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Optimizing the Strategic Application of Management Science: An Urban Case Study for the Sustainability of MSMEs in Bintaro, South Tangerang City

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ABSTRACT
The objective of this study is to explore the most effective ways to apply Management Science strategically within Micro, Small, and Medium Enterprises (MSMEs/UMKM) located in the Bintaro area of South Tangerang City, West Java, Indonesia. Through a combination of mathematical analysis and technology utilization in a case study framework, the research evaluates the management science strategies employed by MSMEs in Bintaro and their effects on business performance and sustainability. The outcomes of this investigation are anticipated to offer valuable perspectives for stakeholders, business professionals, and scholars aiming to enhance MSME management techniques for better outcomes.

Keywords:←
Management Science; UMKM; Sustainibility; City; Urban

INTRODUCTION

In the midst of rapid urbanization and economic development, Micro, Small, and Medium Enterprises (MSMEs) are pivotal in driving local economies, particularly in urban centers like Bintaro, South Tangerang City. However, these enterprises often encounter multifaceted challenges, particularly in effective business management. A significant issue faced by many MSMEs is the deficiency in comprehending management science and its strategic application within their operations. This limitation hampers their capacity to optimize business strategies, thereby impacting business sustainability. Understanding management science is crucial for MSMEs to navigate strategic decisions, ranging from capital management to pricing strategies. Management science plays a vital role in aiding MSMEs to surmount these obstacles. With a firm grasp of management principles and methodologies, MSMEs can make informed decisions across various facets of their operations, including financial planning, marketing strategies, and pricing policies. Previous research underscores the significance of integrating management science within MSMEs, especially in urban landscapes like Bintaro. This research delves into how the strategic utilization of management science can enhance the sustainability of MSMEs in the Bintaro region. By examining prevailing business practices and exploring effective applications of management science, this study seeks to offer valuable insights for MSMEs, stakeholders, and researchers, highlighting the pivotal role of management science in urban business environments like Bintaro. Given the escalating importance of management science for MSMEs in urban settings, this research endeavors to uncover avenues for optimizing its strategic application within the context of Bintaro, South Tangerang City. The objective is to foster sustainable growth and continuity for MSMEs in this urban locale, thereby providing pertinent insights for stakeholders, business professionals, and academics to enhance MSME management practices and ensure sustainable development in the area.

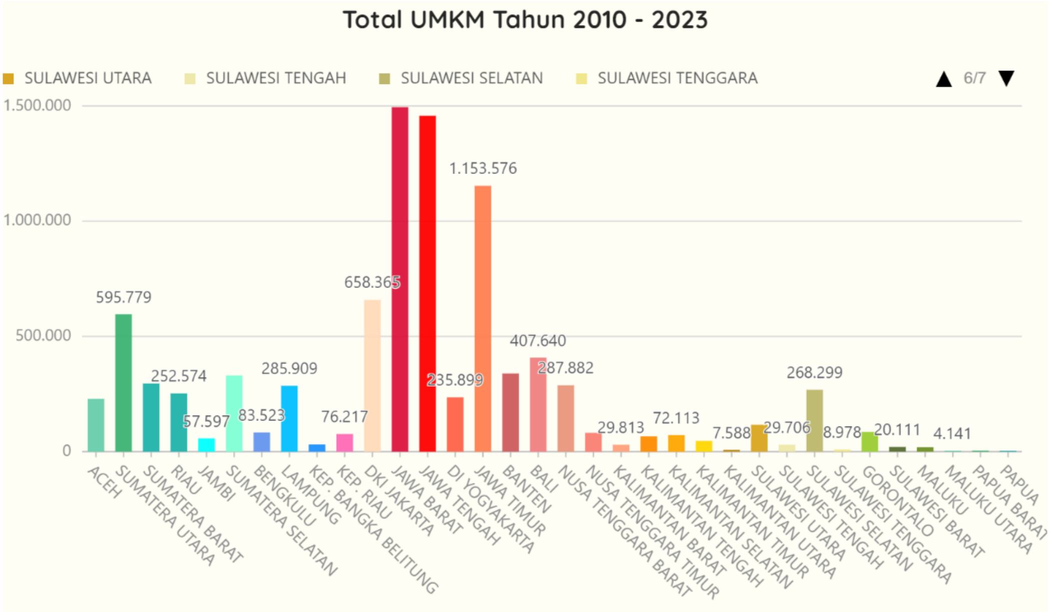

Figure 1. MSME Growth for the Period 2010 - 20233 in the Indonesian Province with the Largest Number of Cities

Literature Review And Research Framework

In his book titled "Introduction to Management Science," WT Bernard defines management science as a scientific discipline that employs mathematically oriented methods to aid managers in making informed decisions. This definition suggests that management science encompasses various mathematically oriented techniques either developed within its own field or adapted from other scientific domains like natural sciences, mathematics, statistics, and engineering. The text serves as an introduction to these techniques and illustrates their practical application in solving management challenges. Management science is a well-established discipline in the business realm, recognized for its extensive applications and credited with enhancing company efficiency and productivity. Many businesses report utilizing scientific management techniques, with most attesting to the excellent results achieved. It is commonly included in the core curriculum of business programs under various names such as operational research, quantitative methods, quantitative analysis, and decision science. The emphasis of scientific management largely revolves around problem-solving in the economic sphere. The approach typically involves a series of stages aimed at addressing specific issues, as depicted in the accompanying chart. This leads to the emergence of management techniques as a sub-discipline within management science. In management engineering, mathematics serves as the primary tool for problem formulation, with mathematical operations yielding solutions to these problems.

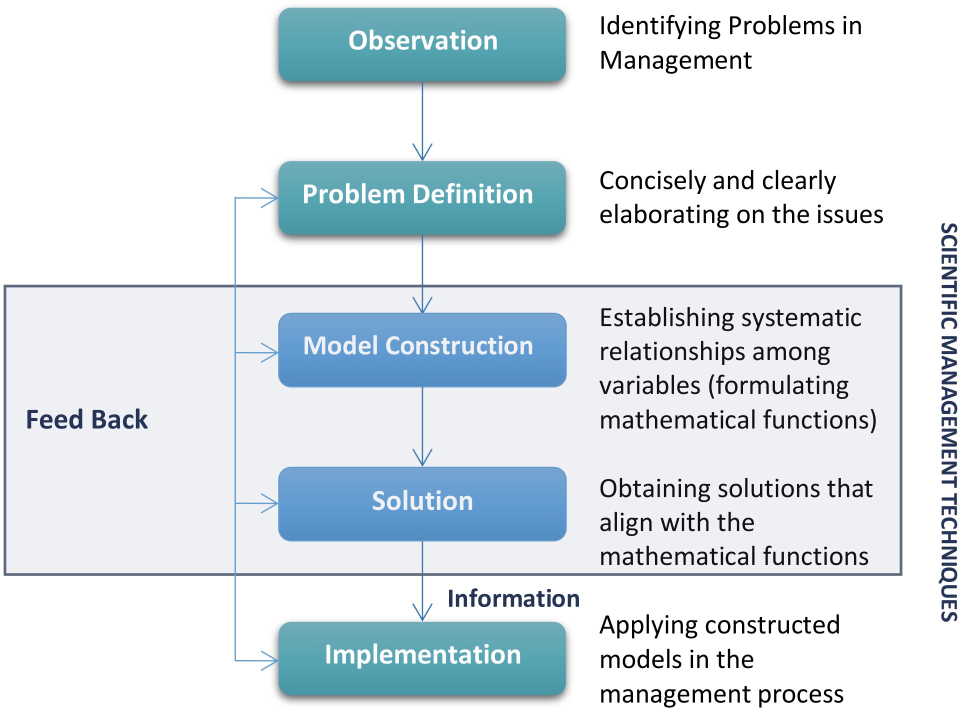

Figure 2 Science Management Process (Problem Solving Approach)

Reference Software

In this research, we will utilize QM for Windows software as an assistive tool to implement the simplex method. this application will aid us in determining the optimal profit result by maximizing resource utilization. data will be presented in the form of tables, and we will discuss the meaning of each table individually.

METHOD

This research uses MSME financial data, including income, costs and existing limitations. The data is then entered into a linear programming model that is in accordance with the research objective, namely maximizing MSME profits. The application of Management Science in this writing uses the Linear Programming Method and S implex method, which is used in problem solving to obtain optimal solutions that provide maximum benefits for MSMEs. It is hoped that the research results will show that the use of linear programming and the simplex method can be effectively used to optimize MSME profits. By using this model, MSMEs can identify the optimal combination of factors such as selling price, production costs, and production capacity that can produce maximum profits. Apart from that, this research also shows that linear programming can help MSMEs make smarter and more efficient decisions.

a. Linear Programming

Linear programming is a mathematical method used to maximize or minimize a certain objective function, taking into account existing limitations or constraints. This method is often used in decision making in various fields, including economics, management, logistics, and computer science. In linear programming, the main goal is to find an optimal solution that satisfies all existing constraints. This optimal solution is found using a mathematical technique called the simplex method. The simplex method involves iterative calculations to find the extreme points that produce the maximum or minimum value of the objective function.

A linear programming model consists of decision variables, an objective function, and a set of constraints. Decision variables are variables whose values can be changed to reach an optimal solution. An objective function is a mathematical function that is to be maximized or minimized, such as profits or costs. Constraints are restrictions that must be met, for example resource availability or capacity restrictions. In linear programming, all variables and objective functions must be linear, which means they can be represented in the form of linear equations or inequalities. In cases where the variables or objective function are not linear, other techniques such as nonlinear programming can be used. Overall, linear programming is a powerful mathematical method for optimizing decisions in situations with clear limitations. Using this technique, optimal solutions can be found for various problems involving decision making.

The Linear Programming Model Contains Three Main Elements, Namely:

a) Decision Variables: Decision variables are variables whose values can be changed to reach an optimal solution. These variables represent the decisions that must be taken in the problem being programmed. For example, in a resource allocation problem, the decision variables may represent the amount of resources allocated to each activity.
b) Objective Function: An objective function is a mathematical function that is to be maximized or minimized in linear programming. This objective function reflects the goals or criteria to be achieved in the problem being programmed. An example of an objective function in a linear programming problem is profit maximization or cost minimization.
c) Constraints: Constraints are restrictions or limitations that must be met in linear programming. These constraints limit the values of the decision variables and describe the constraints that must be followed in the problem being programmed. For example, constraints may limit resource availability, production capacity, or customer demand.

Basic Assumptions of Linear Programming

a) Proportionality
The rise and fall of the Z value and the use of available resources or facilities will change proportionally with changes in activity levels
b) Additivity
The goal value of each activity does not influence each other, or the increase in the goal value (Z) resulting from an increase in one activity can be added without affecting the part of the Z value obtained from other activities.
c) Divisionability
The output produced by each activity can be a fractional number, as can the resulting Z value.
d) Deterministic (Certainty)
All parameters contained in the LP model (aij, bi, Cj) can be estimated with certainty, although rarely precisely.

b. Simplex Method

The Simplex Method is a technique for solving linear programming iteratively. This method is used to solve every problem in linear programming which consists of a combination of variables. The Simplex method searches for a basic solution that is feasible. This method is a development of the algebraic method which only tests a portion of the number of base solutions in tabular form. Simplex tables only. The revised Simplex method is a method for solving linear programming problems. This method is a modification of the simplex method which offers the opportunity to increase the number of iterations and the steps used in both methods remain the same, the difference lies in the details of calculating key columns and key rows.

Some terms that are often used in the simplex method include:

Iteration	:	Calculation stages where the value in the calculation depends on previous table values
Non-base variable	:	A variable whose value is set to zero at any iteration. The number of non-basic variables is always equal to the degrees of freedom in the system of equations.
Base variable	:	A variable whose value is non-zero in any iteration. In the initial solution, the base variable is a slack variable (if the constraint function uses the inequality <) or an artificial variable (if the constraint function uses the inequality > or =).
Solution / Right Value (NK)	:	The value of the limiting resource that is still available. In the initial solution, the right value or solution is equal to the sum.
Key Column	:	The column selected to enter the base variable in the next iteration.
Key Row	:	The row selected to insert the base variable in the next iteration.
Key K number	:	The intersection number of the key column and key row.
Fixed Ratio	:	The key column number divided by the key number.
Simplex Table	:	A table used to calculate the values of basic and non-basic variables at each iteration.

In the Simplex method, these terms are used to calculate the values of the basic and non-basic variables at each iteration until the optimal solution to the linear programming problem is found.

Simplex Method Solution Steps

a) Modifying the objective function along with constraints involves shifting all objective functions to an implicit form, whereby Cj Xij is relocated to the left.
b) Example: Z = 40x1 + 35x2 Z - 40x1 - 35x2 Arrange the equations into a simplex table.
c) Select the key column by selecting the column that has the value on the target function line which is negative with the largest number.
d) Selecting a key row Select the row that has the ratio limit with the smallest number. Limit ratio = right value / key column value.
e) Altering the pivotal row value entails dividing by the pivotal number and substituting the basic variable in the pivotal row with the variable positioned at the top of the pivotal column.

f) Changing values other than those in the key row To change them use the formula New row = old row – (coefficient per key column * key row value).
g) Continue improvements or changes, repeating steps 3 – 6, until all values in the objective function are positive.

RESULTS AND DISCUSSION

Case Studies

In this case study, all data was obtained through interviews with the business owner. So that the data collected by the author has obtained permission from the owner to be used in research and published. The method used uses a manual written method and uses an application called Software QM for Windows 5.3.

1. Orens Kitchen, Bintaro

Taichan Sate and Omelet Rice from Dapur Orens is one of the favorite menus in the Bintaro area of South Tangerang City, due to its delicious taste and pocket-friendly prices for consumers, especially students. We will calculate these two products to get maximum profits by providing raw materials and other costs efficiently.

Scope of problem:

The maximum raw materials needed for Taichan Satay are 1,000 grams of chicken and 200 grams of bird's eye chilies. Meanwhile, for Omelet Rice a day, you need a maximum of 2,000g of rice and 10 chicken eggs. Where in a day Orens Kitchen can produce 25 portions of Taichan Satay, while for Egg Rice it is 10 portions, and produces a maximum of 45 portions. Taichan Sate and Egg Rice can make a profit of IDR 90,000 and IDR 20,000 per day.

Mathematical Function Modeling:

The raw materials for making these two menus in one day are as follows.

Table 1. Table of Raw Materials and Costs for Orens Kitchen

Material	Product		Stock available
	Taichan Satay	Omelet Rice	
Portion	25 servings	10 servings	45 servings
Chicken meat	100g	0	3000g
Cayenne pepper	5g	5g	400g
Rice	0	150g	2500g
Egg	0	1 item	15 items

The profit obtained from taichan satay is IDR 90,000, and omelet rice is IDR 20,000 in one day. Therefore, the objective function can be formulated as follows:

$$Maximize(Z) = 90\ X1 + 20\ X2\ \text{(in units of 1,000)}$$

The limitation function is determined by assessing the quantity of raw materials utilized in each variant of seblak and comparing it with the daily capacity for raw material usage.

Linear Programming:

From the previous survey, variable linear programming was used using the simplex method using manual calculations and QM software as follows:

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- Decision variables
  X1 = Taichan Satay
  X2 = Omelet Rice
- Objective function
  Maximize: Z = 90 X1 + 20 X2 (in units of 1,000) converted into Z - 90 X1 - 20 X2 = 0
- Constraint function
  Portions : 25 X1 + 10 X2 ≤ 45
  Chicken Meat : 100 X1 ≤ 3000
  Cayenne Pepper : 5X1 + 5X2 ≤ 400
  Rice : 150 X2 ≤ 2500
  Eggs : X2 ≤ 15
- Limiting variables
  X1,X2 ≥ 0

A. Approach using the simplex method manually

1. Standard general form of simplex

Z - 90 X1 - 20 X2 = 0
100 X1 + S1 = 3000
5X1 + 5X2 + S2 = 400
150 X2 + S3 = 2500
X2 + S4 = 15

2. Enter the standard general form of simplex into the table

Basic Variables	Z	X1	X2	S1	S2	S3	S4	S5	NK	Index
Z	1	-90	-20	0	0	0	0	0	0	
S1	0	100	0	0	1	0	0	0	3000	
S2	0	5	5	0	0	1	0	0	400	
S3	0	0	150	0	0	0	1	0	2500	
S4	0	0	1	0	0	0	0	1	15	

3. Define key columns, key rows, and calculate indexes

Basic Variables	Z	X1	X2	S1	S2	S3	S4	S5	NK	Index
Z	1	-90	-20	0	0	0	0	0	0	
S1	0	100	0	0	1	0	0	0	3000	30
S2	0	5	5	0	0	1	0	0	400	80
S3	0	0	150	0	0	0	1	0	2500	~
S4	0	0	1	0	0	0	0	1	15	~

4. Change key row values
   Key new row = key row : key number
   So the table looks like this:

Basic Variables	Z	X1	X2	S1	S2	S3	S4	S5	NK	Index
Z	1	-90	-20	0	0	0	0	0	0	
X1	0	1	0	0	0.01	0	0	0	30	30
S2	0	5	5	0	0	1	0	0	400	80
S3	0	0	150	0	0	0	1	0	2500	~
S4	0	0	1	0	0	0	0	1	15	~

5. Create a new table by iterating

New row = old row – (key column Number coefficient) x key new row value
Line Z = (-90: -20: 0: 0: 0: 0: 0: 0) – (-90 x 1: 0: 0: 0.01: 0: 0: 0: 30)
= 0: -20: 0: 0.9: 0: 0: 0: 2,700
Row S2 = (5: 5: 0: 0: 1: 0: 0: 400) – (5x 1: 0: 0: 0.01: 0: 0: 0: 30)
= 0: 5: 0: -0.05: 1: 0: 0: 250
Row S3 = (0: 150: 0: 0: 0: 1: 0: 2500) – (0 x 1: 0: 0: 0.01: 0: 0: 0: 30)
= 0: 150: 0: 0: 0: 1: 0: 2500
Row S4 = (0: 1: 0: 0: 0: 0: 1: 15) – (0 x 1: 0: 0: 0.01: 0: 0: 0: 30)
= 0: 1: 0: 0: 0: 0: 1: 15

Basic Variables	Z	X1	X2	S1	S2	S3	S4	S5	NK	Index
Z	1	0	-20	0	0.9	0	0	0	2,700	2,680
X1	0	1	0	0	0.01	0	0	0	30	~
S2	0	0	5	0	-0.05	1	0	0	250	50
S3	0	0	150	0	0	0	1	0	2500	16.66
S4	0	0	1	0	0	0	0	1	15	15

6. Continuing improvements
Line Z = (0: -20: 0: 0.9: 0: 0: 0: 2,700) – (-20 x 0: 1: 0: 0: 0: 0: 1: 15)
= 0: 0: 0: 0.9: 0: 0: 20: 3000
Row S2 = (0: 5: 0: -0.05: 1: 0: 0: 250) – (5 x 0: 1: 0: 0: 0: 0: 1: 15)
= 0: 0: 0: -0.05: 1: 0: -5: 175
Row S5 = (0: 150: 0: 0: 0: 1: 0: 2,500) – (150 x 0: 1: 0: 0: 0: 0: 1: 15)
= 0: 0: 0: 0: 0: 1: -150: 250

Basic Variables	Z	X1	X2	S1	S2	S3	S4	S5	NK	Index
Z	1	0	0	0	0.9	0	0	0	3,000	
X1	0	1	0	0	0.01	0	0	0	30	
S2	0	0	0	0	-0.05	1	0	-5	175	
S3	0	0	0	0	0	0	1	-150	250	
X2	0	0	1	0	0	0	0	1	15	

The first row (Z) has no negative values anymore. So the table cannot be optimized anymore and the table is the optimal result.
From the final table obtained
X1 = 30
X2 = 15
Maximum Z = 3,000

B. Simplex method approach using QM for Windows software

1. Standard general form of simplex

Z - 90 X1 - 20 X2 = 0
100 X1 + S1 = 3000
5X1 + 5X2 + S2 = 400
150 X2 + S3 = 2500
X2 + S4 = 15

Steps to Find and Calculate the Iteration Table:

Step 1 > When opening the software, click the number of Constraints section, enter 6 columns (adjust to your needs), then click ok.

Step 2 > Enter the standard simplex form into the table in the QM for Window software, then select linear programming on the left.

Step 3 > Click Solve.

Step 4 > Then select 4 Iterations.

Step5 > Then the Iteration table will appear until the negative numbers in Z disappear.

2. Entering the simplex standard form into the table in the QM for Window software

Table 2. Initial Calculation Of The Simplex Method

	X1	X2		RHS	Equation form
Maximize	90	20			Max 90X1 + 20X2
Constraint 1	100	0	<=	3000	100X1 <= 3000
Constraint 2	5	5	<=	400	5X1 + 5X2 <= 400
Constraint 3	0	150	<=	2500	150X2 <= 2500
Constraint 4	0	1	<=	15	X2 <= 15
Constraint 5	0	0	<=	0	<= 0

3. Complete a linear program by performing several iterations

Table 3. First Iteration

Cj	Basic Variables	Quantity	90 X1	20 X2	0 slack 1	0 slack 2	0 slack 3	0 slack 4	0 slack 5
Iteration 1									
0	slack 1	3.000	100	0	1	0	0	0	0
0	slack 2	400	5	5	0	1	0	0	0
0	slack 3	2.500	0	150	0	0	1	0	0
0	slack 4	15	0	1	0	0	0	1	0
0	slack 5	0	0	0	0	0	0	0	1
	zj	0	0	0	0	0	0	0	0
	cj-zj		90	20	0	0	0	0	0

Table 4. Second Iteration

Iteration 2									
90	X1	30	1	0	0,01	0	0	0	0
0	slack 2	250	0	5	-0,05	1	0	0	0
0	slack 3	2.500	0	150	0	0	1	0	0
0	slack 4	15	0	1	0	0	0	1	0
0	slack 5	0	0	0	0	0	0	0	1
	zj	2.700	90	0	,9	0	0	0	0
	cj-zj		0	20	-0,9	0	0	0	0

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Table 5. Third Iteration

Iteration 3										
90	X1	30	1	0	0,01	0	0	0	0
0	slack 2	175	0	0	-0,05	1	0	-5	0
0	slack 3	250	0	0	0	0	1	-150	0
20	X2	15	0	1	0	0	0	1	0
0	slack 5	0	0	0	0	0	0	0	1
	zj	3.000	90	20	,9	0	0	20	0

For the final calculation results table from the simplex method:

Step 1	>	Enter the mathematical model of the case being tested into the table provided into QM (based on the order of the specified modeling), then select linear programming on the left.
Step 2	>	Then in the number of Constraints section enter 6 columns (adjust to your needs), then click ok.
Step 3	>	Then enter the existing data in the QM application table.
Step 4	>	Click Solve.
Step 5	>	Then select 3 Solution List.
Step 6	>	Then a table of the final calculation results from the simplex method will appear.

Table 6. Final calculation results from the simplex method

Variable	Status	Value
X1	Basic	30
X2	Basic	15
slack 1	NONBasic	0
slack 2	Basic	175
slack 3	Basic	250
slack 4	NONBasic	0
slack 5	Basic	0
Optimal Value (Z)		3000

Results and Analysis

Based on the results of linear programming analysis using the simplex method for UKM Dapur Orens in the canteen at Pembangunan Jaya University, Bintaro, South Tangerang, Banten. It can be obtained that the value S2 = 175 processed chilies and S3 = 250 rice, and the objective function z (profit) = 3,000 = 300,000. This means that to get a maximum profit of Rp. 300,000, Dapur Orens should produce 30 portions of Taichan Satay and 15 portions of Omelet Rice. The difference between before and after optimization is IDR 190,000. - / day.

2. My Honey, Bintaro

Mozzarella Fried Chicken and Smoked Beef Fried Rice from My Honey are favorite menus at this food stall which is located in the Bintaro area, South Tangerang City. We will calculate these two products to get maximum profits by providing raw materials and other costs efficiently.

Scope of problem:
The raw materials needed for the My Honey shop a day are 14,000 grams of rice or the equivalent of 14 kg, 1,200 grams of smoked beef or 1.2 kg, 3,400 grams of chicken or 3.4 kg, 600 grams of mozzarella or the equivalent of 0.6 kg, and 450 grams of chili or the equivalent of 0.45 kg. Where rice is available in 80 stocks and is divided into 40 stocks for smoked beef fried rice and 30 stocks for fried mozzarella chicken, smoked beef also has 80 stocks and is usually used for 40 stocks, chicken also has 80 stocks and 30 stocks are used to make chicken. Geprek, Mozzarella is also usually used as much as 30 stocks out of the 80 available for mozzarella smashed chicken, and finally there are chilies which are also used from 80 stocks to make 30 stocks to make geprek chicken chili sauce.

Mathematical Function Modeling:
The raw materials for making these two menus in one day are as follows.

Table 7. Table of Raw Materials and Costs for My Honey

Material	Product		Stock available
	Smoked Beef Fried Rice	Mozzarella Fried Chicken	
Portion	40	30	80
Rice	200 grams	140 grams	14,000 grams
Smoked Beef	30 grams	0	1,200 grams
Chicken	0	85 grams	3,400 grams
Mozzarella	0	20 grams	600 grams
Chilli	0	15 grams	450 grams

Of everything sold, My Honey shop usually makes a profit of IDR 120,000 from smoked beef fried rice and IDR 90,000 from mozzarella fried chicken:

$$Maximize(Z) = 120\ X1 + 90\ X2\ (in\ units\ of\ 10{,}000)$$

Linear Programming:
From the previous survey, variable linear programming was used using the simplex method using manual calculations and QM software as follows:

- Decision variables
  X1 = Smoked Beef Fried Rice
  X2 = Mozzarella Fried Chicken

- Objective function
  Maximize : Z = 120 X1 + 90
- Constraint function
  Portions : $40\ X1 + 30\ X2 \leq 80$
  Rice : $200\ X1 + 140\ X2 \leq 14{,}000$
  Smoked Beef : $30\ X1 + \leq 1{,}200$
  Chicken : $85\ X2 \leq 3{,}400$

Mozzarella : 20 X2 ≤ 600
Chili : 15 X2 ≤ 450

➢ Limiting variables
X1,X2 ≥ 0

B. Approach using the simplex method manually

1. Standard general form of simplex

$$
\begin{aligned}
Z - 120X1 - 90X2 &= 0 \\
40\ X1 + 30\ X2 &\leq 80 \\
200\ X1 + 140\ X2 + S1 &\leq 14{,}000 \\
30\ X1 + S2 &\leq 1{,}200 \\
85\ X2 + S3 &\leq 3{,}400 \\
20\ X2 + S4 &\leq 600 \\
15\ X2\ S5 &\leq 450
\end{aligned}
$$

2. Enter the standard general form of simplex into the table

Variable Base	Z	X1	X2	S1	S2	S3	S4	S5	NK	INDEX
Z	1	-120	-90	0	0	0	0	0	0	
S1	0	200	140	1	0	0	0	0	14,000	
S2	0	30	0	0	1	0	0	0	1,200	
S3	0	0	85	0	0	1	0	0	3,400	
S4	0	0	20	0	0	0	1	0	600	
S5	0	0	15	0	0	0	0	1	450	

3. Define key columns, key rows, and calculate indexes

Variable Base	Z	X1	X2	S1	S2	S3	S4	S5	NK	INDEX
Z	1	-120	-90	0	0	0	0	0	0	0
S1	0	200	140	1	0	0	0	0	14,000/200	70
S2	0	30	0	0	1	0	0	0	1,200/30	40
S3	0	0	85	0	0	1	0	0	3,400/0	0
S4	0	0	20	0	0	0	1	0	600/0	0
S5	0	0	15	0	0	0	0	1	450/0	0

Red = Key Row
Yellow = Key Column

4. Change key row values

New key row S1 = old Key Row / (Divided) Corresponding key column
= (-120 -90 0 0 0 0 0 0) / (30) = (1 0 0 0.033 0 0 0 40)

Variable Base	Z	X1	X2	S1	S2	S3	S4	S5	NK	INDEX
Z	1	-120	-90	0	0	0	0	0	0	
S1	0	200	140	1	0	0	0	0	14,000/200	
X1	1	0	0	0.033	0	0	0	40	1	
S3	0	0	85	0	0	1	0	0	3,400/0	
S4	0	0	20	0	0	0	1	0	600/0	
S5	0	0	15	0	0	0	0	1	450/0	

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5. Create a new table by iterating
   Create new row = (old row) – (corresponding key column*new key row)
   Line Z = (-120 -90 0 0 0 0 0 0) - (-120 x 1 0 0 0.033 0 0 0 40)
   = 0 -90 0 3.96 0 0 0 4,800
   Row S1 = (200 140 1 0 0 0 0 0 14,000) - (200 x 1 0 0 0.033 0 0 0 40)
   = 0 140 1 -6.6 0 0 0 6,000
   Row S3 = (0 0 85 0 0 1 0 3,400) - (0 x 1 0 0 0.033 0 0 0 40)
   = 0 0 85 0 0 1 0 3,400
   Row S4 = (0 20 0 0 0 1 0 600) - (0 x 1 0 0 0.033 0 0 0 40)
   = 0 20 0 0 0 1 0 600
   Row S5 = (0 15 0 0 0 0 1 450) - (0 x 1 0 0 0.033 0 0 0 40)
   = 0 15 0 0 0 0 1 450

Variable Base	Z	X1	X2	S1	S3	S4	S5	NK	INDEX
Z	0	-90	0	3.96	0	0	0	4,800	53.3
S1	0	140	1	-6.6	0	0	0	6,000	42.8
X1	1	0	0	0.033	0	0	0	40	0
S3	0	85	0	0	1	0	0	3,400	40
S4	0	20	0	0	0	1	0	600	30
S5	0	15	0	0	0	0	1	450	30

6. New key row S1 = Old key row / Corresponding key column
   = (0 -90 0 3.96 0 0 0 4,800) / (15) = (0 1 0 0 0 0 0.06 30)
   Create new row = (Old row) - (Corresponding key column*New Key Row)
   Line Z = (0 -90 0 3.96 0 0 0 4,800) - (-90 x 0 1 0 0 0 0 0.06 30)
   = 0 0 0 3.96 0 0 5.4 7,500
   Row S1 = (0 140 1 -6.6 0 0 0 6,000) - (140 x 0 1 0 0 0 0 0.06 30)
   = 0 0 1 -6.6 0 0 -8.4 1,800
   Row S3 = (0 85 0 0 1 0 0 3,400) - (85 x 0 1 0 0 0 0 0.06 30)
   = 0 0 0 0 1 0 -5.1 850
   Row S4 = (0 20 0 0 0 1 0 600) - (20 x 0 1 0 0 0 0 0.06 30)
   = 0 0 0 0 0 1 -1.2 0

Variable Base	Z	X1	X2	S1	S3	S4	S5	NK	INDEX
Z	0	0	0	3.96	0	0	5.4	7,500	
S1	0	0	1	-6.6	0	0	-8.4	1,800	
X1	1	0	0	0.033	0	0	0	40	
S3	0	0	0	0	1	0	-5.1	850	
S4	0	0	0	0	0	1	-1.2	0	
X2	0	1	0	0	0	0	0.06	30	

The first row (Z) has no negative values anymore. So the table cannot be optimized anymore and the table is the optimal result.

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From the final table obtained
X1 = 40
X2 = 30
Maximum Z = 7,500

B. Simplex method approach using QM for Windows software

1. Standard general form of simplex

$$
\begin{aligned}
Z - 120X1 - 90X2 &= 0 \\
40\,X1 + 30\,X2 &\leq 80 \\
200\,X1 + 140\,X2 + S1 &\leq 14{,}000 \\
30\,X1 + S2 &\leq 1{,}200 \\
85\,X2 + S3 &\leq 3{,}400 \\
20\,X2 + S4 &\leq 600 \\
15\,X2\ S5 &\leq 450
\end{aligned}
$$

2. Entering the standard simplex form into the table in the QM for Windows software

Table 8. Initial Calculation Of The Simplex Method

	X1	X2		RHS	Equation form
Maximize	120	90			Max 120X1 + 90X2
Constraint 1	200	140	<=	14000	200X1 + 140X2 <= 14000
Constraint 2	30	0	<=	1200	30X1 <= 1200
Constraint 3	0	85	<=	3400	85X2 <= 3400
Constraint 4	0	20	<=	600	20X2 <= 600
Constraint 5	0	15	<=	450	15X2 <= 450

3. Complete a linear program by performing several iterations

Table 9. First Iteration

(untitled) Solution

Cj	Basic Variables	Quantity	120 X1	90 X2	0 slack 1	0 slack 2	0 slack 3	0 slack 4	0 slack 5
Iteration 1									
0	slack 1	14,000	200	140	1	0	0	0	0
0	slack 2	1,200	30	0	0	1	0	0	0
0	slack 3	3,400	0	85	0	0	1	0	0
0	slack 4	600	0	20	0	0	0	1	0
0	slack 5	450	0	15	0	0	0	0	1
	zj	0	0	0	0	0	0	0	0
	cj-zj		120	90	0	0	0	0	0

Table 10. Second Iteration

(untitled) Solution

Cj	Basic Variables	Quantity	120 X1	90 X2	0 slack 1	0 slack 2	0 slack 3	0 slack 4	0 slack 5
	cj-zj		120	90	0	0	0	0	0
Iteration 2									
0	slack 1	6,000	0	140	1	-6.6667	0	0	0
120	X1	40	1	0	0	0.0333	0	0	0
0	slack 3	3,400	0	85	0	0	1	0	0
0	slack 4	600	0	20	0	0	0	1	0
0	slack 5	450	0	15	0	0	0	0	1
	zj	4,800	120	0	0	4	0	0	0
	cj-zj		0	90	0	-4	0	0	0

Table 11. Third Iteration

Iteration 3									
0	slack 1	1,800	0	0	1	-6.6667	0	-7	0
120	X1	40	1	0	0	0.0333	0	0	0
0	slack 3	850	0	0	0	0	1	-4.25	0
90	X2	30	0	1	0	0	0	0.05	0
0	slack 5	0	0	0	0	0	0	-0.75	1
	zj	7,500	120	90	0	4	0	4.5	0
	cj-zj		0	0	0	-4	0	-4.5	0

Table 12. Final Calculation Results From The Simplex Method

(untitled) Solution

Variable	Status	Value
X1	Basic	40
X2	Basic	30
slack 1	Basic	1800
slack 2	NONBasic	0
slack 3	Basic	850
slack 4	NONBasic	0
slack 5	Basic	0
Optimal Value (Z)		7500

Based on linear programming calculations using the simplex method manually for this problem, an optimal solution was found which produces the maximum value of the objective function (Z = 7,500,000) (in units of 10,000). This solution achieves optimal results with the following decision variables:

- (X_1) (Smoked Beef Fried Rice) = profit obtained amounting to IDR 120,000
- (X_2) (Mozzarella Fried Chicken) = profit obtained amounting to IDR IDR 90,000

CONCLUSION

Through the implementation of techniques in scientific management, Micro, Small, and Medium Enterprises (MSMEs / UMKM) can experience a significant increase in their maximum profit value. This is evidenced by the provided case study where MSMEs employed scientific management techniques successfully enhanced operational efficiency, optimized resource utilization, and generated greater profits compared to those not utilizing these methods. Therefore, it is crucial for MSMEs to understand and apply the principles of scientific management to achieve better business growth and sustainability.

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