Application of the Decision Tree Method to Decision Makin in Using Trucking Services at A Freight Forwarding Company

Yusuf Rachmat Hidayat [a,1,*], Siti Sya'aroh [b,2]

[a,b] Logistics Management Study Program, Department of Social Sciences and Management, STIAMI, Jakarta, Indonesia
[1] sitisyaaroh@gmail.com *; [2] yusup.rachmat@gmail.com;
* corresponding author

ARTICLE INFO

ABSTRACT

   PT. Ricakusuma Lestari Abadi is a company operating in the freight forwarder sector by providing transportation services. Non-optimality and limited fleet capacity causes delivery activities to be inefficient in terms of time and cost. This research aims to determine the application of the decision tree method and determine the correct choice of decision making when using trucking services.
   Selecting trucking services using the Decision Tree method is a decision tool that uses a tree-shaped decision model. Meanwhile, for data analysis using the Decision Analysis method and to make it more effective and efficient, Information Technology is used in the form of Quantitative Method (QM) For Windows 5 software.
   The dependent variable in this research is the Decision Tree Method, and the independent variable is decision making. The data used in the research is field research and observation, direct observation at PT. Ricakusuma Lestari Abadi.
   The results of this research produced a minimum yield for Colt Diesel Engkel (CDE) trucks of IDR 270,000 for the Jakarta Area in the AKU trucking category and IDR 382,500 for Bekasi destinations in the ATT trucking category. And the minimum yield on a Colt Diesel Double (CDD) truck is IDR 315,000 for the Jakarta Area with the AKU trucking category and IDR 472,500 for Bekasi with the ATT trucking category.

1. INTRODUCTION

   Transportation options are very important in the business sector. Without means of transportation, no business, whatever its form or industry, but especially in the commercial sector, cannot possibly function properly to generate profits. As a result, Freight Forwarding emerged as a provider of transportation management services(Damayanti & Darmayanti, 2022). Using multimodal transportation that includes land, sea, and air, Freight Forwarding is a company that seeks to provide services and handle all operations necessary for shipping, transporting, and receiving goods. The role of freight forwarders in export imports is very large, including carrying out procedures and documentation formalities required by the government regulations of the export country, transit countries and import countries, completing documents relating to the Letter of Credit/Certificate of Receipt/ Bill of Lading/Delivery Order and so on, and settle costs incurred as a result of transportation activities, cargo handling at the port/warehouse. The costs incurred by the sender will then be reimbursed by the customer plus service/reimbursement fees(Suryaningsih, 2021).

   Where one of the private companies operating in the field of freight forwarders is PT. Ricakusuma Lestari Abadi.Trucking activities carried out by PT. Ricakusuma Lestari Abadi is delivering goods from the port to the destination or vice versa. This is a challenge from PT. Ricakusuma Lestari Abadi means making large expenses at the company. For PT trucking services. Ricakusuma Lestari Abadi has trucks, namely Colt Diesel Double Trucks (CDD), Colt Diesel Engkel Trucks (CDE), Pick up Reefer and Fuso wingbox.

   The main problem being faced by PT. Ricakusuma Lestari Abadi is that the high number of requests for delivery of goods is not balanced by the availability of sufficient number of vehicles and

truck capacity, then there is an inconsistency in the distribution/delivery schedule of goods every day. mTransportation problems in the form of the value of transportation costs, the number of vehicles available and the amount of demand at the destination for an item cannot always be known with certainty and can change from time to time. KThe non-optimization that occurs in the delivery fleet is caused by limited fleet capacity which causes delivery activities to be inefficient in terms of time and cost.

It is necessary to calculate the costs from the data above for the objectives to be achieved in this research, namely: (1) To find out the application of the Decision tree method at PT. Ricakusuma Lestari Abadi. (2) To find out the decision making choices in using trucking services at PT. Ricakusuma Lestari Abadi.

2. LITERATURE REVIEW

a. Management

According to Wilson and Gilligan (2012) inJhuji (2020) Management is a collection of activities carried out by members of an organization to achieve its goals. According to (Manaf, 2001) inShaban (2022) Management is work that plans, organizes, directs and directs activities within an organization to achieve organizational goals effectively and efficiently

b. Understanding Decision Tree

According to (Widodo et al., 2013) inIriadi (2021)Decision trees are a well-known data mining technique and one of the most popular ways to make decisions in a case. Because this method does not require prior management knowledge and can easily solve large cases. Accuracy is very good as long as the data used as a reference is correct information. According to Kusrini & Luthfi (2009) inFadli & Butar (2019)A very effective and well-known technique for categorization and prediction is decision trees

c. Decision-Making

According to J. Winardi (2004) inNuryanto & Hidayana (2021)states that "Decision making is a process in which people must choose between various groups of alternative actions". According to Siagian (1985:83) inDwiyanti & Adisanjaya (2022)"Decision making is essentially a systematic approach to a problem, collecting facts and data, determining alternatives carefully and acting according to calculations is the most appropriate action.

d. Quantitative Method

QM is an abbreviation for Quantitative Method, software found in operations management textbooks. This application is a combination of QM and POM, compared to POM Windows, QM for Windows has more modules available(Budianti et al., 2020). According to Sarjono (2011) in Haryanti (2019) QM software for Windows is software designed to perform the calculations that management needs to make production and marketing decisions. This software was developed by Howard J. Weiss in 1996 to specifically assist production managers in creating estimates and budgets for the production of everything from raw materials to finished or semi-finished products in the manufacturing process.

3. METHOD

a. Data

The type of research used is descriptive techniques with a quantitative approach as the research methodology. According to Sugiyono, (2012) inEffendy & Sunarsi (2020) "Data collection techniques are the most important step in research, because the main aim of research is to obtain data, without knowing data collection techniques, researchers cannot obtain data that is in accordance with predetermined data standards." According to Sugiyono (2013:193) inTriputranto (2020)Primary data is information that has been collected directly from the original source. The

techniques for collecting data are carried out in 2 ways, namely Field Research and Observation by collecting observation data directly at PT. Ricakusuma Lestari Abadi.

According to Sugiyono (2013:62) inTriputranto (2020) Datasecondary is information that does not directly provide information to researchers; for example, research may need to be done through other people or document searches.The technique for collecting data is carried out in 2 ways, namely literature review which is references from journals published in the last 5 years. and library research. The order demand report is for 1 (one) year (from January 2022 to December 2022), which in this case shows how much demand for trucks by consumers is in each period.

According to (Swarjana, 2015) inSetiawati (2019)Sampling technique is sampling to determine the samples that will be used in research.In this study the population is trucking operational costs. According to(Sugiyono, 2013:81) inSilaban et al. (2019).The sample must meet the required standards, the ideal sample size of participants is determined by the desired level of imprecision. In this study the sample is vendor trucking costs This research aims to overcome this problem by using a Decision tree, and meanwhile for data analysis using the Decision Analysis method and to make it more effective and efficient, Information Technology is used in the form of Quantitative Method (QM) For Windows 5 software.

b. Operational Variables

Operational research variables explain the types of variables and descriptions of the variables studied in the form of variable names, sub-variables, variable indicators, variable sizes and measurement scales used by researchers, according to Sugiyono (2017:38) inFajri et al. (2022)argues that a variable is anything in whatever form that the researcher chooses to study in order to learn more about it before drawing conclusions.

Table 1.   Variable Grid

Stages	Definition	Method
Maximax (Optimistic)	Find the maximum value of each maximum payoff alternative.	*Decision Analysis* / Decision Analysis
Maximin (Pessimistic)	Find the maximum value of each minimum payoff alternative.	*Decision Analysis* / Decision Analysis
Hurwicz Criteria	Find the value between Maximax (Optimistic) & Maximin (Pessimistic). In this decision criteria principle, decision making is not completely optimistic.	*Decision Analysis* / Decision Analysis
Equal Likelihood	Finds the value in each basic condition which has the same probability of occurring.	*Decision Analysis* / Decision Analysis
Minimax Regret	Find the maximum outcome value from each condition, then subtract the alternative outcome from each economic situation. After that, choose the minimum value from the maximum payoff alternative	*Decision Analysis* / Decision Analysis
EMV (Expected Monetary Value)	is a breakthrough to find out the amount of payoff that occurs, where there is a formulation contained therein	*Decision Trees* /Decision Tree

c. Data Analysis Method

Decision making under uncertainty using Decision Tables.

a. *Maximax (Optimistic)*: find the maximum value of each maximum payoff alternative.
b. *Maximin (Pessimistic)*: find the maximum value of each minimum payoff alternative.
c. *Hurwicz Criteria*: find the value between Maximax (Optimistic) & Maximin (Pessimistic). In this decision criteria principle, decision making is not completely optimistic.

d. *Equal Likelihood*: find a value in each basic condition that has the same probability of occurring.

e. *Minimax Regret*: finding the maximum outcome value from each condition, then subtracting the alternative outcome from each economic situation. After that, choose the minimum value from the maximum payoff alternative.

Risky decision making using Decision Tree

a. Expected Monetary Value (EMV)

4. RESULTS AND DISCUSSION

In determining the best decision, the company has two alternatives to maximize company profits, namely using private trucking services or using trucking services. In these two alternatives, requests for truck orders are obtained within a one year period, namely January 2022 to December 2022 from 2 vendors each, namely Jakarta Area and Tangerang. By using the services of two trucking companies, namely AKU trucking and ATT trucking. These two alternatives can be calculated and compared using the Decision Analysis and Decision Tree methods. To compare the results of the two alternatives using the Decision Analysis and Decision Tree methods, they can be processed using the Quantitative Method (QM) for Windows 5 software.

4.1. Decision Analysis

Table 2.   PT Ricakusuma Lestari Abadi Truck Colt Diesel Engkel (CDE) Solution-Jakarta Area

	Bad Economy	Bad Economy
Probabilities	0.5	0.5
Private Trucking	Rp. 850,000	-Rp. 85,000
Trucking ME	Rp. 600,000	-Rp. 60,000
Trucking ATT	Rp. 750,000	-Rp. 75,000

Table 3.   PT Ricakusuma Lestari Abadi Colt Diesel Engkel (CDE) Solution Truck-Bekasi

	Bad Economy	Bad Economy
Probabilities	0.5	0.5
Private Trucking	Rp. 950,000	-Rp 95,000
Trucking ME	Rp. 900,000	-Rp 90,000
Trucking ATT	Rp. 850,000	-Rp. 85,000

To find the probability value for each unknown event, use the equal sign (=) then all probabilities will be set the same. This is Probability or percentage so it must be between 0 and 1. So the probability of good economic conditions is worth 0.5 and bad economic conditions are worth 0.5. A bad economy assumes a cost increase of 10% of the good economy price.
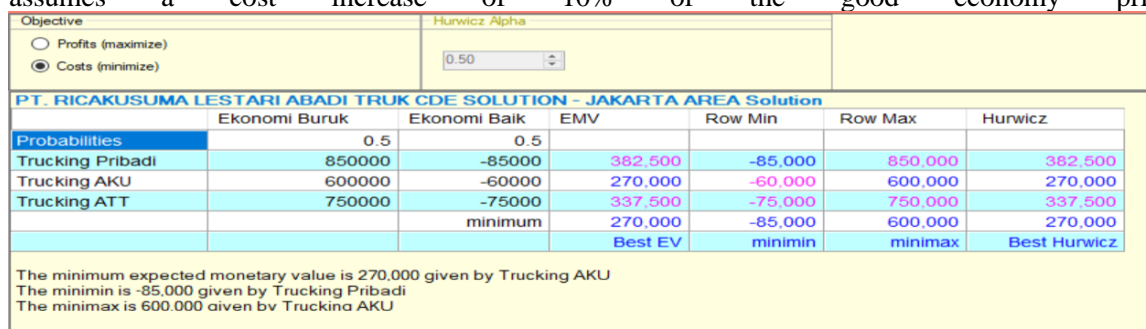
Objective			Hurwicz Alpha			
○ Profits (maximize)						
● Costs (minimize)			0.50 ⇕			

PT. RICAKUSUMA LESTARI ABADI TRUK CDE SOLUTION – JAKARTA AREA Solution

	Ekonomi Buruk	Ekonomi Baik	EMV	Row Min	Row Max	Hurwicz
Probabilities	0.5	0.5				
Trucking Pribadi	850000	-85000	382,500	-85,000	850,000	382,500
Trucking AKU	600000	-60000	270,000	-60,000	600,000	270,000
Trucking ATT	750000	-75000	337,500	-75,000	750,000	337,500
		minimum	270,000	-85,000	600,000	270,000
			Best EV	minimin	minimax	Best Hurwicz

The minimum expected monetary value is 270,000 given by Trucking AKU
The minimin is -85,000 given by Trucking Pribadi
The minimax is 600,000 given by Trucking AKU

Fig 1.   Maximax, Maximin and Hurwicz Criteria Destination Jakarta Area

The Maximax criteria takes the highest conditions from each city. From the table it can be seen that the highest condition is IDR 600,000 with the decision to use trucking services in the AKU

trucking category. Maximin's criteria takes the smallest decision from each condition of each city. From the table above, it can be seen that the highest minimum condition is – IDR 85,000 with the decision to use private trucking services. Hurwicz Criteria makes a decision to find a value between Maximax (Optimistic) & Maximin (Pessimistic). From the table above, it can be seen that the smallest minimum condition is IDR 270,000 with the decision to use trucking services in the AKU trucking category.

Table 4. 　　　 Equal Likelihood Criteria for Jakarta Area Destinations

Vendors	Calculation
Trucking Personal	(1/2) (Rp. 850,000) + (1/2) (-Rp. 85,000) = Rp. 425,000 – Rp. 42,500 = Rp. 382,500
TruckingI	(1/2) (Rp. 600,000) + (1/2) (-Rp. 60,000) = IDR 300,000 – IDR 30,000 = Rp. 270,000
Trucking ATT	(1/2) (Rp. 750,000) + (1/2) (-Rp. 75,000) = IDR 375,000 – IDR 37,500 = Rp. 337,500

Equal likelihood criteria There are two types of cost prospects (Good Economy and Bad Economy), so the probability of each is ½. From the calculations in the table above, it can be seen that the highest result is IDR 382,500 with the decision to use private trucking services.

Objective					Hurwicz Alpha	
○ Profits (maximize)					0.50	
◉ Costs (minimize)						

PT. RICAKUSUMA LESTARI ABADI TRUK CDE SOLUTION – JAKARTA AREA Solution

	Ekonomi Buruk Regret	Ekonomi Baik Regret	Maximum Regret	Expected Regret
Probabilities	.5	.5		
Trucking Pribadi	250,000	0	250,000	125,000
Trucking AKU	0	25,000	25,000	12,500
Trucking ATT	150,000	10,000	150,000	80,000
Minimax regret			25,000	

Fig 2. 　　　 Criteria for Minimax Regret Destination Jakarta Area

Then, from the 2 conditions for each city, the highest value is taken, then that is the Maximax Regret result, after that, among each city, the one with the lowest value is selected, then that is the decision result. From Figure 2, the smallest condition is IDR 25,000 by using a trucking service in the AKU trucking category

Objective					Hurwicz Alpha	
○ Profits (maximize)					0.50	
◉ Costs (minimize)						

PT. RICAKUSUMA LESTARI ABADI TRUK CDE SOLUTION - BEKASI Solution

	Ekonomi Baik	Ekonomi	EMV	Row Min	Row Max	Hurwicz
Probabilities	0.5	0.5				
Trucking Pribadi	950000	-95000	427,500	-95,000	950,000	427,500
Trucking AKU	900000	-90000	405,000	-90,000	900,000	405,000
Trucking ATT	850000	-85000	382,500	-85,000	850,000	382,500
		minimum	382,500	-95,000	850,000	382,500
			Best EV	minimin	minimax	Best Hurwicz

The minimum expected monetary value is 382,500 given by Trucking ATT
The minimin is -95,000 given by Trucking Pribadi
The minimax is 850,000 given by Trucking ATT

Fig 3. 　　　 Criteria Maximax, Maximin and Hurwicz Criteria Destination Bekasi

The Maximax criteria takes the highest conditions from each city. From the table it can be seen that the highest condition is IDR 850,000 with the decision to use trucking services in the ATT trucking category. Maximin's criteria takes the smallest decision from each condition of each city. From the table above, it can be seen that the highest minimum condition is – IDR 95,000 with the decision to use private trucking services. Hurwicz Criteria makes a decision to find a value between Maximax (Optimistic) & Maximin (Pessimistic). From the table above it can be seen that the smallest minimum condition is IDR 382,500 with the decision to use trucking services in the ATT trucking category.

Table 5.   Criteria for Equal Likelihood Destination Bekasi

Vendors	Calculation
Trucking Personal	(1/2) (Rp. 950,000) + (1/2) (-Rp. 95,000) = Rp. 475,000 – Rp. 47,500 = Rp. 427,500
TruckingI	(1/2) (Rp. 900,000) + (1/2) (-Rp. 90,000) = Rp. 450,000 – Rp. 45,000 = Rp. 405,000
Trucking ATT	(1/2) (Rp. 850,000) + (1/2) (-Rp. 85,000) = Rp. 425,000 – Rp. 42,500 = Rp. 382,500

Equal likelihood criteria There are two types of cost prospects (Good Economy and Bad Economy), so the probability of each is ½. From the calculations in the table above, it can be seen that the highest result is IDR 427,500 with the decision to use private trucking services.
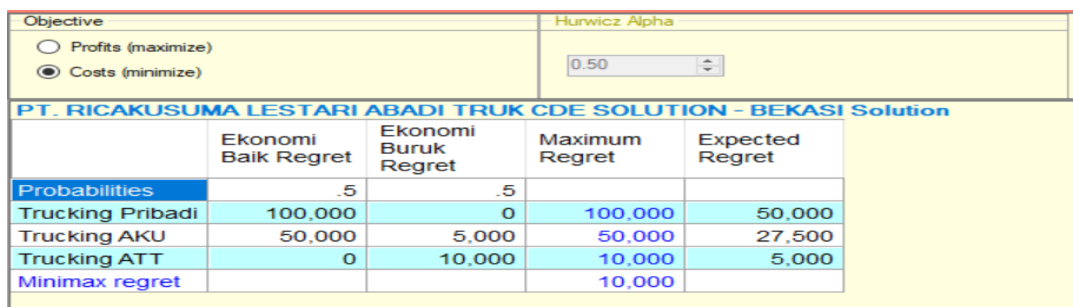
Objective		Hurwicz Alpha		
○ Profits (maximize)				
◉ Costs (minimize)		0.50		

PT. RICAKUSUMA LESTARI ABADI TRUK CDE SOLUTION – BEKASI Solution

	Ekonomi Baik Regret	Ekonomi Buruk Regret	Maximum Regret	Expected Regret
Probabilities	.5	.5		
Trucking Pribadi	100,000	0	100,000	50,000
Trucking AKU	50,000	5,000	50,000	27,500
Trucking ATT	0	10,000	10,000	5,000
Minimax regret			10,000	

Fig 4.   Minimax Criteria for Bekasi Destination Regret

Then, from the 2 conditions for each city, the highest value is taken, then that is the Maximax Regret result, after that, among each city, the one with the lowest value is selected, then that is the decision result. From Figure 4, the smallest condition can be obtained, namely IDR 10,000 by using a trucking service in the ATT trucking category.

Table 6. PT Ricakusuma Lestari Abadi Colt Diesel Double (CDD) Truck Solution-Jakarta Area

	Bad Economy	Bad Economy
Probabilities	0.5	0.5
Private Trucking	Rp. 950,000	-Rp 95,000
Trucking ME	Rp. 700,000	-Rp. 70,000
Trucking ATT	Rp. 850,000	-Rp. 85,000

Table 7.   PT Ricakusuma Lestari Abadi Truck Colt Diesel Double (CDD) Solution-Bekasi

	Bad Economy	Bad Economy
Probabilities	0.5	0.5
Private Trucking	IDR 1,120,000	-Rp 95,000
Trucking ME	IDR 1,150,000	-Rp 90,000
Trucking ATT	IDR 1,050,000	-Rp 85,000

To find the probability value for each unknown event, use the equal sign (=) then all probabilities will be set the same. This is Probability or percentage so it must be between 0 and 1. So the probability of good economic conditions is worth 0.5 and bad economic conditions are worth 0.5. A bad economy assumes a cost increase of 10% of the good economy price.

	Ekonomi Baik	Ekonomi Buruk	EMV	Row Min	Row Max	Hurwicz
Probabilities	0.5	0.5				
Trucking Pribadi	950000	-95000	427,500	-95,000	950,000	427,500
Trucking AKU	700000	-70000	315,000	-70,000	700,000	315,000
Trucking ATT	850000	-85000	382,500	-85,000	850,000	382,500
		minimum	315,000	-95,000	700,000	315,000
			Best EV	minimin	minimax	Best Hurwicz

The minimum expected monetary value is 315,000 given by Trucking AKU
The minimin is -95,000 given by Trucking Pribadi
The minimax is 700,000 given by Trucking AKU

Fig 5. Maximaz, Maximin and Hurwicz Criteria Destination Jakarta Area

The Maximax criteria takes the highest conditions from each city. From the table it can be seen that the highest condition is IDR 700,000 with the decision to use trucking services in the AKU trucking category. Maximin's criteria takes the smallest decision from each condition of each city. From the table above, it can be seen that the highest minimum condition is – IDR 95,000 with the decision to use private trucking services. Hurwicz Criteria makes a decision to find a value between Maximax (Optimistic) & Maximin (Pessimistic). From the table above, it can be seen that the smallest minimum condition is IDR 315,000 with the decision to use trucking services in the AKU trucking category.

Table 8. Equal Likelihood Criteria for Jakarta Area Destinations

Vendors	Calculation
Trucking Personal	(1/2) (Rp. 950,000) + (1/2) (-Rp. 95,000) = Rp. 475,000 – Rp. 47,500 = Rp. 427,500
TruckingI	(1/2) (Rp. 700,000) + (1/2) (-Rp. 70,000) = Rp. 350,000 – Rp. 35,000 = Rp. 315,000
Trucking ATT	(1/2) (Rp. 850,000) + (1/2) (-Rp. 85,000) = Rp. 425,000 – Rp. 42,500 = Rp. 382,500

Equal likelihood criteria There are two types of cost prospects (Good Economy and Bad Economy), so the probability of each is ½. From the calculations in the table above, it can be seen that the highest result is IDR 427,500 with the decision to use private trucking services.

	Ekonomi Baik Regret	Ekonomi Buruk Regret	Maximum Regret	Expected Regret
Probabilities	.5	.5		
Trucking Pribadi	250,000	0	250,000	125,000
Trucking AKU	0	25,000	25,000	12,500
Trucking ATT	150,000	10,000	150,000	80,000
Minimax regret			25,000	

Fig 6. Criteria for Minimax Regret Destination Jakarta Area

Then, from the 2 conditions for each city, the highest value is taken, then that is the Maximax Regret result, after that, among each city, the one with the lowest value is selected, then that is the decision result. From Figure 6, the smallest condition is Rp. 25,000 by using a trucking service in the AKU trucking category.

Objective	Hurwicz Alpha
○ Profits (maximize)	
● Costs (minimize)	0.50

PT. RICAKUSUMA LESTARI ABADI TRUK CDD SOLUTION - BEKASI Solution						
	Ekonomi Baik	Ekonomi Buruk	EMV	Row Min	Row Max	Hurwicz
Probabilities	0.5	0.5				
Trucking Pribadi	1200000	-120000	540,000	-120,000	1,200,000	540,000
Trucking AKU	1150000	-115000	517,500	-115,000	1,150,000	517,500
Trucking ATT	1050000	-105000	472,500	-105,000	1,050,000	472,500
		minimum	472,500	-120,000	1,050,000	472,500
			Best EV	minimin	minimax	Best Hurwicz

The minimum expected monetary value is 472,500 given by Trucking ATT
The minimin is -120,000 given by Trucking Pribadi
The minimax is 1,050,000 given by Trucking ATT

Fig 7.   Maximax, Maximin and Hurwicz Criteria Destination Bekasi

The Maximax criteria takes the highest conditions from each city. From the table it can be seen that the highest condition is IDR 1,050,000 with the decision to use trucking services in the ATT trucking category. Maximin's criteria takes the smallest decision from each condition of each city. From the table above, it can be seen that the highest minimum condition is – IDR 120,000 with the decision to use private trucking services. Hurwicz Criteria makes a decision to find a value between Maximax (Optimistic) & Maximin (Pessimistic). From the table above, it can be seen that the smallest minimum condition is IDR 472,500 with the decision to use trucking services in the ATT trucking category.

Table 9.   Equal Likelihood Criteria Destination Bekasi

Vendors	Calculation
Trucking Personal	(1/2) (Rp. 1,200,000) + (1/2) (-Rp. 120,000) = Rp. 600,000 – Rp. 60,000 = Rp. 540,000
TruckingI	(1/2) (Rp. 1,150,000) + (1/2) (-Rp. 115,000) = Rp. 575,000 – Rp. 57,500 = Rp. 517,500
Trucking ATT	(1/2) (Rp. 1,050,000) + (1/2) (-Rp. 105,000) = Rp. 525,000 – Rp. 52,500 = Rp. 472,500

Equal likelihood criteria There are two types of cost prospects (Good Economy and Bad Economy), so the probability of each is ½. From the calculations in the table above, it can be seen that the highest result is IDR 427,500 with the decision to use private trucking services.

Objective	Hurwicz Alpha
○ Profits (maximize)	
● Costs (minimize)	0.50

PT. RICAKUSUMA LESTARI ABADI TRUK CDD SOLUTION - BEKASI Solution				
	Ekonomi Baik Regret	Ekonomi Buruk Regret	Maximum Regret	Expected Regret
Probabilities	.5	.5		
Trucking Pribadi	150,000	0	150,000	75,000
Trucking AKU	100,000	5,000	100,000	52,500
Trucking ATT	0	15,000	15,000	7,500
Minimax regret			15,000	

Fig 8.   Minimax Criteria for Bekasi Destination Regret

Then, from the 2 conditions for each city, the highest value is taken, then that is the Maximax Regret result, after that, among each city, the one with the lowest value is selected, then that is the decision result. From Figure 8, the smallest condition can be obtained, namely IDR 15,000 by using a trucking service in the ATT trucking category.

4.2. Decision Trees

a. Expected Monetary Value (EMV), Decision Tree Model to Get the Best Delivery Method for Colt Diesel Engkel (CDE) trucks Destination to the Jakarta Area

- Delivery uses transportation belonging to PT. Ricakusuma Lestari Abadi
  EMV (private trucking) = (0.5) (Rp. 850,000) + (0.5) (-Rp. 85,000)
                      = IDR 425,000 – IDR 42,500 = IDR 382,500

- Delivery using trucking services
 EMV (trucking AKU) = (0.5) (Rp. 600,000) + (0.5) (-Rp. 60,000)
   = IDR 300,000 – IDR 30,000 = IDR 270,000
- Delivery using trucking services
 EMV (trucking ATT) = (0.5) (Rp. 750,000) + (0.5) (-Rp. 75,000)
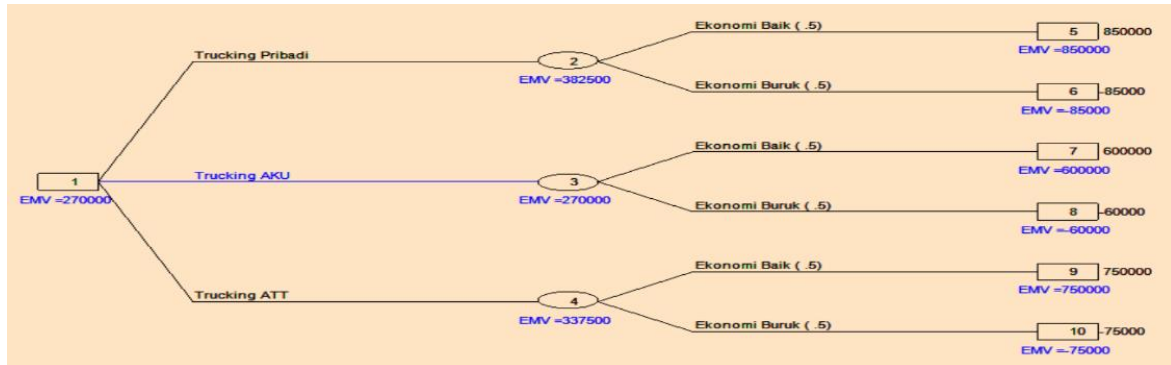
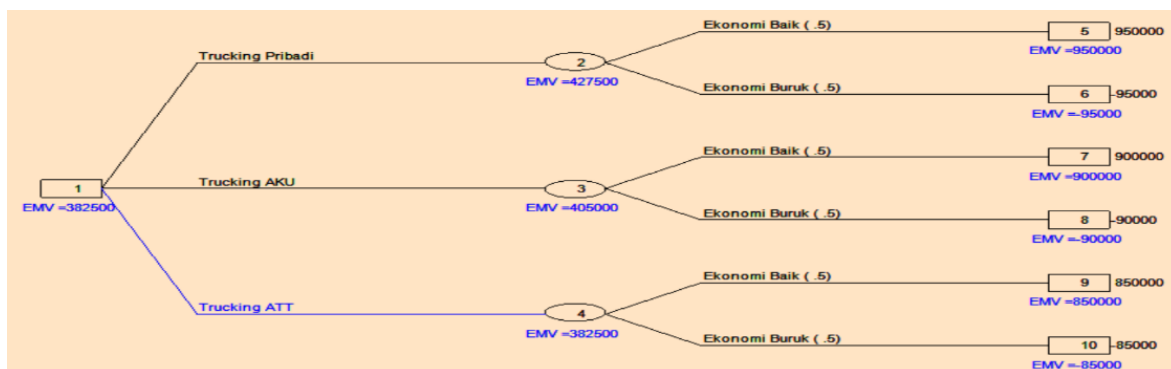   = IDR 375,000 – IDR 35,000 = IDR 337,500

Fig 9.   Decision Tree

The final stage to determine the decision point that the company can choose is to choose the branch that produces the lowest Expected Monetary Value (EMV) value from the previous Expected Monetary Value (EMV) calculation, namely using PT's transportation. Ricakusuma Lestari Abadi and trucking services. The decision choice is to use trucking services in the AKU trucking category, because it produces the lowest Expected Monetary Value (EMV).

b. Expected Monetary Value (EMV), Decision Tree Model to Get the Best Delivery Method for Colt Diesel Engkel (CDE) trucks Destination to Bekasi

- Delivery uses transportation belonging to PT. Ricakusuma Lestari Abadi
 EMV (private trucking) = (0.5) (Rp. 950,000) + (0.5) (-Rp. 95,000)
   = IDR 475,000 – IDR 47,500 = IDR 427,500

- Delivery using trucking services

 EMV (trucking AKU) = (0.5) (Rp. 900,000) + (0.5) (-Rp90,000)
   = IDR 450,000 – IDR 45,000 = IDR 405,000

- Delivery using trucking services

 EMV (trucking ATT) = (0.5) (Rp. 850,000) + (0.5) (-Rp. 85,000)

   = IDR 425,000 – IDR 42,500 = IDR 382,500

Fig 10.   Decision Tree

The final stage to determine the decision point that the company can choose is to choose the branch that produces the lowest Expected Monetary Value (EMV) value from the previous Expected Monetary Value (EMV) calculation, namely using PT's transportation. Ricakusuma Lestari Abadi and trucking services. The decision choice is to use trucking services in the ATT trucking category, because it produces the lowest Expected Monetary Value (EMV).

c. **Expected Monetary Value (EMV), Decision Tree Model to Get the Best Delivery Method for Colt Diesel Double (CDD) trucks Destination to the Jakarta Area**

- Delivery uses transportation belonging to PT. Ricakusuma Lestari Abadi
  EMV (private trucking) = (0.5) (Rp. 950,000) + (0.5) (-Rp95,000)
  = IDR 475,000 – IDR 47,500 = IDR 427,500
- Delivery using trucking services
  EMV (trucking AKU) = (0.5) (Rp. 700,000) + (0.5) (-Rp. 70,000)
  = IDR 350,000 – IDR 35,000 = IDR 315,000
- Delivery using trucking services
  EMV (trucking ATT) = (0.5) (Rp. 850,000) + (0.5) (-Rp. 85,000)

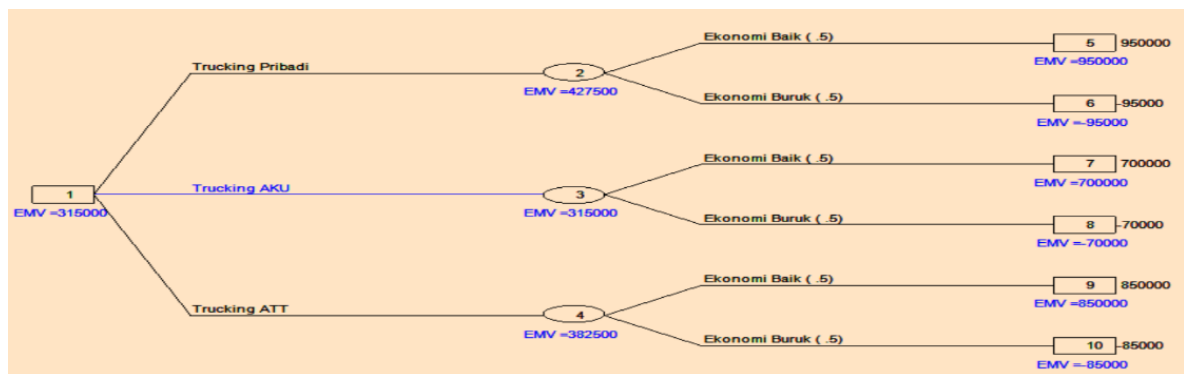 = IDR 425,000 – IDR 42,500 = IDR 382,500

Fig 11.   Decision Tree

The final stage to determine the decision point that the company can choose is to choose the branch that produces the lowest Expected Monetary Value (EMV) value from the previous Expected Monetary Value (EMV) calculation, namely using PT's transportation. Ricakusuma Lestari Abadi and trucking services. The decision choice is to use trucking services in the AKU trucking category, because it produces the lowest Expected Monetary Value (EMV).

d. **Expected Monetary Value (EMV), Decision Tree Model to Get the Best Delivery Method for Colt Diesel Double (CDD) trucks Destination to Bekasi**

- Delivery uses transportation belonging to PT. Ricakusuma Lestari Abadi
  EMV (private trucking) = (0.5) (Rp. 1,200,000) + (0.5) (-Rp. 120,000)
  = IDR 600,000 – IDR 60,000 = IDR 540,000
- Delivery using trucking services
  EMV (trucking AKU) = (0.5) (Rp. 1,150,000) + (0.5) (-Rp. 115,000)
  = IDR 575,000 – IDR 57,500 = IDR 517,500
- Delivery using trucking services
  EMV (trucking ATT) = (0.5) (Rp. 1,050,000) + (0.5) (-Rp. 105,000)

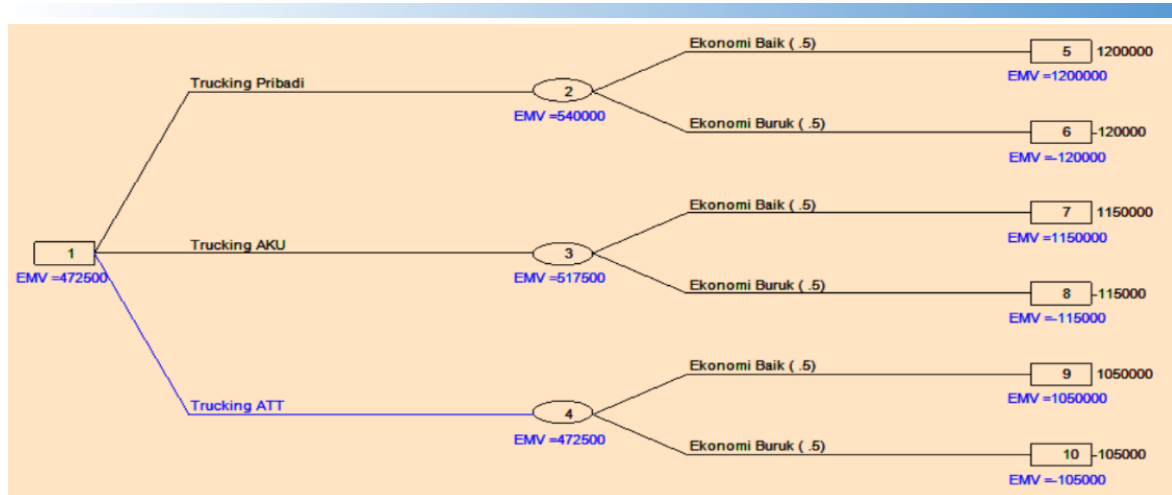 = IDR 525,000 – IDR 52,500 = IDR 472,500

Fig 12. Decision Tree

The final stage to determine the decision point that the company can choose is to choose the branch that produces the lowest Expected Monetary Value (EMV) value from the previous Expected Monetary Value (EMV) calculation, namely using PT's transportation. Ricakusuma Lestari Abadi and trucking services. The decision choice is to use trucking services in the ATT trucking category, because it produces the lowest Expected Monetary Value (EMV)

4.3. Implications of the Selected Solution

Table 10. Results of Cold Diesel Engkel (CDE) truck decisions between each alternative using Decision Analysis and Decision Tree

Criteria	Cold Diesel Engkel (CDE) truck decision results		
	Trucking Personal	TruckingI	TruckingATT
	Decision Analysis		
Maximax	*Jakarta Area*		
	Rp. 850,000	Rp. 600,000	Rp. 750,000
	Bekasi		
	Rp. 950,000	Rp. 900,000	Rp. 850,000
Maximin	*Jakarta Area*		
	(Rp. 85,000)	(Rp. 60,000)	(Rp. 75,000)
	Bekasi		
	(Rp 95,000)	(Rp 90,000)	(Rp. 85,000)
Hurwicz Criteria	*Jakarta Area*		
	Rp. 382,500	Rp270,000	Rp. 337,500
	Bekasi		
	Rp. 427,500	Rp405,000	Rp. 382,500
Equal Likelihood	*Jakarta Area*		
	Rp. 382,500	Rp. 270,000	Rp. 337,500
	Bekasi		
	Rp. 427,500	Rp. 405,000	Rp. 382,500

Criteria	Cold Diesel Engkel (CDE) truck decision results		
	Trucking Personal	TruckingI	TruckingATT
	Decision Analysis		
Minimax Regret	*Jakarta Area*		
	Rp. 250,000	Rp25,000	Rp. 150,000
	Bekasi		
	Rp. 100,000	Rp50,000	Rp. 10,000
	Decision Trees		
Expected Monetary Value(EMV)	*Jakarta Area*		
	Rp. 382,500	IDR 270,000	Rp. 337,500
	Bekasi		
	Rp. 427,500	IDR 405,000	Rp. 382,500

Table 11.   Decision Results for Cold Diesel Double (CDD) Trucks Between Each Alternative Using Decision Analysis and Decision Tree

Criteria	Cold Diesel Engkel (CDE) truck decision results		
	Trucking Personal	TruckingI	TruckingATT
	Decision Analysis		
Maximax	*Jakarta Area*		
	Rp. 950,000	Rp. 700,000	Rp. 850,000
	Bekasi		
	Rp. 1,200,000	Rp. 1,150,000	Rp. 1,050,000
Maximin	*Jakarta Area*		
	(Rp 95,000)	(Rp 70,000)	(Rp 85,000)
	Bekasi		
	(Rp. 120,000)	(Rp. 115,000)	(Rp. 105,000)
Hurwicz Criteria	*Jakarta Area*		
	Rp. 427,500	Rp. 315,000	Rp. 382,500
	Bekasi		
	Rp. 540,000	Rp. 571,000	Rp. 472,000
Equal Likelihood	*Jakarta Area*		
	Rp. 427,500	Rp. 315,000	Rp. 382,500
	Bekasi		
	Rp. 540,000	Rp. 571,000	Rp. 472,500
Minimax Regret	*Jakarta Area*		
	Rp. 250,000	Rp. 25,000	Rp. 150,000
	Bekasi		

Criteria	Cold Diesel Engkel (CDE) truck decision results		
	Trucking Personal	**TruckingI**	**TruckingATT**
	Decision Analysis		
	Rp. 150,000	**Rp. 100,000**	**Rp. 15,000**
	Decision Trees		
Expected Monetary Value(EMV)	***Jakarta Area***		
	Rp. 427,500	**Rp. 315,000**	**Rp. 382,500**
	Bekasi		
	Rp. 540,000	**Rp. 517,500**	**Rp. 472,500**

Table 10 Results of the profit value of Cold Diedel Engkel (CDE) trucks based on operational costs obtained using the maximax criteria are IDR 600,000 for the Jakarta Area with the decision to use trucking services in the AKU trucking category and IDR 850,000 for the Bekasi destination with the decision to use the services trucking with the ATT trucking category, the maximum criteria is -Rp. 85,000 for the Jakarta Area and -Rp. ,500 destination Bekasi with the decision to use trucking services in the ATT trucking category, equal likelihood criteria of IDR 382,500 destination Jakarta Area and IDR 427,500 destination Bekasi with the decision to use private trucking services, and minimax regret criteria of IDR 25,000 destination Jakarta Area with decision to use trucking services in the AKU trucking category and Rp. 10,000 for Bekasi destination with the decision to use trucking services in the ATT trucking category.

For testing using the Decision Tree, the best decision result for the company was to use trucking services in the AKU trucking category with an Expected Monetary Value (EMV) value of IDR 270,000 for the Jakarta Area and IDR 382,500 for the Bekasi destination using trucking services in the trucking category ATT from calculations using the Decision Tree model.

Table 11 Results of the profit value of Cold Diesel Double (CDD) trucks based on operational costs obtained using the maximax criteria are IDR 700,000 for the Jakarta Area with the decision to use trucking services in the AKU trucking category and IDR 1,050,000 for the Bekasi destination with the decision to use services. trucking with the ATT trucking category, the maximum criteria is -Rp. 95,000 for the Jakarta Area and -Rp. 120,000 Using private trucking services, the hurwicz criteria is Rp. 315,000 for the Jakarta Area with the decision to use trucking services with the AKU trucking category and the amount is Rp. destination Bekasi with the decision to use trucking services in the ATT trucking category, the equal likelihood criteria is IDR 427,500 destination Jakarta Area and IDR 540,000 destination Bekasi with the decision to use private trucking services, and the minimax regret criteria is IDR 25,000 destination Jakarta Area with the decision to use trucking services in the AKU trucking category and Rp. 15,000 for Bekasi with the decision to use trucking services in the ATT trucking category.

For testing using the Decision Tree, the best decision for the company was to use a private trucking service with an Expected Monetary Value (EMV) value of IDR 315,000 for the Jakarta Area with the decision to use a trucking service in the AKU trucking category and IDR 472,500 for the Bekasi destination. with the decision to use trucking services with the ATT trucking category from calculations using the Decision Tree model.

5. CONCLUSION

The implementation of the Decision tree uses the data management application Quantitative Method (QM) Software for Windows 5 to make Expected Monetary Value (EMV) decisions.

Decision making in using trucking services uses the results of Quantitative Method (QM) Software For Windows 5 data processing, where this research data uses 2 vendor comparisons and 2 destination comparisons, namely the Jakarta Area and Bekasi. With a minimum yield on Colt Diesel

Engkel (CDE) trucks of IDR 270,000 for the Jakarta Area using trucking services in the AKU trucking category and IDR 382,500 for Bekasi destinations using trucking services in the ATT trucking category. And the minimum yield on a Colt Diesel Double (CDD) truck is IDR 315,000 for the Jakarta Area with the decision to use trucking services in the AKU trucking category and IDR 472,500 for bekasi with the decision to use trucking services in the att trucking category.

REFERENCES

[1]   Damayanti, NME, & Darmayanti, NPA (2022). The Influence of Company Size, Liquidity, Profitability, and Capital Structure on the Value of Transportation and Logistics Companies. Udayana University Management E-Journal, 11(8), 1462. https://doi.org/10.24843/ejmunud.2022.v11.i08.p02

[2]   Dwiyanti, NMC, & Adisanjaya, K. (2022). Decision Making for New PTS Students in Bali in Choosing a Tourism Study Program during the Covid-19 pandemic. JIIP - Scientific Journal of Educational Sciences, 5(1), 139–147. https://doi.org/10.54371/jiip.v5i1.402

[3]   Effendy, AA, & Sunarsi, D. (2020). Student Perceptions of the Ability to Establish MSMEs and the Effectiveness of Online Promotion in South Tangerang City. MEA Scientific Journal (Management, Economics and Accounting), 4(3), 702–714. http://journal.stiemb.ac.id/index.php/mea/article/view/571/248

[4]   Fadli, F., & Butar, BB (2019). Implementation of a Decision Tree Using the C4.5 Algorithm for Dengue Fever Detection in Hospitals. IMC Bintaro. Indonesian Journal on Software Engineering (IJSE), 5(1), 75–86. https://doi.org/10.31294/ijse.v5i1.5866

[5]   Fajri, C., Amelya, A., & Suworo, S. (2022). The Influence of Job Satisfaction and Work Discipline on PT Employee Performance. Indonesia Applicad. JIIP - Scientific Journal of Educational Sciences, 5(1), 369–373. https://doi.org/10.54371/jiip.v5i1.425

[6]   Haryanti, D., Phalipi, S., & Hamzah, MI (2019). Analysis of Forecasting Guitar Production Results Using the Apx500ii Model in January 2015 at PT Yamaha Music Manufacturing Indonesia (Forecasting and QM Methods for Windows). JEBI | Indonesian Journal of Business Economics, 14(01), 69–76. https://doi.org/10.36310/jebi.v14i01.126

[7]   Iriadi, N., Setioningtias, L., & Priatno, P. (2021). Implementation of Data Mining in Employee Absence Classification Using the C4.5 Method. Computer Science (CO-SCIENCE), 1(1), 53–61. https://doi.org/10.31294/coscience.v1i1.198

[8]   Jhuji, E.a. (2020). Definition, Scope of Management and Leadership in Islamic Education. Indonesian Journal of Educational Literacy, 1(2), 113.

[9]   Nuryanto, & Hidayana, A. (2021). Application of Logistics Information Systems in Decision Making Using Trucking Services for Partners of Pt. Samudera Bandar Logistik Jakarta. Gema Maritim Scientific Magazine, 23(1), 32–38. https://doi.org/10.37612/gema-maritim.v23i1.120

[10]   Setiawati, I. (2019). Effectiveness of Effleurage Massage Techniques and Relaxation Techniques for Back Pain in Third Trimester Pregnant Women. Proceedings of the National Seminar on Poltekkes Karya Husada Yogyakarta, 2. http://jurnal.poltekkeskhjogja.ac.id/index.php/PSN/article/view/351

[11]   Silaban, SE, Elisabeth, E., & Sagala, R. (2019). The Influence of Promotion, Price and Product Innovation on Purchasing Decisions at Kentucky Fried Chicken (Kfc) Simpang Mataram Medan. Journal of Accounting & Finance Research, 5(2), 209–228. https://doi.org/10.54367/jrak.v5i2.534

[12]   Suryaningsih, L. (2021). The Role of Insurance in Shipping Imported Goods Using Air Freight Forwarding. Aviation : Aerospace Scientific Journal, 17(2), 111–123. https://doi.org/10.52186/aviation.v17i2.64

[13]   Syaban, M. (2022). Basic Concepts Of Islamic Education Management Marwan Syaban. Journal of Women, Gender and Religion Studies, 12 Number 2, 131–141.

Triputranto, A. (2020). The Influence of Price on Purchase Decisions for E-Culse Transactions (Case study at Indomaret Sudirman Tangerang). Journal of Business Disruption: Scientific Journal of Management Study Program, Faculty of Economics, Pamulang University, 3(2), 1. https://doi.org/10.32493/drb.v3i2.6292