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Total revenue forecasting at BUMDEs using single moving average method

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ABSTRACT

The use of various information systems in supporting daily business activities has become common today, including the use of a financial recording system in BumDes Sarining Winangun Kukuh that has been built. However, to support managerial decision making, a profit/loss forecasting system is needed as a basis for making future business strategies. For this reason, this research develops a profit/loss forecasting system using the Simple Moving Average method. Based on testing the accuracy of forecasting using the MAPE method, the results show that the average error rate generated is 23.53% by using financial data for 1 year, where the smallest error rate is around 4%, while the highest error rate reaches a value of 0.632 or around 63.2%, so that it can help BUMDes in knowing total revenue forecasting.

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1. INTRODUCTION

As one of the villages that is developing rapidly and has even received the title as a digital village, various breakthroughs have been made by leaders who are certainly supported by the Kukuh villagers, located in Kerambitan District, Tabanan Regency, Bali Province. Village community empowerment is the main goal of implementing this digital village concept (Suyatna, 2019). The rapid development of information technology has recently become a necessity for all people, not only those living in urban and rural areas(Damanik et al., 2022; A. A. Fauzi et al., 2023; Lubis et al., 2020). Digitalization has been carried out in Kukuh Village in several fields, such as population registration, letter requests, including digitalization carried out on Village-Owned Enterprises (BumDes) in Kukuh Village, namely BumDes Sarining Winangun Kukuh.

Several information systems have been developed that facilitate the management of businesses carried out by BumDes Sarining Winangun Kukuh, for example the development of a Supply Chain Management System (SCM) which is used to monitor the flow of goods in and out of BumDes, the development of a Livestock Bank System which aims to monitor the development of the group of assisted breeders in Kukuh Village. , as

well as the development of the Financial Recording System including the development of the Point of Sale application which aims to record cash disbursements and income transactions as a result of various business fields run by BumDes Sarining Winangun Kukuh managers. Prior to the existence of the Financial Recording System, all daily transactions were recorded using Microsoft Excel and then recapitulated into daily, weekly and annual reports. Based on the results of interviews with BumDes management Sarining Winangun Kukuh, the recording method which is done through Microsoft Excel is indeed quite easy to use because the BumDes admin is familiar with using the application, but the problem that occurs is that there is often difficulty in calculating and preparing cash reports because they have to compile manual day per day of existing transactions and frequent errors in entering the appropriate post. Through the development of a financial recording system, the problems found in BumDes Sarining Winangun Kukuh related to the inefficient process of recording BumDes daily transactions can be resolved. the recording method which is done through Microsoft Excel is indeed quite easy to use because the BumDes admin is familiar with using the application, but the problem that occurs is the complexity of calculating and preparing cash reports because they have to manually compile existing transactions day by day and they often occur error in entering the appropriate post. Through the development of a financial recording system, the problems found in BumDes Sarining Winangun Kukuh related to the inefficient process of recording BumDes daily transactions can be resolved. the recording method which is done through Microsoft Excel is indeed quite easy to use because the BumDes admin is familiar with using the application, but the problem that occurs is the complexity of calculating and preparing cash reports because they have to manually compile existing transactions day by day and they often occur error in entering the appropriate post. Through the development of a financial recording system, the problems found in BumDes Sarining Winangun Kukuh related to the inefficient process of recording BumDes daily transactions can be resolved. but the problem that occurs is the frequent complexity of calculating and preparing cash reports because you have to manually compile existing transactions day by day and there are frequent errors in entering the appropriate headings. Through the development of a financial recording system, the problems found in BumDes Sarining Winangun Kukuh related to the inefficient process of recording BumDes daily transactions can be resolved. but the problem that occurs is the frequent complexity of calculating and preparing cash reports because you have to manually compile existing transactions day by day and there are frequent errors in entering the appropriate headings. Through the development of a financial recording system, the problems found in BumDes Sarining Winangun Kukuh related to the inefficient process of recording BumDes daily transactions can be resolved.

After the financial recording system has been completed, the next challenge is the need for BumDes Sarining Winangun Kukuh management to predict the profit or loss that BumDes will earn in the following month's period. This feature is important as a consideration for decision-making for BumDes management in making future BumDes development strategies, where predictions of profits or losses that BumDes will get are needed to better prepare BumDes needs in the future(Akbar & Devi, 2022; R. M. Fauzi & Mulyana, 2021; Permatasari, 2019). For this reason, this research builds the development of the BumDes Sarining Winangun Kukuh financial recording system to predict income next month. A forecasting method is certainly needed in developing a profit and loss forecasting system in the BumDes Sarining Winangun Kukuh financial recording system, where choosing the right method will result in better accuracy of forecasting results and of course it can have a positive impact on the development of BumDes Sarining Winangun Kukuh.

Several forecasting methods have been developed by previous researchers in different case studies. One of the forecasting methods that can be used is the Simple Moving Average (SMA) method. The Simple Moving Average is a forecasting method by

calculating the average over a certain period of time without weighting(Anggraeni, 2019; Marita & Darwati, 2022). The characteristic of this method is that it can be used on data that is unstable, has no trend, and does not use weighting(Dewi et al., 2021; Sundari et al., 2015). The simple moving average method will produce good forecasts if the observed values do not show a trend and do not indicate a seasonality(Azizah, 2015; Listiowarni et al., 2020). Some studies with similar cases and applying the SMA method are research by (Gustin & Pakereng, 2023) which forecasts revenue trends with data on stores by producing an accuracy value of 66.743%, other research by (Aini et al., 2018) in forecasting revenue profits in the carpet laundry business with an average data interval of four months. Further research by Fauziah et al., 2019) in forecasting total sales using SMA in the internet cafe business by obtaining a lower forecasting error rate its about 5%. The comparison between previous and current research lies in the amount of data being forecasted, because this study uses 12 months of revenue data, so that it can affect the results of the Mean Absolute Percentage Error (MAPE). Some results from previous research become the basis for determining the suitability of applying the SMA method to the financial recording system at BumDes Sarining Winangun Kukuh. For this reason, this research was made to develop a forecasting system for the financial recording system of BumDes Sarining Winangun Kukuh using the Simple Moving Average method. For this reason, this research was created to develop a forecasting system for the BumDes Sarining Winangun Kukuh financial recording system using the Simple Moving Average method. The accuracy of forecasting results is an important issue that must be accommodated before a forecasting system, therefore this study uses the Mean Absolute Percentage Error (MAPE) method to determine the accuracy of the profit and loss forecasting results(Gustin & Pakereng, 2023; Sophia et al., 2021; Sukamto & Setiawan, 2018) of the system that is built and will be compared with the profit and loss results obtained by BumDes Sarining Winangun Kukuh in the previous month period.

2. RESEARCH METHOD

2.1 Simple Moving Average (SMA)

The Simple Moving Average is a method that is quite popular in developing a forecasting system in various cases that has been developed by many previous researchers. The ease of using this method is one of the reasons for the many forecasting system developments that use the Simple Moving Average method. This technique can eliminate noise, thus the trend movement will be smoother(Lauren & Harlili, 2014; Wahyuddin et al., 2023).The basic concept of the Simple Moving Average Method is to take the average value over a certain period of time. For example, suppose forecasting will be carried out using data from 7 days, forecasting calculations are calculated from the average value of the current and the previous 6 days (SMA 7)(Swari et al., 2021). The data period used in this method can be adjusted to the needs and desires of the forecasting system development. Equation 1 is a computational model used in calculating forecasts using the simple moving average method.

$$S\ M\ A = \frac{X_1 + X_2 + \cdots + X_n}{\mathrm{n}} \quad (1)$$

Wherenis the total period used, while it is the value in the period to .X_1n

2.2 Mean Absolute Percentage Error (MAPE)

In an information system development, functionality requirements are the main aspects that need to be ensured to be able to conclude that the software is running well and meets user needs. However, for an intelligent system, for example a forecasting system as developed in this study, it is necessary to test the accuracy of the forecasting

system built to determine the feasibility of forecasting results, where good forecasting will certainly be a good input so that it can provide accurate information for leaders. in formulating the company's development strategy. Mean Absolute Percentage Error (MAPE) is a method of testing the accuracy of forecasting systems that can be used. MAPE is widely used in practice because of its simple interpretation(De Myttenaere et al., 2016).

$$MAPE = \frac{\sum \frac{|y^1 - yt'|}{y^1}}{n} x\ 100\% \quad (2)$$

2.3 Research Stages

The financial recording system was developed on a web basis using the Laravel framework and MySQL database(Muhammad Wali et al., 2023). The financial recording system at BumDes Sarining Winangun Kukuh is equipped with a profit/loss forecasting feature for the next month using the Simple Moving Average method, so Figure 1 is a flowchart for developing a financial recording system along with features for forecasting income carried out in this study.

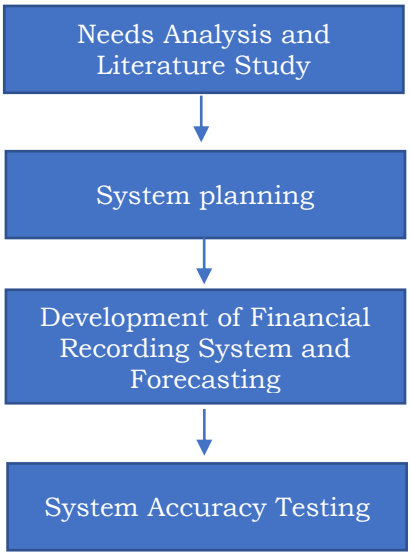

Figure 1. Research Steps

As shown in Figure 1, there are 4 steps in the development phase of the financial recording system and profit/loss forecasting carried out in this study, namely the needs analysis phase and literature study. The results of the needs analysis are in the form of a list of system requirements that must be met as listed below: (a) Settings menu to set the variables used in the system and account mapping (b) Master data related to main account and COA (chart of account) (c) Cash flow which includes goods revenue, service income, and expenses (d) Journal consisting of adjusting journal and closing journal (e) Balance sheet and income statement, (f) Profit/loss prediction

While the literature used as a reference includes libraries related to the development of information systems, especially using the Laravel framework, theories related to the Simple Moving Average and MAPE. The next step is followed by the system design phase, after the system design has been successfully made, it is continued by implementing the design results into lines of program code using the PHP programming language, and the last step is testing the accuracy of the system using MAPE.

3. RESULT AND DISCUSSIONS

On this section describes the results of system design, the results of implementing a financial recording system and forecasting, as well as the results of testing the accuracy of forecasting results using the MAPE method. Financial recording and forecasting systems are designed using Data Flow Diagrams (DFD) and Physical Data Models (PDM). The context diagram of the system being built is shown in Figure 2.

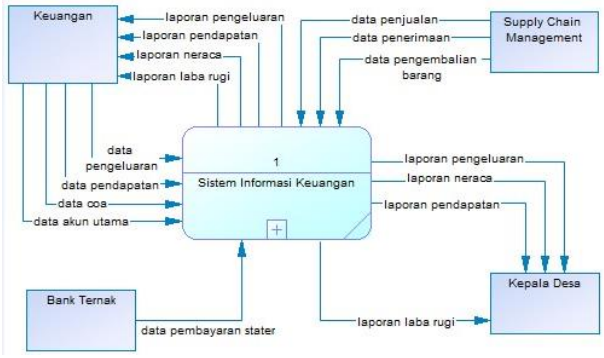

Figure 2. Context Diagram

System financial recording and forecasting is a system that is integrated with several external entities, namely livestock banks, where in livestock banks there is cash flow in and out which will later affect BumDes income per day. Other outside externals that influence the revenue of BOEs come from Supply Chain Management which has been built on previous research, SCM will document the flow of goods in and out. The financial recording information system can be accessed by the village head to receive expenditure reports, balance sheets, income and income statement. Meanwhile, the PDM design implemented in this study can be seen in Figure 3.

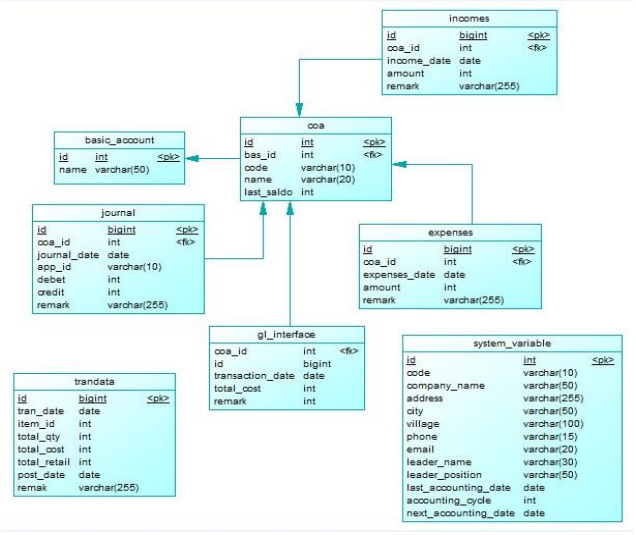

Figure 3. Physical Data Model of the Financial Recording System

As can be seen in Figure 3, there are 8 tables that are formed and used in the financial recording system that is being built, namely the incomes table, coa,

basic_account, journal, expenses, gl_interface, system_varianle, and trandata which will store cash flow transaction data in and out of BumDes. The display of the results of forecasting income, profit/loss for the next month generated by the financial recording and forecasting system that has been built can be seen in Figure 4.

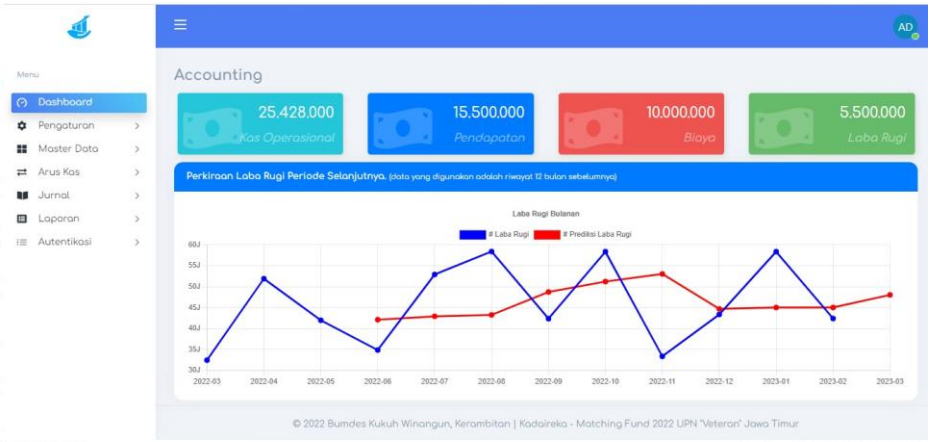

Figure 4. Forecasting Results Using the SMA Method

The actual income earned by BumDes Sarining Winangun Kukuh is represented using the blue line, while forecasting revenue results are represented by the red line/Profit/loss is obtained by subtracting the amount of income and expenses written on the top right of the dashboard. To ensure the accuracy of system forecasting results using SMA, a system accuracy test was carried out using the MAPE method, the results of which can be seen in Table 1.

Table 1. Accuracy Testing Using MAPE

Year	month	Actual Data	Forecasts	Error
2022	3	32,456,754		
2022	4	51,908,756		
2022	5	41,987,650		
2022	6	34,876,598	42,117,720	0.17264
2022	7	52,909,870	42,924,335	0.28631
2022	8	28,389,384	43,258,039	0.28102
2022	9	32,363,382	38,725,272	0.22409
2022	10	58,363,382	37,887,533	0.63269
2022	11	33,363,687	39,705,371	0.10866
2022	12	43,363,687	41,363,484	0.05995
2023	1	58,363,607	45,030,252	0.30748
2023	2	42,405,684	45,030,327	0.04497
		Average Error		0.23529
		MAPE		23.53%

Based on the results of accuracy testing using the MAPE method as shown in Table 1, the results show that the smallest error rate occurs in forecasting month 1 of the 23rd year, which is equal to 0.045, or only about 4%, while the highest error rate occurs in forecasting in month 10th year. 2022 which reached a value of 0.632 or around 63.2% with an average error rate of 23.53%.

4. CONCLUSION

A financial recording system and profit/loss forecasting has been developed that is used in BumDes Sarining Winangun Kukuh, where a large enough error rate is obtained from

the test results using the MAPE accuracy testing method, which is 23.53% using financial data for 1 year. The average value of this error rate is quite large for a forecasting system, but in several months forecasting actually produces a fairly small error rate, even only worth 4%. The research limitations on the range of data used are financial data for 1 year, so the addition of test data can be a suggestion for further research.

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