [9][19].

In working on the Analytical Network Process method, it can be assisted by using Super Decision Software. Super decision is a software that is used for the selection of the Analytical Hierarchy Process or Analitycal Network Process method [3].

3. RESULTS AND DISCUSSION

3.1. Results

In this study, the stage of data collection and data processing. Criteria and sub-criteria are collected from several supporting journals, then the criteria and sub-criteria data are made into a questionnaire after which they are given to the research company to select which criteria and sub-criteria to use for data processing. For alternatives, the data collection is taken from the results of interviews with companies. With the results of data processing (Table 6):

Table 6. Research Criteria, Sub Criteria, and Alternatives

Criteria	Sub Criteria	Alternative
Price	Low price Payment	
Quality	Goods safety Goods condition Paying attention to K3 in all operational activities	
Service	Document Fleet condition Flexible Good handling	PT FM Global Logistic
Delivery	Accurate Timeliness Items are not lost Non-defective goods Unit received in good condition Accuracy of the quantity of units delivered	Indah Cargo JNE
Responsive	Responsibility Good communication Vendor's ability to respond to defect and delay claims	Lion Prcel
Performance	Vendor reputation of car carrier availability when there is demand	
Insurance	Late goods insurance Lost goods insurance Damaged goods insurance	
Experience	Ability to meet specified schedules	

After obtaining the criteria and sub-criteria that have been chosen, then the Analitycal Network Process is formed. The network was obtained from the results of the questionnaire on the relationship between different criteria, between sub-criteria in one criterion, and between sub-criteria in different criteria. The network is created using Super Decision (Figure 2).
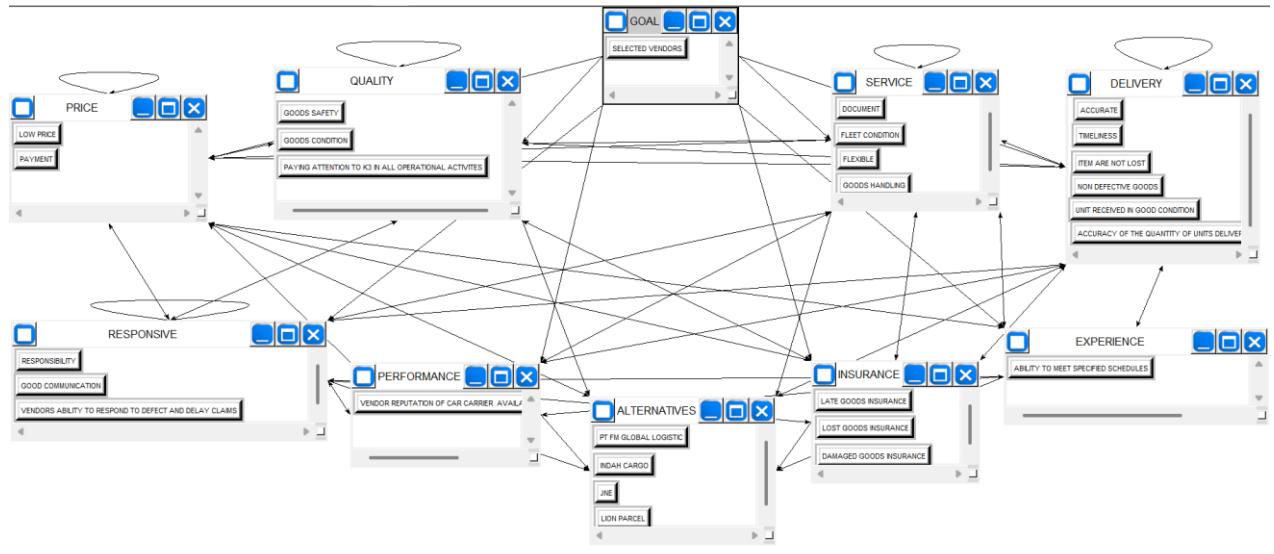
Fig. 2. ANP Network Model (Software Super Decision)

After the network is created, the existing data from the results of the comparison scale questionnaire if the respondents have more than one data must be processed first to obtain a geometric mean. After obtaining the geometric mean data, the data is input into pairwaise comparison in the Super Decision Software (Figure 3 and Figure 4).

Fig. 3. Input Data (Software Super Decision)
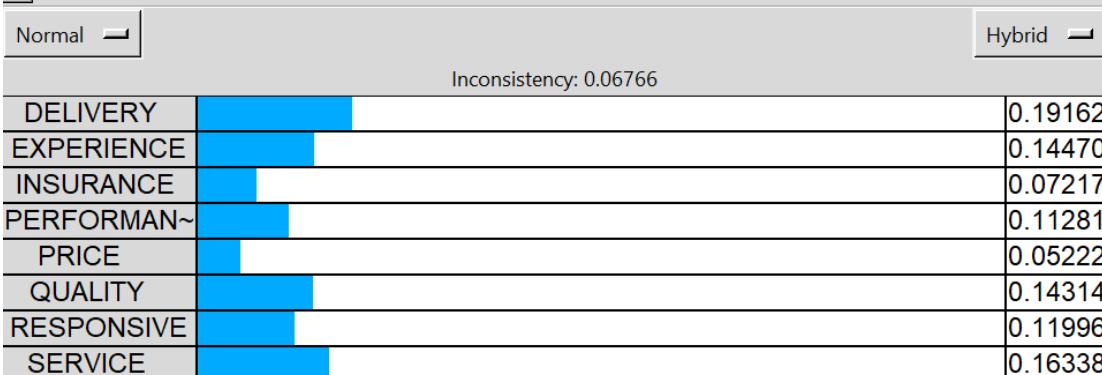
Fig. 4. Data Results (Software Super Decision)

For the results of data processing using Super Decision Software, it can be analyzed that the inconsistency value of the respondents' answers is <10%. This shows that the answers from the respondents can be used to assess the weight of criteria, sub-criteria and alternatives.

Table 7. Priority Criteria

Table Priority		
Criteria	**Weight**	**Ranking**
Price	5%	8
Quality	14%	4
Service	16%	2
Delivery	19%	1
Responsive	12%	5
Insurance	7%	7
Experience	15%	3
Performance	11%	6

Based on the results of data processing using Super Decision Software, it can be analyzed that the priority weight value of the highest weight of the delivery criteria with a weight of 19% with a weight of one, for the rank of two services with a weight of 16%, for the rank of three experiences with a weight of 15%, for the rank of four qualities with a weight of 14%, for the rank of five responsive with a weight of 12%, for the rank of six performance with a weight of 11%, for the seventh insurance with a weight of 7% and the last price with a weight of 5% the rank of eight.

Table 8. Priority Sub Criteria

Sub Criteria	**Weight**	**Ranking**
Low price	8,29%	4
Payment	8,92%	2
Lost goods insurance	2,78%	15
Damaged goods insurance	3,39%	13
Late goods insurance	3,78%	11
Goods safety	4,94%	9
Goods condition	3,25%	14
Paying attention to K3 in all operational activities	0,00%	21
Complain good handling	9,47%	1
Sub Criteria	**Weight**	**Ranking**
Document	0,71%	20
Flexible	6,28%	7
Fleet condition	2,07%	18
Ability to schedule specified when there is a request	8,68%	3
Accurate	1,38%	19
Non-defective goods	2,59%	16
Items are not lost	2,47%	17
Accuracy of the quantity of units delivered	2,59%	16
Timeliness	3,76%	12
Unit received in good condition	2,59%	16
Vendor reputation of car carrier availability when there is demand	5,23%	8
Vendor's ability to respond to defect and delay claims	3,86%	10
Good communication	6,52%	5
Responsibility	6,47%	6

For the highest weight of the sub-criterion of good complain handling with a weight of 9.47% with a weight of one, payment with a weight of 8.92% for the second place, for the third rank of the ability to fulfill the specified schedule when there is a demand with a weight of 8.68%, for the rank of four low prices with a weight of 8.29%, for the rank of five good communication with a weight of 6.52%, for the rank of six responsibilities with a weight of 6.47%, For the seventh rank flexible with a weight of 6.28%, for the rank of the eighth reputation of the car carrier availability vendor when there is a demand with a weight of 5.23%, for the rank of ninth security of goods with a weight of 4.94%, for the rank of ten vendors in responding to defect and delay claims with a weight of 3.86%, for the rank of eleven late goods insurance with a weight of 3.78%, for the rank of twelfth punctuality with a weight of 3.76%, For the thirteenth rank of damaged goods insurance with a weight of 3.39%, for the fourteenth rank of the condition of the goods with a weight of 3.25%, for the fifteenth rank of lost goods insurance with a weight of 2.78%, for the ranking of sixteen non-defective goods, the accuracy of the quantity of units delivered and the units received in good condition with a weight of 2.59%, for the ranking of seventeen goods not lost with a weight of 2.47%, for the eighteenth rank of fleet conditions with a weight of 2.07%, for the rank of nineteen accurate with a weight of 1.38%, for the rank of twenty documents with a weight of 0.71% and the last rank of twenty-one pay attention to K3 in all operational activities with a weight of 0.00%, this is because this sub-criterion affects other sub-criteria but is not affected by other sub-criteria.

Table 9. Priority Alternatives

Alternative	Weight	Ranking
Indah Cargo	26,21%	2
JNE	23,85%	3
Lion Parcel	36,39%	1
PT FM Global Logistics	13,55%	4

For the highest weight alternative Lion Parcel with a weight of 36.39% in first place, for the second place Indah Cargo with a weight of 26.21%, for the third place JNE with a weight of 23.85%, and the last place is the fourth place PT FM Global with a weight of 13.55%. These results are expected to help PT BASIL in determining the most suitable 3PL logistics partner based on the appropriate criteria and sub-criteria.

3.2. Discussion

The results of the study show that the delivery criteria have the highest weight, in accordance with the research of D P Shabrina (2024) [17] and Rizka Hutami Putri P, Ali Mohamad Rezza (2018) [12] who also found an important factor, namely delivery for decision-making in the selection of Third Party Logistics vendors. But according to research of Sicilya Wulandari, Anggi Widya P, Nurlaela Kumala Dewi (2023) [19] found that delivery is not important or discussed because delivery has been included in other criteria or sub-criteria so that according to the company it is not selected or needed. The difference between this research and the previous research is that this research focuses on the garment industry. So that each company has its own criteria and sub-criteria that are adjusted to the company's conditions.

4. CONCLUSION

Based on the results of data processing and analysis, the top three highest weights of the criteria are delivery with a weight of 19% with a weight of one, for ranking two services with a weight of 16%, for ranking three experiences with a weight of 15%. While the top three have the highest weight of the sub-criteria of good complain handling with a weight of 9.47% with a weight of one, payment with a weight of 8.92% for rank two, for the third rank ability to fulfill the specified schedule when there is a demand with a weight of 8.68%. For the alternative highest weight result is Lion Parcel with a weight of 36.39% in first place.

Suggestion for companies because research with the Analytical Network Process method has produced recommendations for criteria and sub-criteria, so it can be used for decision-making. And for the resulting alternative, it is Lion Parcel.

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