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Research Article

Trend Analysis in Sales Forecasting and Decision Support Systems AHP Method on the Selection of Types of Motorcycles PT. AHM

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ABSTRACT

During the current Covid-19 pandemic, it has a direct impact on decreasing motorcycle sales at PT. Astra Honda Motor in large enough numbers, resulting in losses for the company. This study aims to analyze the forecasting of motorcycle sales in the future and supported by a decision support system in selecting the type of motorbike that consumers are most interested in. The method used in this research is the Trend method and the Analytical Hierarchy Process (AHP) method. The results of this study are based on the mean square error analysis, sales forecasting method at PT. Astra uses exponential trend analysis. The results of forecasting sales for the next 2 periods using the exponential trend analysis method are 2,715,032 units and 2,671,937 units, the sales levels tend to be the same as sales in the 2020 period. Meanwhile, the results of the decision support system analysis use the Analytical Hierarchy Process method (AHP), in choosing the type of motorbike that consumers are most interested in is an automatic motorbike at 0.63 with the preferred alternative is the fuel consumption aspect of 0.36.

Keywords: *Analytical Hierarchy Process (AHP), Decision Support Systems, Forecasting, Trend Analysis*

Background

In early 2020, the COVID-19 pandemic began to enter Indonesia. Many aspects of life are affected, one of which is the manufacturing industry. The impact of the Covid-19 pandemic on motorcycle sales in 2020 experienced a considerable decline, where sales in 2020 were only 3,660,616 units, very far below the average motorcycle sales in the last 10 years. The decline in sales figures was also experienced by PT. Astra Honda Motor, even based on data from AISI, Honda motorcycle sales in May 2020 were lower than its competitor, Suzuki [1].

During the current covid-19 pandemic, it is important for companies to be able to recover

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from unstable market conditions, the Company needs to forecast motorcycle sales in the next few years. Referring to several research journals that have been carried out, in doing a forecast using the trend analysis method [2-6]. Trend forecasting analysis can be used by PT. Astra Honda Motor to forecast motorcycle sales in the next few years.

In order to support the company in evaluating the results of sales forecasting in the coming year period, a decision support system is needed for companies in analyzing the types of motorcycles that are most in demand by consumers. Based on several research journals that have been carried out, one method that can be used in analyzing decision support systems is the Analytical Hierarchy Process (AHP) method [7-11]. This method can be applied to PT. Astra Honda Motor in analyzing decision support systems on the selection of the type of motorcycle that is most in demand by consumers.

Literature Review

Forecasting

Forecasting is a step to measure or estimate the state of the business in the future [13]. Sales forecasting is an estimate of sales that will occur in the future and under certain conditions and is made based on data that has occurred and may occur.

There are several types of forecasting as follows [14]:

1) *Economic forecasting* is about the business cycle by predicting the inflation rate, the money supply, housing development, and other indicators.
2) *Technological forecasting* is related to the level of development in technology, where technology can result in the creation of new, more attractive products that require new plants and equipment.
3) *Demand forecasting* is a projection of the demand for products or services from the company. Forecasting drives decisions so managers need fast and accurate information about actual demand levels.

Forecating Methods

1) *Qualitative forecasting* is a forecasting that combines several factors such as intuition in decision making, emotions, personal experiences, and value systems.
2) *Decision of the opinion of the executive jury,* In this method the opinions of experts or a group of managers are often combined with statistical models, and then aggregated to obtain predictions of group demand.
3) *Delphi method* is a forecasting technique that uses a group process, where experts make forecasts as follows:
   - Combination or combination of sales force, this forecasting method optimizes the number of sales in a particular region, this forecast is then reviewed to ensure whether the forecast is realistic enough, then combined at regional and national levels to obtain an overall forecast.
   - Consumer market research, this forecasting method asks for input from consumers regarding their purchase plans in the future.
4) *Quantitative forecasting* is forecasting that uses one or more mathematical models with past data and causal variables to forecast demand. There are five methods in the quantitative method, namely the naive approach method, the moving average method, the exponential smoothing method, trend smoothing, and linear regression. Basically this quantitative method is divided into two:
   - Forecasting method based on time series, this model looks at what happened over a period of time using past data series to make predictions.
   - The causal methods or correlation methods, combined into variables or relationships that can affect the amount being forecasted.

Decision Support System

Decision support system is a system intended to support managerial decision makers in semi-structured decision situations [15]. Meanwhile, Decision support system as a system that has five main characteristics [16], namely:

- A computer-based system.
- Used to help decision makers.

- Solve complex problems that are impossible to do using manual calculations.
- Through interactive simulation.
- Data and analysis models as the main components.

In a decision support system there are three main components, namely:

- Database management is a data subsystem that has been organized in a database. The data comes from the internal and external environment. The decision support system requires data that is relevant to the problem to be solved through a simulation.
- Base model is a model that presents the problem in a quantitative format which becomes a simulation of decision making, the purpose of the problem, the associated components, and the existing constraints. This base model allows decision making in developing and comparing alternative solutions.
- The user interface is a combination of database management and model base. This user interface displays system output for users and receives input from users in a decision support system.

There are several benefits to a decision support system, namely:

- Improve the ability of decision makers in processing and processing data for users.
- Helping decision makers to solve very complex and unstructured problems.
- Produce solutions quickly and accurately.
- Can be a stimulant for decision makers in understanding the problem because it is able to present various alternative solutions to problems.

Methods

Trend Analysis

Trend analysis method is used to forecast sales at the company PT. Astra Honda Motor in the next 2 years. In conducting the analysis using the trend analysis method has the following stages [4]:

1) *Collecting Data to be Analyzed*: The data used in conducting this research is statistical data on motorcycle sales in the period 2011 to 2020 obtained from Aisi.or.id [1].
2) *Calculating Linear Trend Analysis*: In performing linear trend analysis calculations, it has the following formula [2,3]:

$$Yt = a + bt \qquad (1)$$

With the values a and b obtained from the formula:

$$a = \frac{\sum Y}{n}$$
$$b = \frac{\sum tY}{t^2} \qquad (2)$$

3) *Calculating Quadratic Trend Analysis*: In performing the calculation of quadratic trend analysis has the following formula or formula:

$$Yt = a + bt + ct^2 \qquad (3)$$

With values a, b, and c obtained from:

$$a = \frac{\sum Y - c\sum t^2}{n}$$
$$b = \frac{\sum tY}{\sum t^2} \qquad (4)$$
$$c = \frac{n\sum t^2 Y - \sum t^2 \sum Y}{n\sum t^4 - (\sum t^2)^2}$$

4) *Calculating Exponential Trend Analysis*: In calculating the exponential trend analysis has the following formula or formula:

$$Yt = a - b^t \qquad (5)$$

But to make it easier to find the values of a and b, the above equation can be converted into semi log form as follows:

$$\log Y = \log a + \log b$$

$$\rightarrow a = anti\log\left[\frac{\sum \log Y}{n}\right] \qquad (6)$$
$$\rightarrow b = anti\log\left[\frac{\sum t \log Y}{\sum t^2}\right]$$

5) *Choosing the Best Trend Analysis*: In determining the best forecasting analysis results, the method used is the Mean Square Error (MSE) method. Mean Square Error

(MSE) calculation has the following formula [2]:

$$MSE = \frac{\sum e^2}{n} \qquad (7)$$

6) *Conduct Evaluation*

Analytical Hierarchy Process (AHP) Analysis

Analytical Hierarchy Process (AHP) is a method of decision making developed by Thomas Saaty in the 1970s [12]. The Analytical Hierarchy Process (AHP) analysis method is used to analyze the decision support system in selecting the type of motorcycle that is most in demand by consumers. The results of the analysis can be used in supporting decisions for the company PT. Astra Honda Motor in determining the products to be produced and distributed in the market. In conducting the analysis using the Analytical Hierarchy Process (AHP) analysis method, it has the following stages [7-9, 11]:

1) *Defining Problems and Goals*: After knowing the results of the analysis of sales forecasting in the coming year period, the company PT. Astra Honda Motor needs to know the products that will be produced and distributed to the market, so that the company can obtain the maximum level of sales and profits, so that from these problems it can be determined that the goal to be achieved by using the Analytical Hierarchy Process (AHP) analysis method is the selection types of motorcycles that are most in demand by consumers.
2) *Creating a Hierarchical Structure*: Based on the identification of existing problems and predetermined goals, the hierarchical structure is as shown in Fig. 1 below:

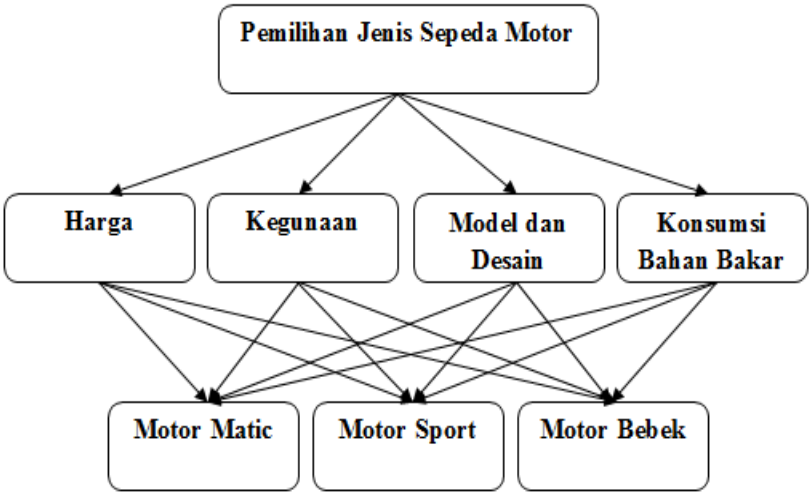

Figure 1. AHP Hierarchical Structure in Motorcycle Type Selection
Source : Thomas Saaty, 2021

4) *Create a Pairwise Comparison Matrix*: Each criterion will be made a pairwise comparison matrix with other criteria, for example, the price criteria will be compared with the criteria for use, model and design, fuel consumption, and so on. Each alternative will also be made a pairwise comparison matrix with other alternatives, the comparison of these alternatives is carried out according to each predetermined criterion.
5) *Setting the Priority of Elements*: In determining the priority of each of these elements, it is determined based on the results of the questionnaire data, where the weight of the element values is obtained from the results of the answers of the respondents (customers and prospective consumers of Honda products) that have been processed.
6) *Synthesizing Priorities*: The results of the pairwise comparison of each criterion and

alternative will be prioritized by adding up the values of each column in the matrix, then normalizing the matrix by dividing each value from the column by the total column concerned, after that get the average value by adding up the values of each row and dividing by the number of elements.

7) *Measuring Consistency*: After synthesizing priorities, the next step is to measure the level of consistency by multiplying each value in each column by the relative priority of the respective element, then adding up each row, then dividing the result from the sum of the rows by the priority element. the relative concerned, the last step is to add up the quotient above with the number of elements that exist, the result must be maximum.
8) *Calculating Consistency Index (CI)*: Performing the calculation of Consistency Index using the formula:

$$CI = \frac{\lambda - n}{n - 1} \qquad (8)$$

Where *n* is the number of elements.

9) *Calculating Consistency Ratio (CR)*: Performing the calculation of Consistency Ratio using the formula:

$$CR = \frac{CI}{IR} \qquad (9)$$

10) With *CR* is the consistency ratio, *CI* is the consistency index, and *IR* is the random consistency index.
11) *Checking Hierarchical Consistency*: Rechecking all calculation results provided that the consistency ratio must be less than or equal to 0.1.
12) *Obtaining Analysis Results and Conducting Evaluations.*

Software Tools Used

In conducting this research, to conduct analysis with trend analysis method using a tool (Software Tool), namely Microsoft Excel. Software tools are needed to speed up and avoid errors in calculating formulas. The stages in using Microsoft Excel software are as follows:

- open the microsoft excel application
- displaying statistical data on motorcycle sales to be analyzed
- perform analysis using linear trend analysis method
- perform analysis using the quadratic trend analysis method
- perform analysis using the exponential trend analysis method
- perform analysis on the results of forecasting calculations using the linear trend, quadratic trend, and exponential trend method using the mean square error method
- choose the trend method that has the lowest error rate as the best trend method.

In addition, to perform analysis using the Analytical Hierarchy Process (AHP) method using Super Decision software [10]. The stages in using this Super Decision software are as follows:

- open the super decision app
- create a new cluster according to a predefined hierarchical structure,
- inserting nodes or elements in each cluster
- connect each element in each cluster
- carry out an assessment or weighting according to the results of the questionnaire
- display the results of the analysis.

Results and Discussion

Forecasting Analysis Trend Method

In conducting sales forecasting analysis using the trend method, the data used is secondary data, namely statistical data on motorcycle sales at PT. Astra Honda Motor in the period 2011 to 2020. The statistical data has been processed and can be presented briefly in Table 1 below.

Table 1. Motorcycle Sales Statistics PT. AHM

Year	Sales Volume of PT. AHM (Unit)
2011	4,275,212
2012	4,092,693
2013	4,696,999
2014	5,051,100
2015	4,453,888
2016	4,380,888
2017	4,385,888
2018	4,759,202
2019	4,910,688
2020	2,892,168
Total	43,898,726

Source : Association of Indonesia Motorcycle Industry, 2021.

Based on the data in Table 1 above, the results of the calculation of linear trend analysis at PT. Astra Honda Motor using Microsoft Excel software are as follows:

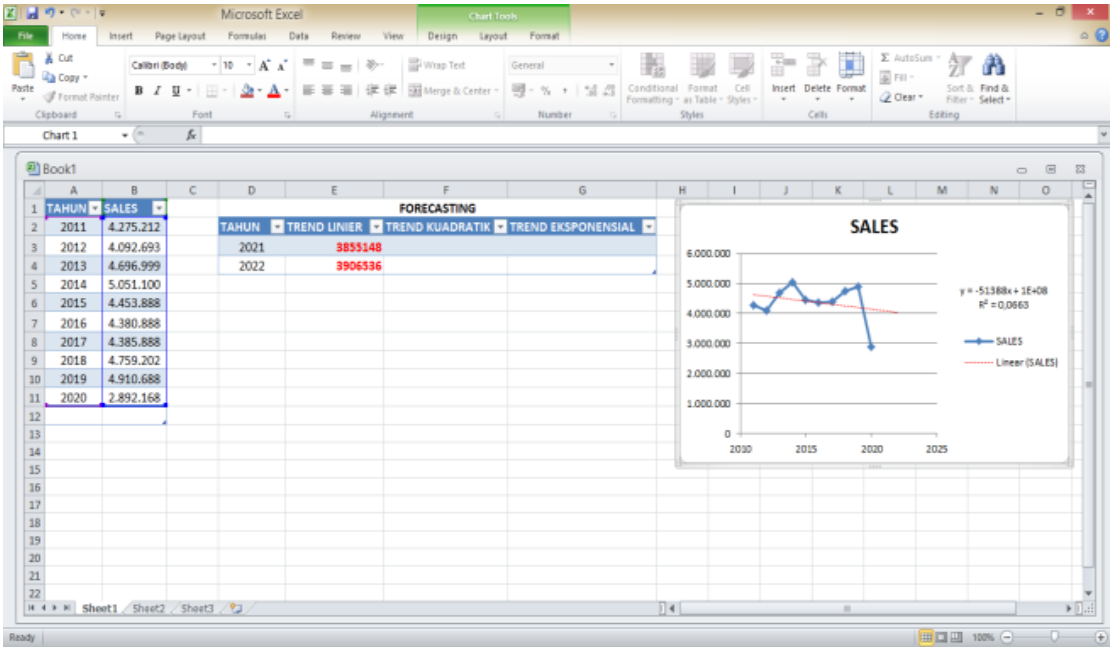

Figure 2. Linear Trend Analysis Results
Source : Microsoft Excel, 2021

Based on Fig. 2 above, the results of the calculation of linear trend analysis using Microsoft Excel software, in 2021 PT. Astra Honda Motor has forecast sales of 3,855,148 units, while in 2022 PT. Astra Honda Motor has forecast sales of 3,906,536 units.

Based on Fig. 3 above, the calculation results of quadratic trend analysis using microsoft excel software, in 2021 PT. Astra Honda Motor has a sales forecast of 17,071,335,585 units, while in 2022 PT. Astra Honda Motor has a sales forecast of 17,086,105,540 units.

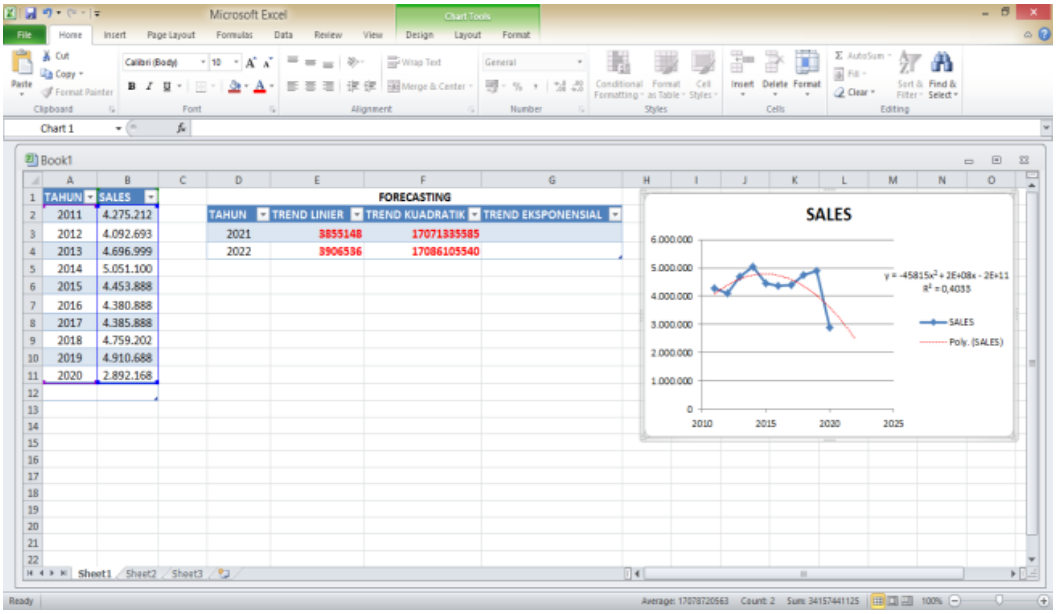

Figure 3. Quadratic Trend Analysis Results
Source : Microsoft Excel, 2021

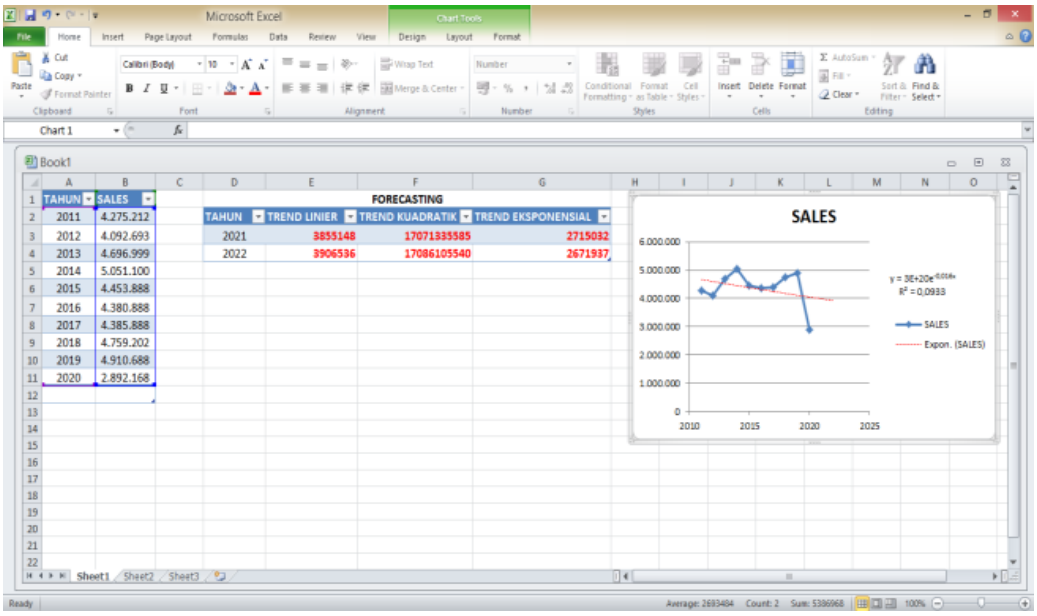

Figure 4. Exponential Trend Analysis Results
Source : Microsoft Excel, 2021

Based on Fig. 4 above, the results of the calculation of the exponential trend analysis using Microsoft Excel software, in 2021 PT. Astra Honda Motor has forecast sales of 2,715,032 units, while in 2022 PT. Astra Honda Motor has forecast sales of 2,671,937 units.

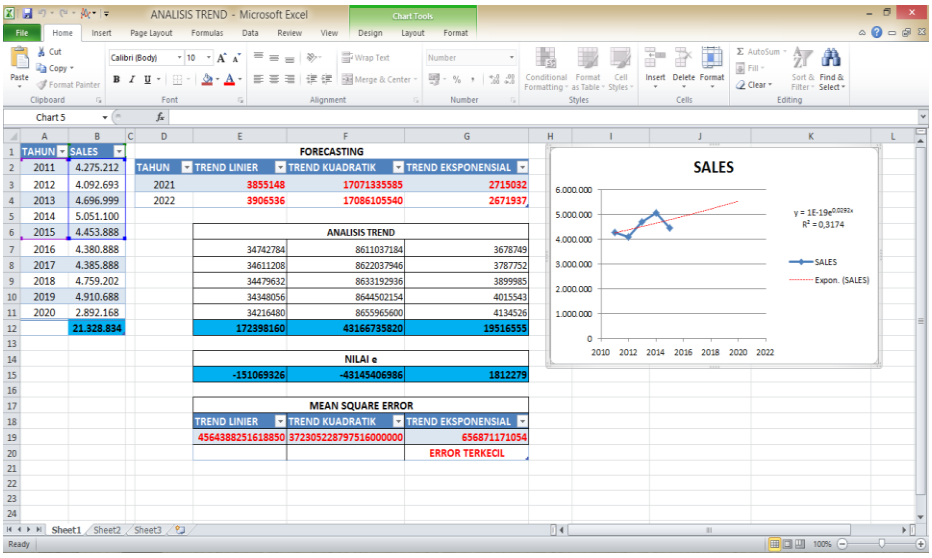

Figure 5. Mean Square Error Analysis Results
Source : Microsoft Excel, 2021

Based on Figure 5 above, the results of the calculation of the mean square error analysis using Microsoft Excel software, it is known that the error value of the linear trend method is 4,564,388,251,618,850 (4.6E+14), the error value of the quadratic trend method is 372,305. 228,797,516,000,000 (3.7E+19), and the error value of the exponential trend method is 656,871,171,054 (6.5E+11), so that the exponential trend analysis method is the best method to choose as an analytical method in sales forecasting PT. Astra Honda Motor.

Analysis of Decision Support System AHP Method

In analyzing the decision support system using the Analytical Hierarchy Process (AHP) method, the data used are primary data, namely questionnaire data distributed to consumers and potential customers of PT. Astra Honda Motor. The data has been processed and presented in the following Table 2.

Table 2. Geomean Value of Questionnaire Data

Geomean Values		
Criteria Comparison		
Price vs Usability	Price vs Model & Design	Price vs Fuel Consumption
0,49	0,78	0,37
Usability vs Model & Design	Usability vs Fuel Consumption	Model & Design vs Fuel Consumption
2,22	1,09	0,46
Alternative Comparison		
Based on Price Criteria		**Based on Usability Criteria**
Matic vs Sport	Matic vs Underbone	Sport vs Underbone	Matic vs Sport	Matic vs Underbone	Sport vs Underbone
5,41	3,15	0,52	5,47	3,77	0,45
Based on Model & Design Criteria			**Based on Fuel Consumption Criteria**		
Matic vs Sport	Matic vs Underbone	Sport vs Underbone	Matic vs Sport	Matic vs Underbone	Sport vs Underbone
1,84	3,88	1,35	4,62	2,11	0,45

Source : Google Form and Microsoft Excel, 2021.

1) Validity Test

In analyzing the decision support system, the questionnaire data used needs to be tested for validity first. This is done to determine the accuracy and accuracy of an instrument or question data given. Testing is done by using SPSS software. The results of the validity test of the questionnaire data can be seen in Table 3 below.

Table 3. Validity Test Results

Pair Comparison	R Count (Pearson Correlation)	R Table (Coefficient 0.05)	Information
1	0,303	0,132	Valid
2	0,300	0,132	Valid
3	0,349	0,132	Valid
4	0,288	0,132	Valid
5	0,377	0,132	Valid
6	0,254	0,132	Valid
7	0,625	0,132	Valid
8	0,669	0,132	Valid
9	0,456	0,132	Valid
10	0,617	0,132	Valid
11	0,684	0,132	Valid
12	0,451	0,132	Valid
13	0,511	0,132	Valid
14	0,669	0,132	Valid
15	0,400	0,132	Valid
16	0,586	0,132	Valid
17	0,654	0,132	Valid
18	0,465	0,132	Valid

Source: SPSS Software, 2021.

Based on the results of the validity test in Table 3 above, it is known that the calculated r value in all comparisons from pairwise comparisons 1 to 18 has a value greater than the value of r table (0.132), so that all questionnaire data instruments can be declared valid and ready to be used. analysis was carried out.

2) Reliability Test

In analyzing the decision support system, in addition to testing the validity, the questionnaire data used also needs to be tested for reliability first. This is done to show the consistency of a measuring instrument and the measurement results can be trusted. Testing is done by using SPSS software. The results of the questionnaire data reliability test can be seen in Table 4 below.

Table 4. Reliability Test Results

Reliability Statistics				
Cronbach's Alpha	R Table (Coefficient 0.05)	Cronbach's Alpha Standardized	N of Items	Information
0,797	0,132	0,6	18	Reliabel

Source: SPSS Software, 2021

Based on the results of the reliability test in Table 4 above, it is known that the Cronbach's Alpha value is 0.797, this value is greater than the r table value (0.132) and the Cronbach's Alpha Standardized value (0.6), so that all questionnaire data instruments can be declared reliable and ready for analysis.

3) Analytical Hierarchy Process (AHP) Analysis

In analyzing the Analytical Hierarchy Process (AHP) using processed questionnaire data, namely the data in Table II, the calculations are carried out using the Super Decision software. The results of the calculations are as follows:

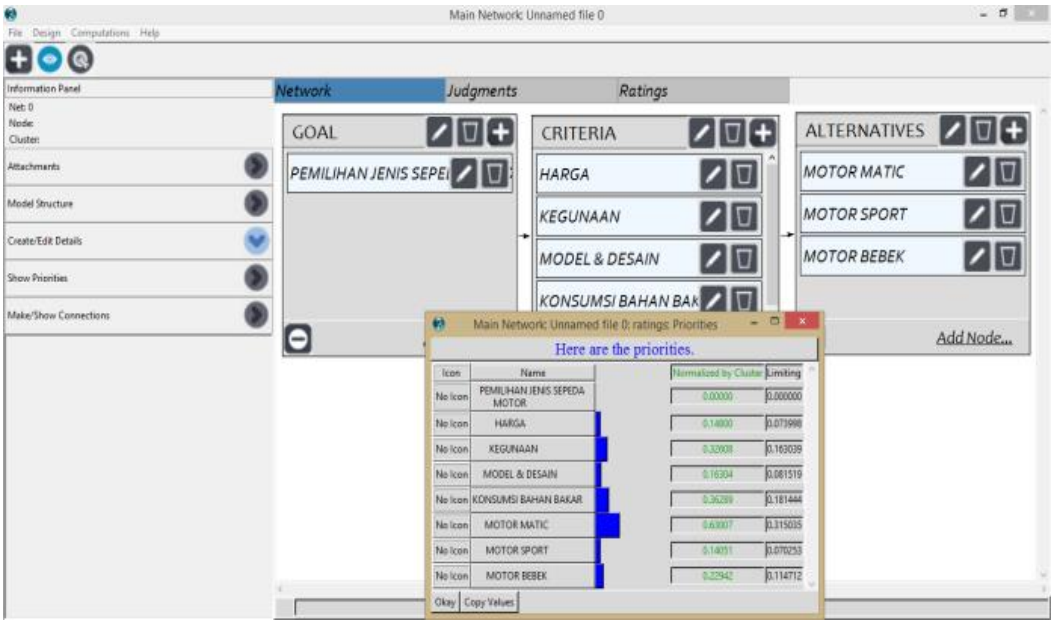

Figure 6. AHP Method Analysis Results
Source: Super Decision Software, 2021

Based on Fig. 6 above, the results of the Analytical Hierarchy Process (AHP) analysis using Super Decision software, it is known that the price criterion has a priority value of 0.07 (15%), the usability criterion has a priority value of 0.16 (33%), the model & design criteria have a priority value of 0.08 (16%), the fuel consumption criterion has a priority value of 0.18 (36%), while the motor matic alternative has a priority value of 0.32 (63%) , the sport motorbike alternative has a priority value of 0.07 (14%), and the duck motorbike alternative has a priority value of 0.12 (23%).

Conclusion

In this study, in analyzing the company's sales forecasting PT. Astra Honda Motor uses three trend forecasting analysis methods, namely linear trend, quadratic trend, and exponential trend. Based on the calculation of the mean square error analysis, the trend analysis method that has the smallest error value is the exponential trend method, so that method is chosen as the best trend analysis method for forecasting sales.

Based on the results of the analysis of the decision support system using the Analytical Hierarchy Process (AHP) method, the type of motorcycle that is most in demand by consumers is the automatic motorcycle. The criteria for motorcycles that are needed by consumers are aspects of fuel consumption.

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References

Aisi, "Statistic: Domestic Distribution and Export", http://www.aisi.or.id/statistic, 2021.

Efraim Turban, "Decision Support Systems and Intelligent Systems", Andi Offset, Yogyakarta, 2015.

Hakim, R. T., dan Kusumastuti, R. D., " A Model to Determine Relief Warehouse Location In East Jakarta Using The Analytic Hierarchy Process", International Journal of Technology, vol. 9, no. 7, pp. 1405 - 1414, 2018.

Heizer, Jay dan Render, Barry., "Manajemen Operasi edisi 11", Salemba Empat, Jakarta, 2017.

Hozairi, dkk., "Determining The Influencing Factors of The Indonesian Maritime Security Using Analytical Hierarchy Process", Jurnal Pertahanan. vol. 5, no. 3, pp. 65 - 76, 2019.

Icha Yulian, Dini Sri Anggraeni, dan Qurrotul Aini, "Penerapan Metode Trend Moment Dalam Forecasting Penjualan Produk CV. Rabbani Asyisa", JURTEKSI (Jurnal Teknologi dan Sistem Informasi), vol. 6, no. 2, pp. 193 - 200, 2020.

Nawal Sael, Touria Hamim, and Faouzia Benabbou, "Implementation of the Analytic Hierarchy Process for Student Profile Analysis", International Journal of Emerging Technologies in Learning, vol. 14, no. 15, pp. 78 - 93, 2019.

Nurmalita Oktaviana dan Nurisqi Amalia.. "Gross Regional Domestic Product Forecasts Using Trend Analysis: Case Study of Bangka Belitung Province", Jurnal Ekonomi dan Studi Pembangunan, vol. 19, no. 2, pp. 142 - 151, 2018.

Octaviani, Nur Ilmi. Erry Sunarya, dan Kokom Komariah, "Analisis Laporan Keuangan dengan Menggunakan Metode Trend sebagai Dasar Menilai Kondisi Perusahaan", Journal of Economic Bussines and Accounting, vol. 3 no. 1, pp.93 - 97, 2019.

Olumuyiwa Idowu Ojo, Femi Dakaye and Masengo Francois Ilunga, "Trend Analysis of Some Indices of Extreme Rainfall Events", American Journal of Engineering and Applied Sciences, vol. 11, no. 1, pp. 92 - 96, 2018.

Praveen, B., Talukdar, and S. Shahfahad, "Analyzing Trend and Forecasting of Rainfall Changes In India Using Non-parametrical and Machine Learning Approaches", Journal of Atmospheric and Solar, Vol. 10, no. 10342, 2020.

Rosiska, Evan, dan Rika Harman, "Metode Analitical Hierarchy Process (AHP) Dalam Pemilihan Umum Presiden Indonesia 2019", Jurnal Nasional Informatika dan Teknologi Jaringan, vol. 3, no. 2, pp. 193 - 202, 2019.

Saaty, T. L., "Models, Methods, Concepts & Application of the Analytic Hierarchy Process Second Edition", Springer New York Heidelberg Dordrecht, London, 2012.

Sparague, R. H. and Watson H. J., "Decision Support Systems: Putting Theory Into Practice", Englewood Clifts, N. J., Prentice Hall, 1993.

Sunyoto, Danang., "Metodologi Penelitian Akuntansi", PT Refika Aditama, Bandung, 2016.

Timisela, Natelda Rosaldiah. Masyhuri Masyhuri dan Dwidjono Hadi Darwanto, "Development Strategy of Sago Local Food Agroindustry Using Analytical Hierarchy Process Method", AGRARIS: Journal of Agribusiness and Rural Development Research, vol. 7, no 1, pp. 36 - 52, 2021.