



Article

Performance achievement analysis using linear regression and ARIMA (case study: KSP Credit Union Pancur Solidaritas)

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Abstract—Continuous performance measurement is important for organizations, especially cooperatives such as KSP (Koperasi Simpan Pinjam) Credit Union Pancur Solidaritas. This ensures work programs are planned and completed effectively and allows for ongoing success evaluation. Linear Regression and ARIMA are methods applied to set targets for organizational work programs and measure the cooperative's performance over time. This study aimed to examine performance achievement using Linear Regression and ARIMA (Auto Regressive Integrated Moving Average). The research used a quantitative descriptive approach. Study data included documentation on assets, member numbers, outreach activities, loan disbursements, overdue loans, and staff count for KSP Credit Union Pancur Solidaritas from 2021 to 2024. Data analysis employed Linear Regression and ARIMA tests performed using Python software. The study results showed that combining Linear Regression and ARIMA can produce three different performance possibilities: the highest anticipated performance (upper performance), the predicted performance (predicted performance), and the lowest possible performance (lower performance). Based on this analysis, the prediction for KSP CUPS member growth indicates an increase each month, with growth predicted to be 1,426 members by June 2025.

Keywords—*arima; big data; cooperative; linear regression; performance.*

1. Introduction

Company performance is critical for organizational development and progress. A company showing good performance typically exhibits increased assets, higher profits, improved human resources, and a significant positive impact on society (Aminarianti, 2019). Cooperatives are one type of organization that makes a substantial contribution to community development and advancement. Cooperatives function as financial institutions centered on saving and loan services. The loan services they provide can enhance community well-being (Permana, 2017).

The advancement of a cooperative, such as Koperasi Simpan Pinjam Credit Union Pancur Solidaritas (KSP CUPS), depends significantly on its performance across financial, management, and system areas. Measuring cooperative performance is essential for determining the strategies needed to achieve lasting success (Damayanti, 2023). Various elements can influence KSP CUPS's performance outcomes, including economic conditions, internal policies, and member behavior. Therefore, analytical tools are needed to identify the influencing elements and forecast future performance.

Quantitative methods used for measuring cooperative performance include Linear Regression and ARIMA (Auto Regressive Integrated Moving Average) models. Linear Regression is a statistical method used to model the relationship between one dependent variable and one or more independent variables. This approach helps identify variables that notably

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affect performance, such as outreach activities, the volume of loans extended, and the number of staff. ARIMA is a time series analysis model capable of handling non-stationary data with seasonal patterns (Lwaho & Ilembo, 2023). This model can be used to predict KSP CUPS performance based on past data, allowing management to plan long-term strategies more accurately. ARIMA's ability to manage complex data variations makes it an effective tool for long-term performance analysis.

Using both of these methods together to analyze KSP CUPS performance outcomes is expected to provide a more complete approach. Linear Regression can identify the key elements influencing performance, while ARIMA can model and predict performance changes based on historical time series patterns. This combination enables KSP CUPS to not only understand the elements affecting performance but also predict future performance outcomes with greater accuracy. Elements influencing its performance include assets, cooperative members, extent of outreach, number of employees, volume of disbursements, and arrears (Fauziyanti, 2019).

Measuring cooperative performance should use Linear Regression to examine the organization's fundamental strength (Damayanti, 2023). To understand changes in organizational performance over time, conducting ARIMA analysis is necessary. Based on findings from previous research using both methods, measuring financial performance with both Linear Regression and ARIMA is needed. The aim is to provide tools for evaluating and predicting cooperative performance in the future (Phung Duy et al., 2024).

The theoretical foundations for this study consist of company performance theory, linear regression, and ARIMA. Company performance represents a complete view of an organization's state over a specific period, reflecting results or achievements shaped by operational activities that utilize available resources (Herwanto, 2023). Performance also indicates the company's capacity to generate profit at certain levels of sales, assets, and share capital (Nicholson, 2019). Moreover, company performance is the organization's overall success in meeting its established aims and goals through the effective and efficient use of resources (Arsenia, V., 2019).

Cooperative performance can be assessed using member growth. The increase in members plays a significant role in promoting cooperative progress, including growth in asset volume and SHU (*Sisa Hasil Usaha* – Distributable Surplus) (Kiss & Rácz, 2024). SHU refers to the cooperative's income earned in one financial year, reduced by costs, depreciation, and other obligations including tax for that year. A cooperative is considered to have improved performance if it achieves high profitability and shows continued growth.

Elements influencing cooperative performance include assets, cooperative members, the amount of outreach activities, the number of employees, the volume of disbursements, and arrears. These are explained below (D'Amato et al., 2021):

- a. Assets are goods or property holding economic worth. A cooperative with substantial assets will support improved performance. Company assets are economically valuable resources vital for ongoing operations. Every organization holds assets in the form of items considered valuable and usable to ensure operations continue.
- b. Members are customers or individuals who use cooperative services. A large number of cooperative members can boost performance. Cooperative members

are both owners and users of the cooperative services. Membership is based on a shared economic interest within the cooperative's scope.

- c. Socialization refers to the actions taken by the cooperative to provide services and offers information to members, encouraging them to use these services consistently.
- d. Employees are human resources and play a key role in increasing cooperative performance.
- e. Disbursements refer to the total amount of credit extended to cooperative members that is currently outstanding.
- f. Arrears occur when the cooperative is unable to recover the amount of credit provided to members.

This study is being conducted at KSP CUPS because this cooperative has not previously measured performance using Linear Regression and ARIMA methods for predicting performance and as a tool for cooperative management evaluation. KSP CUPS is a significant financial institution providing financial services to its members, particularly savings and loans. As an institution focused on its members, KSP CUPS must ensure its performance remains optimal to meet their needs and expectations. Accurate evaluation and prediction of performance are crucial for KSP CUPS to maintain stability and achieve sustained growth.

The goals of this research are to analyze the connection between asset volume and member numbers and KSP CUPS performance outcomes using linear regression, to model and forecast its performance outcomes using the ARIMA model, and to compare the accuracy of predictions between linear regression and ARIMA.

2. Methods

This study employs a descriptive quantitative method. This research design aims to explain or provide empirical evidence regarding a particular phenomenon, utilizing numerical information gathered from a specific subject. The research data consists of documentation detailing the asset totals, the number of cooperative members, and the distributable surplus for KSP CUPS from January 2021 through July 2024. For data analysis, linear regression and ARIMA tests were performed using Python software.

Linear regression is an analytical test that allows predictions using a straightforward mathematical formula. The purpose of linear regression analysis is to determine the direction and magnitude of an independent variable's influence on a dependent variable (Vinsensius, 2023). Variables that are affected are often termed dependent or endogenous variables, while variables that influence other variables are called independent or exogenous variables. ARIMA analysis is a prediction or forecasting approach initially developed by George Box and Gwilym Jenkins, intended for modeling time series data. The ARIMA model is widely used in time series analysis.

3. Results

3.1. Predicted achievement of KSP CUPS performance

3.1.1. Linear regression model

Based on the data presented in Fig. 1 and Table 1, the potential performance of KSP CUPS over the next year, as

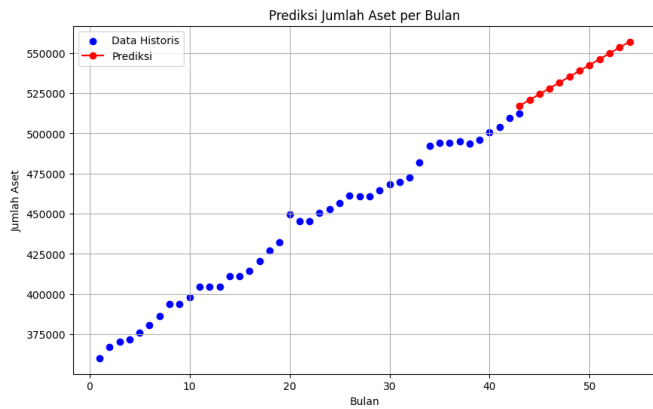


Fig. 1. Prediction of KSP CUPS performance achievement based on total assets using line a regression model

Table 1. Prediction results for the next 12 months

Time	Asset Prediction (Rp)
2024-08-01	517.229.166.755
2024-09-01	520.851.178.583
2024-10-01	524.473.190.411
2024-11-01	528.095.202.238
2024-12-01	531.717.214.066
2025-01-01	535.339.225.894
2025-02-01	538.961.237.722
2025-03-01	542.583.249.549
2025-04-01	546.205.261.377
2025-05-01	549.827.273.205
2025-06-01	553.449.285.032
2025-07-01	557.071.296.860

indicated by total assets, can be forecast using a linear regression model.

The linear regression model shown in Fig. 1 predicts that the performance of KSP CUPS, measured by total asset value, is expected to increase each month. The predicted asset total for August 2024 is Rp. 517,229,166,755, rising to Rp. 557,071,296,860 in July 2025. This projection suggests continuous growth in the total assets of KSP CUPS throughout the upcoming year.

Fig. 2 demonstrates that its performance, based on the history of new member admissions, grew steadily from January 2021 through July 2024. Based on historical data and using a linear regression model, the predicted performance achievement concerning member growth over the next year is detailed in Table 2.

The linear regression model predicts that KSP CUPS will gain 935 incoming members over the next year. Simultaneously, the model forecasts 63 members leaving and 18 members passing away during this period. These figures indicate that the predicted number of members leaving or deceased for the next twelve months remains low.

3.1.2. ARIMA model

Fig. 3 displays the data on KSP CUPS performance evaluated by total assets, using the ARIMA model. Fig. 3 indicates that the performance, when measured by total assets, showed growth

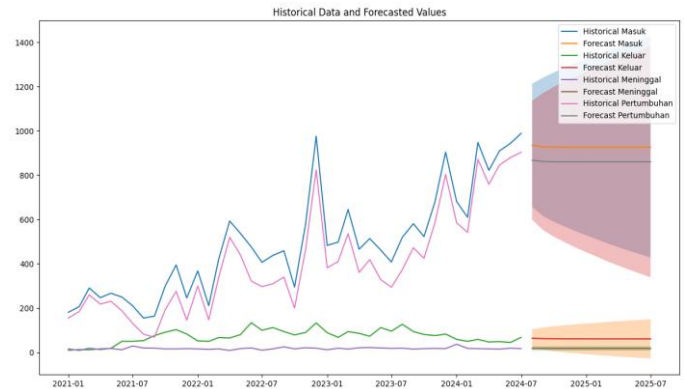


Fig. 2. KSP CUPS member history graph

Table 2. Predicted performance achievement of KSP CUPS by member

Description	Quantity
Incoming <i>Predicted</i>	935.084.791
Incoming <i>Upper CI</i>	1.212.964.203
Incoming <i>Lower CI</i>	65.720.538
left <i>Predicted</i>	6.394.067
left <i>Upper CI</i>	104.364.977
left <i>Lower CI</i>	23.516.363
Deceased <i>Predicted</i>	18.130.674
Deceased <i>Upper CI</i>	27.736.212
Deceased <i>Lower CI</i>	8.525.136
Growth <i>Predicted</i>	867.461.835
Growth <i>Upper CI</i>	1.136.014.941
Growth <i>Lower CI</i>	598.908.729

from January 2021 up to July 2024. Data on the predicted performance based on total assets for the next year, utilizing the ARIMA model, is presented in Table 3.

Based on the ARIMA model, the predicted performance concerning asset value is expected to rise each month. The model forecasts the asset value for August 2024 to be Rp. 516,162,965,455, with a predicted lowest value of Rp. 508,945,292,076 and a predicted highest value of Rp. 523,380,638,835. For July 2025, the forecast is Rp. 555,206,591,735, with a predicted lowest value of Rp. 529,186,727,755 and a predicted highest value of Rp. 581,226,455,715. This suggests that the total assets of KSP CUPS are projected to increase consistently over the upcoming year.

3.2. Factors affecting member growth

A study identifying the factors that influence the growth of KSP CUPS members using a linear regression model is presented in Fig. 4. Based on the linear regression model, the factors found to have the most significant influence on KSP CUPS member growth are staff (employees) with a score of 0.74, followed by credit disbursement with a score of 0.72, default with a score of 0.70, and socialization with a score of 0.62. These findings show that staff (employees) are highly important in increasing KSP CUPS member growth. Therefore, it is expected that staff will maintain appropriate conduct when providing services to members.

Table 3. Predicted performance achievement of KSP CUPS based on total assets

Time	Asset Prediction	Lower Confidence Interval	Upper Confidence Interval
2024-08-01	516.162.965.455	508.945.292.076	523.380.638.835
2024-09-01	519.725.333.800	509.479.549.809	529.971.117.791
2024-10-01	523.285.106.926	510.689.719.238	535.880.494.615
2024-11-01	526.842.286.725	512.244.414.897	541.440.158.553
2024-12-01	530.396.875.085	514.015.841.842	546.777.908.327
2025-01-01	533.948.873.894	515.938.740.559	551.959.007.229
2025-02-01	537.498.285.039	517.974.510.654	557.022.059.424
2025-03-01	541.045.110.405	520.198.110.947	561.992.109.864
2025-04-01	544.589.351.876	522.292.224.080	566.886.479.673
2025-05-01	548.131.011.334	524.544.297.373	571.717.725.296
2025-06-01	551.670.090.661	526.844.897.159	576.495.284.162
2025-07-01	555.206.591.735	529.186.727.755	581.226.455.715

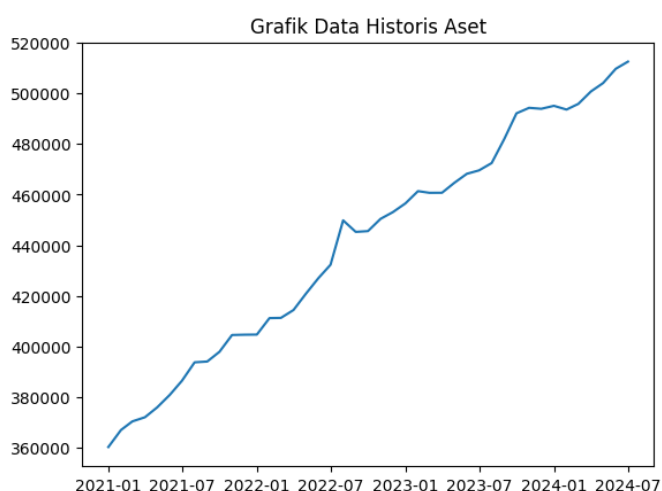


Fig. 3. Historical chart of KSP CUPS assets using the ARIMA model

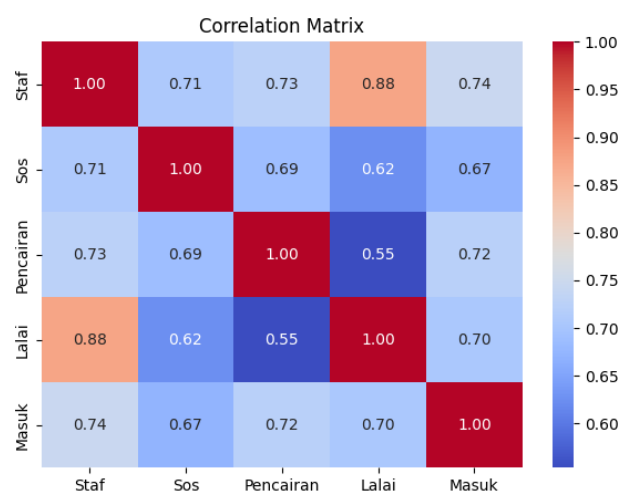


Fig. 4. Factors affecting KSP CUPS member growth

Factors influencing cooperative performance consist of:

- The asset factor, where a higher total amount of assets, suggests that KSP CUPS is performing well.
- The cooperative member factor, where a greater number of members indicate the community trusts toward KSP CUPS, which directly affects its development and performance enhancement.
- The socialization factor, for instance, a more frequent socialization activities can increase public interest in joining and using KSP CUPS services.
- The employee factor, such as the higher number of employees indicates that KSP CUPS is expanding its service to members, which can improve its performance in terms of human resources.
- The disbursement factor, such as a higher amount of credit being disbursed, leads to increased income from loan interest, which can improve KSP CUPS' performance financially.
- The default factor, which refers to KSP CUPS's capacity to recover credit provided to members, as well as the ability of management to keep or increase the number of members.

Based on the data, the prediction of KSP CUPS member

growth using the linear regression model is presented in Table 4. The linear regression model indicates that the predicted growth of KSP CUPS members increases each month. For August 2019, the growth was 1,008 members, increasing to 1,426 members by June 2025. These results demonstrate that KSP CUPS' performance, measured by member growth, is improving each month.

4. Discussion

4.1. Performance prediction using linear regression and ARIMA models

Based on the research results, it has been determined that both linear regression and ARIMA models can accurately predict KSP CUPS performance using total assets. The difference between the predictions derived from the linear regression and ARIMA models was found to be very small. Specifically, the prediction for July 2025 using the linear regression model was Rp. 557,071,296,860, while the prediction using the ARIMA model for the same period was Rp. 555,206,591,735. This indicates only a minor difference in the predicted KSP CUPS performance value when using total assets as the basis for both models.

From these findings, it can be concluded that both linear

Table 4. CUPS membership growth forecast

No	Forecasted Month	Predicted Membership
1	2024-07-01	970.954.442
2	2024-08-01	1.008.416.539
3	2024-09-01	1.046.627.878
4	2024-10-01	1.085.603.443
5	2024-11-01	1.125.358.520
6	2024-12-01	1.165.908.698
7	2025-01-01	1.207.269.880
8	2025-02-01	1.249.458.286
9	2025-03-01	1.292.490.460
10	2025-04-01	1.336.383.277
11	2025-05-01	1.381.153.950
12	2025-06-01	1.426.820.197

regression and ARIMA analysis models are suitable for performance forecasting. The research also indicated that the predicted performance based on the number of new members showed an expected increase of 935 individuals over the next year. This suggests that the overall number of KSP CUPS members will likely experience growth each month.

These research outcomes demonstrate that linear regression and ARIMA analysis models are applicable for predicting company performance. Utilizing both methods concurrently in the analysis of KSP CUPS performance is expected to offer a more thorough analytical approach. Both linear regression and ARIMA are capable of modeling and predicting performance changes by considering historical patterns within the data over time. Forecasting KSP CUPS performance in this manner assists management in planning long-term strategies with increased accuracy.

4.2. Factors affecting KSP CUPS member growth using linear regression models

Based on analysis using a linear regression model, the factors found to influence the growth of KSP CUPS members are staff, followed by credit disbursement, negligence, and socialization. The study's findings indicate that staff is the most significant factor impacting member growth. This highlights the vital role employees play in increasing the number of KSP CUPS members. Therefore, staff are expected to provide a high-quality service to members. To cultivate skilled employees, it is suggested that the recruitment process for new staff be more selective.

The research also identified other factors that influence KSP CUPS member growth: credit disbursement, socialization, and negligence. Credit disbursement is important for boosting the number of members, suggesting that offering low interest rates and simplifying the loan application process can increase growth. Socialization is likewise a factor; increased engagement by staff with the community through socialization efforts can generate greater public interest in becoming KSP CUPS members. Negligence, conversely, has the potential to decrease member growth, so KSP CUPS staff should work to minimize errors or inattention when providing services to members.

5. Conclusion

Based on the study's outcomes, it is evident that both linear

regression and ARIMA models can be employed to forecast KSP CUPS performance accurately using total assets. The prediction results produced by these two modeling approaches demonstrate similar levels of accuracy. Employing these methods in combination is expected to offer a more complete view for management, aiding them in developing more precise long-term strategies.

Regarding factors affecting the expansion of KSP CUPS membership, staff members are the most significant influence. This is followed by the volume of credit extended, instances of oversight or negligence, and community outreach activities (socialization). Employees are crucial to increasing the number of KSP CUPS members. Consequently, it is important that staff members provide excellent service to current and prospective members, as their direct interactions can build trust and encourage participation, thereby supporting sustained membership growth for the organization.

Data availability

All data produced or examined during this study are present in this paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' contributions

All authors participated in the study design, writing, and manuscript revision. MS drafted and revised the manuscript, and TH supervised the study. All authors have reviewed and approved the final manuscript.

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- Photograph and biography of the authors (Martinus Safril and Tonny Hidayat) were not available at the time of publication.