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Implementation of the Single Moving Average Method in Forecasting Sales of Motorcycle Spare Parts

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Abstract

Sales forecasting is an important element in inventory management to ensure product availability in accordance with market demand. One method that can be used for forecasting is the Single Moving Average (SMA), which works by calculating the average sales in a certain period to identify future sales trends. This research aims to implement the SMA method in forecasting sales of motorbike spare parts in order to increase stock management efficiency and reduce the risk of excess or shortage of inventory. This research method involves collecting historical data on sales of motorbike spare parts in a certain period, which is then analyzed using the SMA method with various average period lengths to determine the best accuracy. The research results show that the SMA method can provide fairly accurate estimates of future demand patterns. With better forecasting, stores or distributors can optimize procurement strategies and reduce unnecessary carrying costs. Apart from that, implementing this method also contributes to increasing customer satisfaction because product availability can be more guaranteed. The conclusion of this research shows that the Single Moving Average method is a simple but effective forecasting technique in motorcycle spare parts inventory management. Implementation of this method can help business people make more appropriate decisions in stock planning and marketing strategies.

Keywords: *Sales forecasting, Single Moving Average, inventory management, motorbike spare parts, procurement strategy*

1. Introduction

Information technology has become an inseparable necessity in modern society. Progress in the field of information systems and technology has had a significant impact in various aspects, including more effective and efficient decision making [1]. One of the rapidly developing uses of information technology is in the business world, especially in supporting the process of forecasting the stock of goods needed for the next period. Forecasting is the art and science of predicting future events by collecting historical data and projecting it using a systematic approach model [2].

PT. Sumber Jaya Motor is a company engaged in the distribution and sale of motorbike spare parts located in Stabat. In facing increasingly competitive market competition and fluctuations in customer demand, this company needs to manage spare parts stock more efficiently. One of the main challenges faced is the uncertainty in predicting the amount of stock needed. This can cause various problems such as excess stock which results in high storage costs or stock shortages which have the potential to reduce customer satisfaction and disrupt company operations. Currently, PT. Sumber Jaya Motor still uses manual methods and rough estimates based on experience or previous sales data to determine the amount of spare parts stock. This method has limitations in providing accurate predictions of future stock needs. Therefore, a more systematic and measurable forecasting method is needed to overcome this problem.

The selection of Single Moving Average (SMA) for forecasting motorcycle spare part sales is generally based on its ease of implementation rather than achieving higher accuracy levels. SMA is a simple method that only requires calculating the average of several previous periods without the need for complex parameters like ARIMA or training processes like Machine Learning models. This makes SMA easier to apply, especially for companies that do not yet have an advanced forecasting system. However, in terms of accuracy, SMA is often less effective compared to more complex methods, particularly when the data exhibits significant trends or seasonal patterns.

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In the business world, forecasting has an important role in helping companies design more effective strategies for the future. Previous research conducted by [3] entitled " Sistem Informasi Peramalan Tren Pelanggan Dengan Menggunakan Metode Double Exponential Smoothing Di Mess GM " used the Double Exponential Smoothing method to predict the number of customer guests in one year based on historical data. The results of this research show that the forecasting method can provide more accurate estimates compared to manual estimates.

This research aims to implement the Single Moving Average method in forecasting motorbike spare parts stock at PT. Sumber Jaya Motor. This method was chosen because of its ability to analyze historical data in a simple but accurate manner to identify sales trends. By implementing the Single Moving Average method, companies can increase stock management efficiency, better anticipate demand fluctuations, and ensure optimal spare parts availability. If the company previously experienced overstock due to overly high forecasts, storage costs could increase, and the risk of product obsolescence would be greater. Conversely, if stockout occurs due to underestimating demand, the company may lose sales opportunities. By implementing SMA, it is expected that forecasting errors can be reduced, leading to more efficient inventory management. If, after implementing SMA, there is an improvement in stock management and a reduction in forecasting errors, then this method can be considered effective, even though it may not be the most accurate compared to other methods.

The previous study conducted by [4]showed that SMA remains relevant and even superior in conditions where stability, ease of implementation, and efficiency are more important than extremely high prediction accuracy. Sales forecasting of products at PT. Sunthi Sepuri using the Single Moving Average method was found to be more appropriate and optimal compared to the Single Exponential Smoothing method, as Single Moving Average had a lower error rate.

Based on this background, it is hoped that this research can provide a solution in the form of a forecasting system that helps PT. Sumber Jaya Motor optimizes spare parts sales predictions, reduces the risk of stock imbalances, and increases customer satisfaction through more guaranteed product availability.

2. Methods

2.1. *Research Methods*

The research method used in this research is using the Research and Development (R&D) research method. Research and Development (R&D) is a research method aimed at producing and testing the effectiveness of the product or software [4]. According to Sugiyono (2014) there are steps to implement research and development strategies that are carried out to produce certain products to test the effectiveness of the product in question [5].

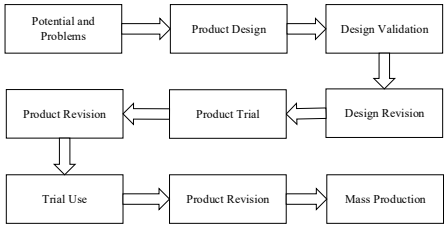

Figure 1. Stages in *Research and Development* (R&D) [6]

The stages in the Research and Development (R&D) research method are:

2.1.1 Potential and problems

The research started from a problem factor that existed at the location and analyzed the needs so that there was a need to develop a new model. document analysis or reviewing the results of previous research. The inability to manage stock efficiently often leads to overstock or understock.

2.1.2 Product Design

The products produced in research and development research vary. To produce a new work system, researchers must create a new work design based on an assessment of the old work system, so that weaknesses in the system can be found. The final result of this activity is a new product design, the design to be achieved is a system that is able to predict motorbike sales more efficiently.

2.1.3 Design Validation

Design validation is an activity process to assess whether the product design, in this case the new work system, will rationally be more effective than the old one. It is said to be rational because the validation here is still an assessment based on rational thinking, not yet a fact in the field.

2.1.4 Design revision

After validating the design, the shortcomings will be known. Once the shortcomings are known, the researcher then adds or subtracts from the design and then the product is tested.

2.1.5 Product trial

The product design that has been created cannot be tested immediately, but must be created first. To produce a product, testing can be done by comparing the effectiveness and efficiency of the current system with the new system.

2.1.6 Product Revision

After passing the trial, it will be possible to identify the weaknesses in the development that the researcher carried out. By studying the weaknesses in the product produced, researchers will carry out product revisions, by collecting data from the participants being tested. The data obtained will make it easier for researchers to carry out product revisions.

2.1.7 Trial Use

At the trial usage stage, researchers still have to study the possible shortcomings. After testing results, researchers must examine the obstacles that arise in order to improve the product.

2.1.8 Product Revision

This stage is carried out if when using the product in actual conditions there are still deficiencies, this must be adjusted to the needs of the motorcycle sales forecasting system.

2.1.9 Mass Product Manufacturing

This stage is when the product that has been tested is declared effective and suitable for mass production, in this case the product is declared useful because it can make it easier to forecast sales of motorbike spare parts.

2.2. *System Development Methods*

The system development method used in this research is Rapid Application Development (RAD). RAD is an object-oriented approach to system development that includes a development method and software tools. RAD can be carried out relatively quickly because when Rapid Application Development (RAD) is implemented, users can become part of the entire system development process by acting as decision makers at each stage of development. RAD can produce a system quickly because the system developed can meet the wishes of users so that it can reduce the time for re-development after the implementation stage [7].

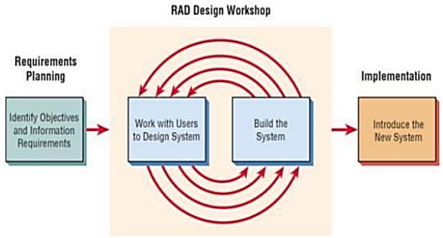

Figure 2. Stages *Rapid Application Development* [8]

2.2.1 Requirements Planning (*Requirement Planning*)

At this stage, a meeting is held to discuss the analysis of application system requirements by involving users and system analysts so that objectives can be clearly identified so that system specifications are obtained that are useful as a reference in designing the system. Requirements planning aims to include analyzing the requirements for the system to be created, for example analyzing the current system and analyzing the proposed system.

2.2.2 Design Workshop

This stage is divided into designing and building the system. The aim of this stage is to provide an overview of the mapping that you want to carry out as well as a description of the stages that you want to carry out. At this stage, start building the system starting from creating a database and table structure according to the design results then making a connection between the database and the source code using a programming language. The design results at the design stage are adjusted to create input and output forms. If something is still not appropriate, you can go back to the system design section and re-build (loop) and so on until it meets the system specifications.

2.2.3 Implementation

At this stage the system part has been completed. The stages of the system that have been approved, constructed and refined are then tested. Testing is carried out using black box testing before being implemented on the server. If it is certain that the system is all working with its function, the application system is moved to the server for configuration, can be accessed locally and publicly and it is ensured that the plugins can run well. Next, an introduction to the system was carried out in the form of providing training and assistance in using the souvenir sales application system to users. This is done so that system bugs can be identified so they can be easily repaired.

2.3. *System Process*

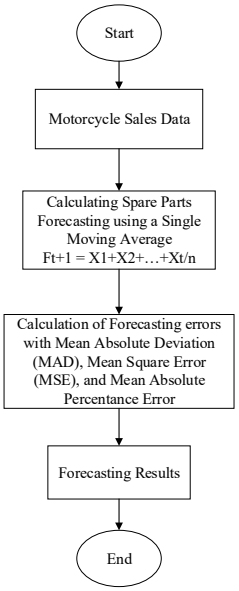

Figure 3. System Process Flow

The system starts by inputting motorbike spare parts data and motorbike sales data, then the sales data will be calculated using *Single Moving Average*. The results of the forecasting calculations are then calculated to measure the error (*error*) use *Mean Absolute Deviation* (MAD), *Mean Square Error* (MSE), and *Mean Absolute Percentance Error* (MAP).

3. Results and Discussion

3.1. Method *Single Moving Average (SMA)*

Single Moving Average or moving average is a forecasting method based on past data for a period that already has an average pattern, the data used for calculations is data that does not have trend elements or seasonal factors [9]. The Single Moving Average forecasting method is carried out by taking a group of observation values and then finding the average, then using the average as a forecast for the next period.

In forecasting motorcycle spare parts sales, several factors must be considered to ensure more accurate predictions, such as seasonality, promotions, and pricing policies. Seasonal patterns may occur when demand increases at certain times, such as before the rainy season, when the need for spare parts like tires or brake pads rises. Promotions also influence sales surges during specific periods, while price changes can cause drastic shifts in demand.

If there are significant demand fluctuations, SMA tends to be less adaptive because it relies solely on historical data with equal weighting for each period. This results in delays in capturing sudden upward or downward trends. For example, if sales rise sharply due to a promotion, SMA will respond slowly because it continues averaging previous data. Similarly, when demand drops significantly, this method may still produce higher-than-actual forecasts, potentially leading to overstock.

Furthermore, SMA must be integrated with inventory management systems to ensure that forecasts can be used automatically in purchasing and procurement decisions. SMA's limitations in capturing external patterns can also be a challenge, making it necessary to consider combining it with other methods or applying manual adjustments based on external factors affecting demand.

The following is sales data *spare parts* 2023 used for predictions as follows:

Table 1. Sales Data

Month	Year	Total Sales
January	2023	115008370
February	2023	106075685
March	2023	143464595
April	2023	132570125
May	2023	131341365
June	2023	116774575
July	2023	122016930
August	2023	112918960
September	2023	112641765
October	2023	108407986
November	2023	102412250
December	2023	123278410

The recapitulation of data presented in table 1 will be calculated using values *n* (number of periods) based on the formula:

3.1.1 Forecasting Calculations *SMA* 2 Period

In the first experiment, calculations were carried out with the value of n for 2 periods, the results were obtained:

$$F_{t+1} = \frac{X_1+X_2+\cdots.+X_t}{n} \quad (1)$$

Forecasting March 2023 = $\frac{115008370 + 106075685}{2} = 110542028$

Table 2. Forecasting Period 2

Month	Total Sales	SMA
January 2023	115008370	-
February 2023	106075685	-
March 2023	143464595	110542028
April 2023	132570125	124770140
May 2023	131341365	138017360
June 2023	116774575	131955745
July 2023	122016930	124057970
August 2023	112918960	119395753
September 2023	112641765	117467945
October 2023	108407986	112780363
November 2023	102412250	110524876
December 2023	123278410	105410118
January 2024	-	112845330

3.1.2 Forecasting Calculations *SMA* 3 Period

$$F_{t+1} = \frac{X_1+X_2+\cdots.+X_t}{n} \quad (2)$$

Forecasting April 2023 = $\frac{115008370+106075685+143464595}{3} = 121516217$

Table 3. Forecasting Period 3

Month	Total Sales	SMA
January 2023	115008370	-
February 2023	106075685	-
March 2023	143464595	-
April 2023	132570125	121516217
May 2023	131341365	127370135
June 2023	116774575	135792028,3
July 2023	122016930	126895355
August 2023	112918960	123377623,3
September 2023	112641765	117236821,7
October 2023	108407986	115859218,3
November 2023	102412250	111322903,7
December 2023	123278410	107820667
January 2024	-	111366215,3

3.1.3 Forecasting Calculations *SMA* 4 Period

$$F_{t+1} = \frac{X_1+X_2+\cdots.+X_t}{n} \quad (3)$$

Forecasting May 2023 = $\frac{115008370+106075685+143464595+132570125}{4} = 124279694$

Table 4. Forecasting Period 4

Month	Total Sales	SMA
January 2023	115008370	-
February 2023	106075685	-
March 2023	143464595	-
April 2023	132570125	-
May 2023	131341365	124279694
June 2023	116774575	128362942,5
July 2023	122016930	131037665
August 2023	112918960	125675748,75
September 2023	112641765	120762957,5
October 2023	108407986	116088057,5
November 2023	102412250	113996410,25
December 2023	123278410	109095240,25
January 2024	-	111685102,75

3.1.4 Forecasting Calculations *SMA* 5 Period

$$F_{t+1} = \frac{X_1+X_2+\cdots.+X_t}{n} \quad (4)$$

Forecasting June 2023 = $\frac{115008370+106075685+143464595+132570125+131341365}{5} = 125692028,2$

Table 5. Forecasting Period 5

Month	Total Sales	SMA
January 2023	115008370	-
February 2023	106075685	-
March 2023	143464595	-
April 2023	132570125	-
May 2023	131341365	-
June 2023	116774575	125692028,2
July 2023	122016930	126045269
August 2023	112918960	129233518
September 2023	112641765	123124391
October 2023	108407986	119138719
November 2023	102412250	114552043,2
December 2023	123278410	111679578,2
January 2024	-	111931874,2

3.1.5 Forecasting Calculations *SMA* 6 Period

$$F_{t+1} = \frac{X_1+X_2+\cdots.+X_t}{n} \quad (5)$$

Forecasting July 2023 = $\frac{115008370+106075685+143464595+132570125+131341365+116774575}{6}$ = 124205786

Table 6. Forecasting Period 6

Month	Total Sales	SMA
January 2023	115008370	-
February 2023	106075685	-
March 2023	143464595	-
April 2023	132570125	-
May 2023	131341365	-
June 2023	116774575	-
July 2023	122016930	124205786
August 2023	112918960	125373879,17
September 2023	112641765	126514425
October 2023	108407986	121377286,67
November 2023	102412250	117350263,5
December 2023	123278410	112528744,33
January 2024	-	113612716,83

After calculating using forecasting *Single Moving Average,* The results of these calculations are then calculated for the level of accuracy using the MSE method. Next, compare the results of the accuracy level to obtain the smallest error value. The table below is a visualization of the average results from error calculations using 2 to 6 periods.

Table 7. Actual Data and Error Results

Month	Total Sales	SMA	Error ET = (Xt-Ft)	Squared Error (Xt-Ft)²
January 2023	115008370	-	-	-
February 2023	106075685	-	-	-
March 2023	143464595	110542028	-4466343	19948219793649
Apr-23	132570125	124770140	18694455	349482647747025
May 2023	131341365	138017360	-5447235	29672369145225
June 2023	116774575	131955745	-614380	377462784400
July 2023	122016930	124057970	-7283395	53047842726025
August 2023	112918960	119395752,5	2621177,5	6870571486506,25
Sep-23	112641765	117467945	-4548985	20693264530225
October 2023	108407986	112780362,5	-138597,5	19209267006,25
Nov-23	102412250	110524875,5	-2116889,5	4481221155210,25
December 2023	123278410	105410118	-2997868	8987212545424
January 2024	-	112845330	10433080	108849158286400
Total	**1426911016**	**1307767627**	**4135019,5**	**602429179467096**

MSE formula calculation (*Mean Squared Error*) can be seen as follows:

$$\textbf{\textit{MSE}}= \sum \frac{|Et|}{n} = \frac{602429179467096}{12} =$$

50202431622258

So the results obtained from error calculations use *MSE (Mean Squared Error)* is 50202431622258. From the table above it can be seen that the error calculation result is 50202431622258 for the MSE value. The test results obtained significant values and can be used as a reference for determining production quantities for the next period.

3.2. *Implementation*

In implementing the process design, program coding is carried out. The results of the coding program are as follows:

3.2.1 Period Page

This Period page is a page that displays a list of periods which contain codes, dates and values. Where this period can be added, edited and deleted according to predicted needs. Here are the period pages:

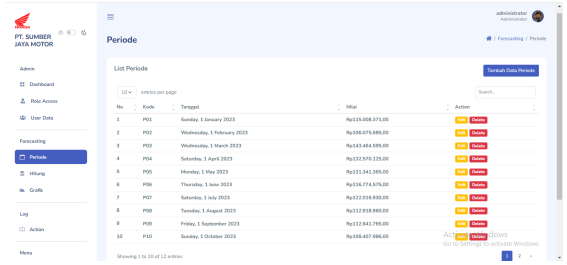

Figure 4. Period Page

3.2.2 Compute Page

On the calculation page, the user first fills in the number of periods and the number of forecast periods, then presses the calculate moving average button to forecast. Then there will be the results of the calculation of sales forecasting for the next month.

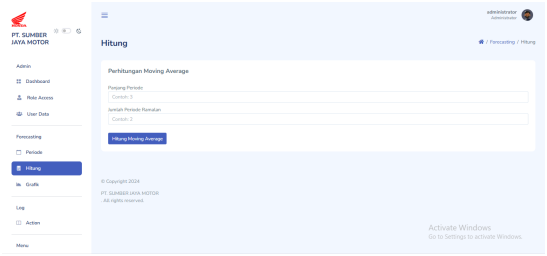

Figure 5. Calculation Page

The following are the results of implementing the count page. With these results, it is hoped that the admin can make a decision for me*restock* products for the following month. As can be seen in Figure 6:

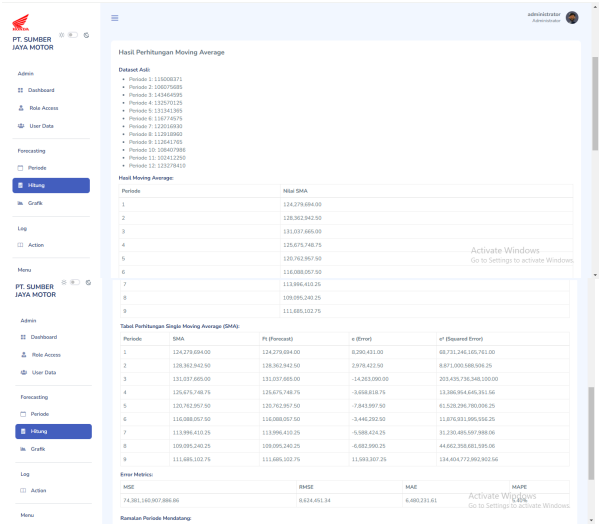

Figure 6. Forecasting Results Using a Single Moving Average

3.2.3 Graphics Page

Next on the Graph Page, before displaying the period graph, first fill in the number of periods that will be forecasted then click show graph, then a forecasting graph with a Single Moving Average will appear.

Figure 7. Graphics page

3.3. *Blackbox Testing*

Testing blackbox is a test to check whether input And output whether the system meets functional requirements or not, this test is carried out by user [10]. Testing is carried out by running the application and analyzing *input* And *output* generated by the system. In Table 4 below.

Table 8. Blackbox Testing

No	Menu	Function	Results	Information
1	Page *Login*	Displays the page *login*	The system will receive login access and then immediately display the admin page	Succeed
3	Period Data Page	This menu is used to view, add, change and delete period data	Displays the period data page in table form	Succeed
			Displaying *form* add period data	Succeed
			Displaying *form* change data	Succeed
			Delete the previously selected data and return to the period data page	Succeed
4	Compute Page	This menu is used to perform calculations and view	Displays the calculation page	Succeed
			Displays the calculation data page *Moving Average*	Succeed

		forecasting results		
5	Graphics Page	This menu is used to view graphic results from forecasting	Displays the forecasting graph page	Succeed

4. Conclusion

Based on research conducted at PT. Sumber Jaya Motor, it can be concluded that the forecasting system using the Single Moving Average method applied in predicting income in 2023 shows quite accurate results with an average Mean Squared Error (MSE) of 50,202,431,622,258, so the difference between the forecasting results and Real conditions are not that great. The Single Moving Average (SMA) method has proven effective in predicting sales of motorbike spare parts in the short term using available historical data. With more accurate forecasting results, companies can plan spare part stock needs better, thereby reducing the risk of stock shortages or excesses and increasing efficiency in inventory management. Overall, the implementation of the Single Moving Average method provides significant benefits in supporting PT's procurement and distribution strategy. Sumber Jaya Motor.

References

[1] D. Susandi and F. Nafis, "Sistem Peramalan Penjualan Paving Block Menggunakan Metode Single Moving Average," *JSiI (Jurnal Sist. Informasi)*, 2021.

[2] H. Sulastri, G. S. Anwar, and E. N. F. Dewi, "Peramalan Stok Barang Percetakan dan ATK Menggunakan Single Moving Average," *J. Rekayasa Teknol. Inf.*, vol. 7, no. 1, p. 59, 2023, doi: 10.30872/jurti.v7i1.11876.

[3] A. S. , S. M. , Syahru Rahmayuda, "Sistem Informasi Peramalan Tren Pelanggan Dengan Menggunakan Metode Double Exponential Smoothing Di Mess Gm," *Coding J. Komput. dan Apl.*, vol. 8, no. 1, 2020, doi: 10.26418/coding.v8i1.39767.

[4] A. Fakhri, T. Hidayat, and Djamaludin, "Sistem Informasi Manajemen Pembudidayaan Ikan Lele Menggunakan Metode Research and Development," *JSiI (Jurnal Sist. Informasi)*, vol. 8, no. 1, pp. 53–58, 2021, doi: 10.30656/jsii.v8i1.3016.

[5] Eko siswanto, Eka Satria Wibawa, and Z. Mustofa, "Implementasi Aplikasi Sistem Peramalan Persedian Barang Menggunakan Metode Single Moving Average Berbasis Web," *Elkom J. Elektron. dan Komput.*, vol. 14, no. 2, pp. 224–233, 2021, doi: 10.51903/elkom.v14i2.515.

[6] K. Haq and S. Suendri, "Implementasi Metode Accrual Basis Pada Sistem Informasi Keuangan," *J. Inf. Syst. Res.*, vol. 4, no. 2, pp. 562–568, 2023, doi: 10.47065/josh.v4i2.2924.

[7] C. Mandang, D. Wuisan, and J. Mandagi, "Penerapan Metode RAD dalam Merancang Aplikasi Web Proyek PLN UIP Sulbagut," *Jointer - J. Informatics Eng.*, vol. 1, no. 02, pp. 49–53, 2020, doi: 10.53682/jointer.v1i02.18.

[8] I. Nofikasari, T. Purwanto, and M. Marginingsih, "Penerapan Metode Rapid Application Development (Rad) Dalam Sistem Informasi Anak Putus Sekolah (Siap Sekolah)," *Biner J. Ilm. Inform. dan Komput.*, vol. 1, no. 2, pp. 139–147, 2022, doi: 10.32699/biner.v1i2.3264.

[9] M. Sam, E. Kurniawati, and S. R. Fausia, "Peramalan Permintaan Smartphone Oppo Android Menggunakan Metode Single Moving Average," *J. Mat. dan Apl.*, vol. 2, no. 2, pp. 93–103, 2022.

[10] Y. F. Achmad and A. Yulfitri, "Pengujian Sistem Pendukung Keputusan Menggunakan Black Box Testing Studi Kasus E-Wisudawan Di Institut Sains Dan Teknologi Al-Kamal," *J. Ilmu Komput.*, vol. 5, p. 42, 2020.
