Quantitative Methods in Sales Forecasting: Profit Maximization Efforts

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ABSTRACT: *Planning is a crucial element for the continuity and development of MSMEs. With effective planning, MSMEs can set clear goals, so that existing resources can be used optimally. One form of planning that is vital for MSMEs is the preparation of a sales budget. The sales budget, which is the basis for preparing other budgets, requires an appropriate forecasting method. This forecasting process can be done using quantitative methods, such as the least squares method, the moment method, and the quadratic method, followed by calculating the standard error of the forecast. This study used one MSME in Padalarang, namely a credit and data quota purchasing house. This study aims to calculate the estimated sales target to reduce the risk of loss due to unsold inventory, as well as optimize MSME profits. The research method used is descriptive quantitative, with data collection through observation, documentation, and interviews. The results of this study indicate that the most appropriate forecasting method for this MSME is the quadratic method because it has the smallest SKP value compared to other methods.*

KEYWORDS –*Quantitative Methods, Sales Forecasting, Maximizing Profits*

I.   INTRODUCTION

Micro, Small, and Medium Enterprises or MSMEs are productive businesses owned by individuals and/or individual business entities that meet the criteria of micro businesses as regulated by law. The potential of MSMEs for the national economy is very large, but in reality, MSMEs often encounter various obstacles. One of the most common obstacles encountered is the inability of MSMEs to maintain the sustainability of their businesses. The sustainability and growth of a business does not only lie in the amount of capital or assets owned but also requires good skills in business management, especially in planning.

Budgeting is a planning of interrelated company operational activities and has an important role as a working guideline so that company activities can be directed to achieve the desired goals. (Septianti & Dahtiah; 2021). Budgeting covers all business areas such as sales, procurement, production, profits, and marketing. The activity that is very influential in obtaining business profits is sales. The sales budget is the basis for preparing other budgets and is usually prepared before preparing other budgets (Nafarin, 2018). Preparing a detailed sales budget helps companies estimate inventory needs more efficiently. In preparing accurate sales planning, the right forecasting method is needed.

The sales forecasting method is an activity to estimate products that will be sold in the future under certain conditions by reviewing data that has occurred or may occur (Nafarin, 2018). Quantitative forecasting can be done through statistical and mathematical methods using several methods such as the least squares method, the moment method, and the quadratic method. On the other hand, qualitative methods are usually

obtained through opinions (judgments). Rumah Pulsa Padalarang is an MSME that sells various products such as starter cards and internet vouchers from various service providers (providers), credit, and smartphone accessories. This MSME has been operating since 2014 and is still operating today. At the beginning of the business, the products sold were limited to credit only but continued to grow with a wider selection of products. Currently, the type of product that is most widely sold is internet quota vouchers. In selling these products, the types of products sold are uncertain (fluctuating). Voucher products consist of Telkomsel, XL, Tri, Indosat, Smartfren, and Axis. This sales uncertainty often causes owners to hesitate in determining the amount of inventory so that they only rely on their instincts and calculations. This is very risky because it can cause a lack of inventory procurement so that consumer demand cannot be met.

Various studies on sales forecasting using quantitative methods have been conducted, including research conducted by Tarigan & Nurhayati (2022) in estimating brick sales using the least squares, moment, and quadratic methods. In addition to being used as a reference for predictions related to sales results in the coming month, forecast results also serve as a basis for decision-making regarding the provision of inventory and appropriate marketing strategies so that desired sales can be achieved.

Based on the background that the author has described above, the research problem can be formulated as follows:

1. How to calculate sales forecasting using the least squares method, the method of moments, and the quadratic method?
2. What is the most appropriate forecasting method for UMKM Rumah Pulsa Padalarang?

The research objectives to be achieved from this study are to determine the preparation of the sales budget at the Rumah Pulsa Padalarang UMKM and to determine the most appropriate forecasting method to be implemented.

II.   LITERATURE REVIEW

A. **Budget**

budget is defined as a plan that is systematically and structured in the form of numbers and expressed in a monetary form that covers all company activities in a certain period in the future (Fuad et al., 2020). Masyhuri (2018) states the definition of a budget as an estimate of the number of units or value of an activity that is operational and related to other activities in a company.

Nordiawan & Hertianti (2010) describe several benefits obtained from budgeting, namely internal communication channels that function to connect departments/divisions within the organization with top management and ensure that company goals can be understood and followed by all parts of the company. Second, the budget presents information on the extent to which actual achievements have reached the standards that have been previously set. Next, the budget acts as a control tool that helps management identify the weaknesses and strengths of the organization and the necessary improvements. Fourth, the budget, is expected to motivate managers and employees to work effectively, efficiently, and consistently in achieving company goals and their individual goals. Finally, the budget functions as a monitoring tool that allows management to compare the implementation of activities and the budget that has been set when completing a task or project.

According to Sasongko & Parulian (2010:4), the preparation of the master budget can be divided into two groups, namely the operational budget and the financial budget. The master budget consists of the sales budget, production budget, raw material usage, and purchase budget, direct labor cost budget, production overheadcost budget, production cost budget, operating expense budget, profit and loss budget, cash budget, and balance sheet budget.

The sales budget generally describes the income that will be received from the company's sales activities. This budget includes the type of product sold, the quantity of the product, the price per unit, and the time of sale. The sales budget is the basis for preparing other budgets. When the sales budget has been prepared, then other operational budgets will begin to be designed (Fuad et al., 2020).

B. Sales Forecasting

The sales forecasting method is an activity to estimate products that will be sold in the future under certain conditions by reviewing data that has occurred or may occur (Nafarin, 2018). This forecast plays an important role because companies need to estimate what will happen to provide an overview of future sales capabilities (Rohana, 2019). Sales forecasting is the most important step in decision-making as well as the basis for long-term planning of the company which covers various existing aspects. In the financial aspect, forecasting is a guideline in determining the budget and controlling the costs incurred. In the marketing aspect, forecasting is needed in planning new products, promotional strategies, and other interests. In the production aspect, sales forecasting is used in planning capacity, facilities, production, scheduling, and product inventory control (Sulistyowati et al., 2020)

Forecasting techniques are divided into two, namely qualitative and quantitative. Qualitative forecasting techniques (judgment method), namely forecasting focuses on someone's opinion. Quantitative forecasting techniques (statistical method), namely forecasting based on calculating numbers using various statistical methods. Quantitative forecasting techniques are divided into several methods, namely the Free Hand Method, Semi Average Method, Moment Method, Parabolic Method, Least Square Method, Multiple Regression, Single Regression. (Widajatun et al .; 2021). The most common methods used by MSMEs and companies as sales forecasting are the least square method, moment method, and parabolic method.

Considerations in selecting sales forecasting methods also need to be considered in calculating forecasting standard errors which aim to determine which method is most appropriate and can be implemented in sales forecasting. The smallest SKP value indicates that the forecast prepared using this method is close to the sales results that will occur in the relevant period (Afriady et al., 2021).

III.   RESEARCH METHODS

Ramdhan (2021) stated that descriptive research refers to research that aims to provide an overview, description, or explanation of the phenomenon being studied. Quantitative research is a method that aims to study a certain population or sample through statistical data analysis (Sugiyono, 2021). This study aims to scientifically process the preparation of sales forecasts, thereby reducing the risk of losses due to unsold inventory, and optimizing MSME profits. This study uses documentary data related to sales activities in 2023 - 2024 as well as interviews with business owners. In this study, using data analysis techniques that are applied through several formulas as follows;

   A. Least Square Method
   $y = \boldsymbol{a} + \boldsymbol{b} X$ with Description: y = Dependent variable, x = Independent variable, a = Constant value, b = Regression direction coefficient, n = Quantity of data
   B. Moment Method
   $y = \boldsymbol{a} + \boldsymbol{b} X$ with Description: y = Dependent variable, x = Independent variable, a = Constant value, b = Regression direction coefficient, n = Quantity of data
   C. Dd
   $Y = \boldsymbol{a} + \boldsymbol{b} x + \boldsymbol{c} (x)^2$ Description: y = Dependent variable, x = Independent variable, a = Constant value, b = Regression direction coefficient, c = Level of development of predicted value with squared time units, n = Quantity of data

After-sales forecasting using the three methods is carried out, the author will then calculate the Forecasting Standard Error to find out which method is most appropriate to implement.

$$\sqrt{\frac{\sum(x - x)^2}{n - 2}}$$

Description: x = actual sales , y = sales forecast, n = data quantity, -2 = two degrees of freedom are lost because two population parameters are being estimated with sample data values (a and b)

IV.   RESULTS AND DISCUSSION

Forecasting and preparing sales budgets can be a strategy that can be done to reduce sales uncertainty that has occurred so far. Forecasting and preparing sales budgets can support the success of MSMEs in obtaining optimal profits while minimizing losses that can occur. Through forecasting, owners can make decisions in determining product inventory better so that they can meet consumer purchases.

To obtain objective results from the forecasting calculations and sales budgeting carried out, this study uses historical sales data from April 2023 to March 2024. The calculations were carried out from six products consisting of different providers. The following is internet voucher sales data

Table 1. Product Sales Results

Year	Month	TypeProduct					
		Axis	Indosat	Smartfren	Three	Telkomsel	XL
2023	April	261	116	93	158	244	91
	May	299	131	109	178	268	111
	June	391	173	148	219	327	122
	July	347	137	101	181	271	118
	August	272	97	88	147	257	102
	September	309	121	123	169	261	101
	October	328	163	125	188	255	88
	November	291	124	98	217	237	93
	December	276	128	101	205	239	96
2024	January	369	142	142	242	302	117
	February	325	130	122	189	275	83
	March	344	148	96	206	342	124

Source: Data processed by researchers (2024)

Based on the product sales results table above, it can be seen that sales of each product have changed or are fluctuating. Changes in product sales can be influenced by many factors. The following is an explanation of the relationship between historical data in the table and factors that influence sales compilation according to Suhardi (2019):

1. Historical data regarding previous sales

    Based on product sales from April 2023 to March 2024, the highest sales came from Axis, Telkomsel, and Tri products. This means that the preparation of the next period's sales budget is expected to focus on these three products. The higher the sales of these three products, the more profit that can be obtained.

2. Company policy on consumers

    Based on observations that have been made, the owner sets a cheaper selling price, especially for products that have the highest sales. In addition, discounts are given for purchases of similar products with quantities of more than 2 pieces in the form of a discount of Rp. 500 per product. Payment for products is also not limited to cash, but can also be via e-money.

3. The number of workers owned

    Excellent service is one of the keys to the success of a business. The location of the business on the side of the road is very strategic because it is busy and easy to reach. Therefore, it is necessary to have sufficient manpower so that the service provided can be fast, friendly, and informative.

4. The amount of capital owned

Based on observations and interviews that the author has conducted, the owner explained that the capital owned so far has been more focused on products with the highest sales, namely Axis, Telkomsel, and Tri. Relevant to the preparation of the budget, the budget prepared for the next period is expected to be able to optimize forecasting on products with the highest sales so that product inventory can meet consumer demand.

5. Competitor Conditions

   Providing discounts and providing complete products is one strategy to make consumers more interested in buying internet voucher products compared to other MSMEs that have similar products.

6. Income level and purchasing power of the community

   The business unit studied is located in an area with a majority of people consisting of school students, college students, and housewives. This community composition greatly influences the sale of internet voucher products which is one of the important needs.

7. Population Distribution Rate

   Although many people are turning to purchasing vouchers through online platforms, there are still large areas where internet access and digital payment facilities are limited.

A. Sales forecast calculation

The products traded in this business unit are 6 products including Axis, Indosa, Smartfren, Tri, Telkomsel, and XL. The following is the calculation for one axis data package product for 1 year with 3 methods used.

Table 2 Sales Forecast Calculation for Axis Products

n	Year	Month	Sales (y)	Least Squares Method			Moment			Quadratic Method				
				x	x2	xy	x	x2	xy	x	x2	xy	$x^2 y$	x4
1	2023	April	261	-11	121	-2,871	0	0	0	-11	121	-2871	31,581	14,641
2		May	299	-9	81	-2.691	1	1	299	-9	81	-2.691	24,219	6,561
3		June	391	-7	49	-2,737	2	4	782	-7	49	-2,737	19.159	2.401
4		July	347	-5	25	-1,735	3	9	1,041	-5	25	-1,735	8.675	625
5		August	272	-3	9	-816	4	16	1,088	-3	9	-816	2,448	81
6		September	309	-1	1	-309	5	25	1,545	-1	1	-309	309	1
7		October	328	1	1	328	6	36	1,968	1	1	328	328	1
8		November	291	3	9	873	7	49	2,037	3	9	873	2,619	81
9		December	276	5	25	1,380	8	64	2.208	5	25	1,380	6,900	625
10	2024	January	369	7	49	2,583	9	81	3.321	7	49	2,583	18,081	2.401
11		February	325	9	81	2.925	10	100	3.250	9	81	2.925	26,325	6,561
12		March	344	11	121	3,784	11	121	3,784	11	121	3,784	41,624	14,641

Total	3.812	0	572	714	66	506	21,323	0	572	714	182,268	48,620

Source: data processed by researchers (2024)

B. Selection of the Appropriate Method to Implement

After the sales forecast is done, the next step is to choose a forecasting method. The selection of the method is done by comparing the three quantitative methods through the calculation of the Sales Forecast Standard Error. From the calculation of SKP, it can be seen how much deviation or error from the forecasting method used. The smaller the SKP value indicates that the method used is an effective method and is suitable for the company to implement. The following is the calculation of SKP for each product,

Table 3 Comparison of Sales Forecast Standard Errors

TypeProduct	MethodSquareThe Smallest	MethodMoment	MethodQuadratic
Axis	41.24	41.24	41.22
Indosat	21.40	21.40	21.35
Smartfren	20.47	20.47	20.25
Three	24.51	24.51	24.51
Telkomsel	34.07	34.07	30.34
XL	14.81	14.81	14.52

Source: data processed by researchers (2024)

Based on the comparison of the standard errors of the sales forecast, it can be seen that the quadratic method has the smallest SKP value. The smallest SKP value indicates that the forecast prepared is close to the sales results that will occur in the relevant period so that it is the most appropriate forecasting method to use in preparing the sales budget (Afriady et al., 2021). In addition, it can be seen that the results of the SKP calculation using the least squares and moment methods have the same value. This happens because the least squares method formula is a simplification of the moment method formula. Based on previous research that the author has reviewed, the results between forecasting and SKP calculations with the two methods tend to always be the same.

C. Sales Budget Target Calculation

After knowing the quadratic method is the right method in implementing the sales budget, then the next form of sales budget calculation for the next 1 year. Here is a table of sales budget calculations for one year.

Table 4 Sales Budget Calculation

Year	Month	Product					
		Axis	Indosat	Smartfren	Three	Telkomsel	XL
2024	April	337	143	107	218	331	110
	May	341	145	104	222	352	113
	June	345	148	101	226	376	117
	July	350	151	96	230	403	121
	August	354	154	92	234	432	126
	September	359	158	86	239	465	131
	October	364	161	81	243	499	137
	November	369	165	74	247	537	143
	December	375	170	67	251	577	150
2025	January	380	174	60	256	620	157
	February	386	179	52	260	666	165

March	392	184	44	264	714	173

Source: data processed by researchers (2024)

Based on the sales budget for each voucher product that has been prepared, there are vouchers that show an increase and some that experience a decrease. By looking at the sales budget calculation and explanation for each type of voucher, it is hoped that MSME owners can consider the factors that affect the sales of each voucher. This can be in the form of increasing promotions for vouchers that are less in demand and maintaining the quality of service for the sale of popular vouchers so that it can help optimize MSME income .

V. CONCLUSION

Based on the data processing and discussion that has been described by there are several things that can be concluded, namely, the author's sales forecast calculation was carried out using three forecasting methods, namely the least squares method, the moment method, and the quadratic method. The calculation produces a total forecast result that is the same as the company's actual total sales. By using the three forecasting methods, the total sales forecast is 3,812 for Axis products, 1,610 for Indosat products, 1,346 for Smartfren products, 2,299 for Tri products, 3,278 for Telkomsel products, and 1,246 for XL products

After the forecast is done, the next step is to calculate the SKP to determine which method has the smallest deviation. Based on the SKP calculation, it is known that the quadratic method has the smallest SKP value. The implementation of the sales budget for 2025 has been prepared using the quadratic method with sales targets. This is expected to be able to help business units in developing strategies so that sales targets can be realized properly.

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