IMPLEMENTATION SYSTEM OF SIMPLEX METHOD FOR OPTIMIZATION PROFIT

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Abstract: Companies that carry out production activities necessarily want the company's goals to be achieved, one of which is optimal profit. Maximum profit in production can be realized by planning the optimal amount of production. The purpose of this study consists of four, namely making a profit formulation to maximize the amount of production, determining the optimal number of brown bread variants that will be produced at Win Bakery, determining the maximum profit in producing bread at Win Bakery, and predicting profits for return on investment. This research was conducted using a linear programming model. Decision variables determine the decisions that will make to achieve the optimal solution. The objective function is a function that describes the goals or objectives in linear programming problems. Relating to the optimal use of resources to obtain maximum profit or to use minimum costs. A constraint function is a form of formulation of the obstacles faced in achieving the goal. The results obtained from the research are the decision variables, with X1 being the number of square chocolate bread productions and X2 is the number of round chocolate bread productions. The objective function of the profit per unit is to maximize $Z = 1000X1 + 800X2$. The constraint function is the raw material used in making chocolate bread. Furthermore, the optimization of production with POM-QM resulted in the number of square chocolate bread production of as many as 13 pieces and round chocolate bread as many as 25 pieces so that the profit gained in one day was Rp. 32,500. The next calculation, the break-even point by entering fixed costs, variable costs, and profits obtained results in units of 55 units and the total profit earned is Rp. 1,777,00.

Keywords: Bread, Chocolate flavor, Maximum profit, POM-QM, Total production.

INTRODUCTION

The development of globalization in the industrial world is currently growing rapidly. This rapid development will lead to very tight competition between companies. Data from the Ministry of Industry Republic of Indonesia based on the Central Statistics Agency (BPS), in 2019 the total bread production was 38,250 tons, in 2020 the total bread production was 36,600 tons, and in 2021 the bread production was 37,594 tons. From 2019 to 2021 bread production decreased by 4.3% due to the covid pandemic, and in 2021 bread production increased again. [1]

Companies that carry out production activities necessarily want the company's goals to be achieved, one of which is optimal profit. Maximum profit in production can be realized by planning the optimal amount of production. Factors to get maximum profit such as the price of raw materials, product prices, the amount of raw material inventory, and the amount of production. The simplex method was maximizing profits for optimizing the amount of production. [2]This problem is also experienced by SMEs Win bakery with different product variations and production quantities. From 2019 to 2021 Factory experienced a 35% decrease in profits.

Company that produces bread produces products with various flavours. The product to be studied is brown bread because the bread is in great demand by consumers and the bread that is most purchased by consumers and sold out is round chocolate bread. The company produces 20 squares and rounds of brown bread each day. The production process can only be optimal because the oven machine's capacity exceeds the dough. This research was conducted to determine the optimal amount of bread production for maximum profit.

The research objectives are: first, to make a profit formulation to maximize production. Second, to determine the optimal number of variants of brown bread to be produced. Third, to determine the maximum profit in making bread production. Fourth, to predict the return on investment.

RESEARCH METHODS
Identification of problems
The problem identification stage is the stage to discover the problems that occur in a company. The problem identified in the Company that produces bread is about determining the maximum profit for the optimal amount of production on brown bread products because the product is in great demand. Chocolate that is used if stored for a long time will cause blooms, namely sugar blooms, where the surface of the chocolate is moist and dissolves the sugar in the chocolate.

Data collection
The next stage is to collect data after identifying the problem. Data collection was carried out to obtain the information needed to achieve the research objectives. Then the necessary data were obtained from the company by providing notes on the size of the recipe and the required cost calculation data. The type of data collected is primary data. The data needed is the inventory of raw materials used, the selling price and profit of the product, the composition of raw materials, and the variety of products to be studied.

Solution to problem
The next stage is to solve the problem from the data obtained using a linear programming model. The data and problems obtained can be used to determine the right method to process the data.

Data Processing and analysis
The next stage is processing data and analysis using data that has been obtained previously. Then determine the decision variables, objective function, and constraint function. The data is then input into POM-QM, calculations are carried out, which are processed with data software to solve the problem, and the output data is obtained so that the result is maximum profit, and then an analysis of the data processing is carried out.

Conclusions and suggestions
The last stage is making conclusions and suggestions from the results of the research that has been done. Conclusions were obtained from the data processing results, and analysis stages were carried out and achieve the research objectives. The conclusions have been obtained and then formulated suggestions for related parties, namely the company or further research.

RESULT AND DISCUSSION
The product under study is brown bread. There are two forms of brown bread produced by that company, namely square chocolate bread and round chocolate bread.

Linear Programming Model
Linear programming is one of the solutions to problems in determining the optimal solution. The formulation of the linear programming model in this study consists of the formulation of decision variables, the formulation of the objective function, and the formulation of the constraint function. Constraints that are used as limitations in this research on the Company that produces bread are raw materials. The following is the formulation of a linear programming model.

Decision Variables
Chocolate variant bread produced by the company has a square and round shape. The amount of production of chocolate flavours bread is used as a decision variable in this study. The decision variable consists of two to determine the optimal amount of production, namely:
X_1 = number of boxed chocolate bread production
X_2 = Total production of round chocolate bread

Objective Function
The objective function contained in this study is used to maximize the profit from the bread produced. The advantage of each type of bread per fruit can be obtained from the coefficient of the objective function. The value of the profit is obtained from the difference between the selling price of the product and the total cost per fruit of the type of bread it produces. The following is a table of data on the selling price and profit of bread at that company, which contains the selling price, the total cost per piece, and the profit per piece.

Table 2. Data on Selling Prices and Profits for Bread

Variable	Bread Type	Price (IDR/pcs)	Profit (IDR/pcs)
X_1	Square chocolate bread	5500	1000
X_2	Round chocolate bread	4000	800

Table 2 represent that bread Selling Price and Profit Data above consists of variables, type of bread, selling price (per piece), total cost (per piece), and profit (per piece). It is known that the variable consists of the X1 variable with the type of bread, namely boxed brown bread. The bread has a selling price of Rp. 5500 per piece and a profit of Rp. 1000 per piece. Variable X2 is the type of round chocolate bread with a selling price of Rp. 4000 per piece and a profit of Rp. 800 per piece. Based on the data above, the objective function formulation model in this study is to maximize $Z = 1000X_1 + 800X_2$.

Constraint Function

The constraint function in this research is raw materials. The company production activities use raw materials to make bread. The coefficient value of the constraint function is the use of raw materials that are following the use and needs of producing bread. Raw material inventory data can be seen in the following Table 3.

Table 3. Inventory Data of Raw Materials

No.	Raw Material	Quantity	Unit
1.	Wheat flour	50.000	Gram
2.	Sugar	5.000	Gram
3.	Margarine	10.000	Gram
4.	Salt	5.000	Gram
5.	Baking powder	2.000	Gram
6.	Egg	5.000	Gram
7.	Milk (powder)	5.000	Gram
8.	Chocolate powder	5.000	Gram
9.	Water	30.000	mL

Table 3 shows the raw materials used in making chocolate bread are flour, sugar, margarine, salt, baking powder, eggs, milk powder, chocolate, and water. Each raw material has a different amount of inventory. The units used are in grams. The use of raw materials in one production to produce boxed brown bread and round chocolate bread has its own measure. In one day, the company can produce as many as 20 squares of chocolate bread and 20 pieces of round chocolate bread. The following table shows the use of raw materials in one production.

Table 4. Composition of Raw Materials in One Production

No.	Raw Materials	Unit	Square chocolate bread	Round chocolate bread
1.	Wheat flour	Gram	1500	1000
2.	Sugar	Gram	100	60
3.	Margarine	Gram	160	150
4.	Salt	Gram	30	20
5.	Baking powder	Gram	60	50
6.	Egg	Butter	10	10
7.	Milk (powder)	Gram	150	120
8.	Chocolate powder	Gram	150	100
9.	Water	mL	1200	600

Table 4 shows that the dose used differs between these two types of chocolate bread. Square chocolate bread has a composition of wheat flour that is more than round chocolate bread. Square chocolate breadand round chocolate breadhave the same egg composition. The function of powdered milk in bread making is to dissolve dry ingredients, while powdered milk adds a savoury and creamy taste to the bread. The data above from the raw material inventory table and the raw material use table in one production can formulate the constraint function in this study, namely as follows:

Wheat flour	$= 1500X_1 + 1000X_2$	≤ 50000	(1)
Sugar	$= 100X_1 + 60X_2$	≤ 5000	(2)
Margarine	$= 160X_1 + 150X_2 \leq 10000$		(3)
Salt	$= 30X_1 + 20X_2$	≤ 5000	(4)
Baking powder	$= 60X_1 + 50X_2$	≤ 2000	(5)
Egg	$= 10X_1 + 10X_2$	≤ 5000	(6)
Milk powder	$= 150X_1 + 120X_2$	≤ 5000	(7)
Chocolate powder	$= 150X_1 + 100X_2 \leq 5000$		(8)
Water	$= 1200X_1 + 600X_2$	≤ 30000	(9)
$X_1 \geq 0$			(10)
$X_2 \geq 0$			(11)

Solving the problem of optimization with POM-QM

The company, in doing bread production, has a problem, namely raw materials. Data processing is carried out using POM-QM software by entering decision variable data and objective functions and showing the results of optimization of production obtained by the company. The following is the optimization of raw materials using the POM-QM software.

Figure 1. Input Data

Based on Figure 4.2, the data in the POM-QM table above consists of raw materials and types of products, namely brown bread boxes and round chocolate bread. Each column is filled with the objective function and material capacity in the Right-Hand Side (RHS) column. Next, the data is solved by solving problems in the software to see the results. The following display of the complete results can be seen in Figure 2.
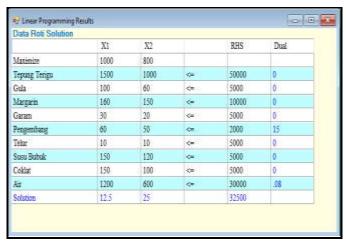

Figure 2. Result of Linear Programming

Based on Figure 2 Linear Programming Result, it can be seen that. The results obtained from data processing are solutions for 12.5 brown bread boxes which are rounded up to 13 pieces and 25 round chocolate breads in one day. The profit earned is Rp.32,500 in one day's production. The next result of the solution list can be seen in Figure 3.
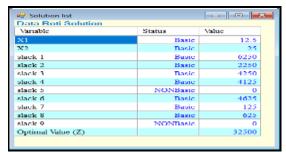
Figure 3. Solution List

Based on Figure 3 above, the variables, status and values are known. The variable column in the solution list table includes decision variables in this study, there are two types of brown bread. The variable is the optimal solution and the amount that must be produced is in accordance with the value of the value. The status column contains results that show basic and non-basic. Basic status means that the variable is a variable that has a non-zero value and indicates a non-limiting raw material because it still has a known remainder in the value column. Then, non-basic status means that the variable shows raw materials as a barrier because the value in the Value column is 0. The next result, namely iteration, can be seen in Figure 4.
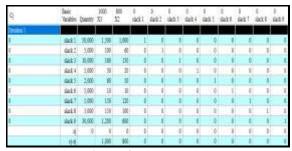

Figure 4. First Iteration

On Figure 4, Iteration 1 shows that the table is not optimal. The iteration process generated from POM-QM is carried out from initial conditions to optimal conditions. This iteration process is done by determining the key column, key row, and key number. The key column is determined from the smallest Z value, X1. Next, determine the ratio by calculating the right value divided by the selected key column to determine the key row. The specified key row is slack 9 with the smallest ratio, and the key number is 1200. Then, optimization testing is carried out in the next iteration because it is known that the solution is not optimal. The next result is the optimization test in iteration 2, which can be seen in Figure 5.

Figure 5. Second Iteration

Figure 5 shows that the results of the solution that is not optimal. Then do the same steps as iteration 1, determining the key column can be seen in rows cj-zj which has the largest positive value of 300 in column X2. Then determine the key row with the smallest ratio, namely the slack line 7 and the key number, which is 45. Next, the optimal test is repeated because the solution obtained is not optimal. The next result is the optimization test of iteration 3 can be seen in Figure 6.

Figure 6. Third Iteration

Based on Figure 6, it is known that in lines cj-zj there are no longer negative values. These results indicate that the solution is optimal. The results of this 3-iteration table, the company produces 12.5 squares of brown bread, rounded up to 13 pieces, which can be seen in line X_1. Produces 25 round brown pieces of bread, which can be seen in row X_2. The profit that can be obtained is Rp. 32,500 can be seen on line zj.

Results Comparison

The results that have been obtained from the POM-QM software are made a comparison table of results. This comparison of results includes the number of productions and profits in one day from the company and POM-QM. The following is a comparison table of results in Table 5.

Table 5. Comparison of Results

Product	Company		POM-QM	
	Production (pcs)	Profit (IDR)	Production (pcs)	Profit (IDR)
Square chocolate bread	20	36.000	13	32.500
Round chocolate bread	20		25	

Table 5, it is known the amount of production and profit in one day from the company and the results of POM-QM. The company produces 20 pieces of square chocolate bread and 20 pieces of round chocolate bread. At the same time, the results obtained from the POM-QM software are as many as 13 pieces for brown bread boxes and as many as 25 pieces for round chocolate bread. The results of the comparison of profits obtained by the calculation of the larger POM-QM are Rp. 32,500 per day, while the company's sales are Rp. 36,000 per day. Based on the results that have been obtained, it is recommended to carry out production according to the results of the processed data.

Break-Even Point Analysis

The break-even point is the point where total revenue equals total costs and the point where profit equals zero. The break-even point is an activity where the income received by the company from sales is equal to the total costs incurred for these activities, and at this level, the company neither gains nor loses. In other words, the profit is equal to zero. The bread products produced are brown bread boxes and round chocolate bread, so the variable costs per fruit and the company's fixed costs can be seen in Table 6.

Table 6. Break-Even Point

No.	Type of Cost	Variable Cost (IDR)	Fixed Cost (IDR)
1.	Raw Material Cost	3.846	
2.	Electrical cost	1.442	
3.	Maintenance Cost		1.500.000
	Total	5.288	1.500.000

Based on the table above consists of types of costs, variable costs, and fixed costs. Variable costs consist of raw material costs and electricity costs. The cost listed is the cost per piece. The cost of raw materials is Rp. 3,846 per fruit is obtained from the cost of raw materials in one month, namely Rp. 4 million divided by

working days which is 26 days, then divided by the number of breads in one day. The electricity cost is Rp. 1,442 per day, obtained from monthly electricity costs, which is Rp. 1,500,000 divided by the number of breads in one month. Fixed costs consist of maintenance costs of Rp. 1,500,000 per month, where the maintenance is in the form of cleaning and checking the machines used to produce bread. Based on the cost data in the table above, BEP can be calculated. The following is the calculation of the break-even point of square chocolate bread and round chocolate bread. [8]

Figure 7. Break-Even Point using POM-QM

Figure 7, it can be seen the amount of BEP in fruit and rupiah. These results are obtained by entering fixed costs, variable costs, and profits converted into dollars (Rp. 14,843) to equalize the units of money contained in the POM-QM software. From the results above, the company's production level with profits from the results of POM-QM to reach the break-even point, the company must produce as many as 54.92 pieces which are rounded up to 55 pieces. Next, the fixed cost value is Rp. 1,500,000, the value of the variable cost is Rp. 5,288, and the revenue value is Rp. 32,500. These values have been converted into rupiah. Based on the results of the break-even point, the company's total revenue is Rp. 1,777,003, which is the result of the conversion from dollars to rupiahs.

Discussion

The analysis of the results contains the results obtained from the above data processing. The results include iterations with POM-QM, comparison, and break-even point results. The POM-QM software iteration results were carried out three times and got optimal results. The result of this iteration is that the company produces 20 squares of brown bread obtained from row X_1 in iteration table 3 and 26.67 round chocolate bread or 27 pieces obtained from row X_2 in iteration table 3. The profit obtained is Rp. 41,333 rounded up to Rp. 42,000 is obtained from row z_j in iteration Table 3. [8]

The comparison table that has been made above shows the comparison between the amount of production and profits of the company and the results POM-QM. The number of boxed brown bread produced by the company is 20, and POM-QM has 13 pieces. The number of round chocolates bread made from POM-QM results is more than the company, namely 25 pieces with a difference of 5 pieces. The profit earned in a month with the results of POM-QM is Rp. 845,000, while the company's sales of Rp. 936,000. The profit earned in a month has a difference of Rp. 91,000. This result was in line with determine the optimal production proportion and profit margins. [9]

Based on the calculation of the optimization level of production and profits obtained by SMEs Win Bakery, a break-even point analysis is carried out to determine the level of break-even point of SMEs Win Bakery. The results obtained from the break-even point, namely the production level, reach the break-even point of as many as 55 pieces. Then the total profit of the company is Rp. 1,777,003. [6]

CONCLUSION

The conclusion contains the results obtained after doing the research. The conclusions obtained in this study are first, this study shows that the profit formulation with a linear programming model consists of decision variables, objective functions, and constraint functions. The decision variable in this study consisted of two variables, namely X_1 for square chocolate bread and X_2 for round chocolate bread. The objective function used is the profit per unit of square chocolate bread and round chocolate bread. The constraint function in this research is the raw material used for making brown bread. Second, the data processing results with POM-QM show the company's optimal amount of production, as many as 13 pieces for brown bread boxes. Producing as many as 27 pieces of round chocolate bread. The amount of production from the results of POM-QM has a difference of 5 pieces more on round chocolate bread than the company's total production.

The amount of round chocolate bread production is more because the use of raw materials is less than square brown bread. These results are recommended to be followed by the company to get maximum profit. Third, based on the results of data processing with POM-QM, it is known that the maximum profit that the

company will obtain. The maximum profit is Rp. 32,500 The profit obtained from the processed data has a difference of Rp. 91,000 from the profit obtained from the sale of the company. Fourth, based on the results of the break-even point that has been carried out using POM-QM, the number of productions the company must sell is 55 pieces. The total profit obtained after being converted into rupiah is Rp. 1,777,003. If all the goods are sold out and there is no increase in raw materials.

Suggestion

Suggestions contain suggestions given by the author so that the company can make improvements based on research that has been done. Based on the research, it is proposed for SMEs Win Bakery, which is recommended in carrying out production following the results obtained after processing the data. These results indicate that factory can increase the size variation of round chocolate bread and add toppings from bread, such as cheese.

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