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Production Planning and Profit Maximization of Furniture Production at PD. Maha Kayu Sejahtera Using Linear Programming Method with LINGO and POM-QM Software

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Article Info	ABSTRACT
Keywords: Maximization, Simplex Method, Linear Programming, LINGO, POM-QM	UMKM is a type of small business that plays an important role in improving and stimulating the local economy. One UMKM engaged in the furniture industry is PD Maha Kayu Sejahtera, located at Jl. Tanjakan Lama, Tanjakan Village, RT05/02, Rajeg District, Tangerang Regency. The Simplex Method is used to ensure the sustainability and growth of the furniture production business, which is part of a linear programming design. The application of the Simplex Method is carried out using software tools such as LINGO and POM-QM. POM-QM, used for modeling and solving linear programming problems, offers advantages in providing an accurate and efficient approach. The maximum profit of products at PD Maha Kayu Sejahtera, based on both manual calculations and software assistance using LINGO and POM-QM, is IDR 8,100,000 per week.
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INTRODUCTION

Micro, Small, and Medium Enterprises (UMKM) are a type of small-scale business that play an important role in improving and boosting the economy of a region [1][2]. UMKM hold a central role in the economic development of Indonesia [3]. The importance of UMKM has become a key indicator of economic success in a given area. In addition to being an alternative source of employment, UMKM also served as a driving force for economic recovery after the 1997 monetary crisis, when large companies faced challenges in expanding their businesses. Today, the contribution of UMKM to both local and national income has become highly significant [3].

The furniture-producing UMKM, PD Maha Kayu Sejahtera, located at Jl. Tanjakan Lama, Tanjakan Village RT05/02, Rajeg District, Tangerang Regency, is one of the businesses striving to sustain and grow its furniture production. In the face of increasingly intense business competition and fluctuating market dynamics, UMKM, including PD Maha Kayu Sejahtera, face significant challenges in optimizing resource management to achieve maximum profit. The sustainability and growth of UMKM are critical focuses in maintaining economic resilience and sustainable development.

To ensure the continuity and growth of the furniture production business at PD Maha Kayu Sejahtera, the Simplex Method is used as part of a linear programming framework. This process allows for the optimization of raw material combinations and the resulting profits. Linear Programming is a mathematical method used to address resource allocation problems with constraints, aiming to achieve optimal outcomes such as maximizing profits or minimizing costs. Solving linear programming problems involves applying a mathematical model consisting of a linear objective function and a system of linear equations [4]. The Simplex Method is a process for solving linear programming problems by iteratively searching for feasible solutions. This method involves a step-by-step development of solutions to reach the optimum result. Its main advantage lies in its effectiveness, guided by benchmarks that indicate when the calculations should stop or continue, to ultimately arrive at an optimal solution—such as maximum profit, maximum revenue, or minimum cost [4].

The Simplex Method includes three key components [5]:

a. Decision Variables: $x_1, x_2, \ldots, x_n$ — variables selected as decision factors based on their values.
b. Objective Function: $Z = f(x_1, x_2, \ldots, x_n)$ — a function to be optimized, either maximized or minimized.
c. Constraints: $g_i(x_1, x_2, \ldots, x_n) \leq b_i$ — boundary parameters that must be satisfied.

Information Technology, through software like LINGO and POM-QM, can be utilized to help solve linear programming problems. The use of technological tools in learning is essential to create an active and engaging educational environment [6]. Linear programming is one of the mathematical methods used to determine solutions to problems, with the goal of either maximizing or minimizing a certain value within specific constraints. It is also known as an optimization method [7].

Problem-solving in linear programming can be done using the Graphical Method or the Simplex Method. The Simplex Method is suitable for solving linear programming problems involving two or more decision variables. The steps in determining the optimal combination are carried out through repeated iterations of the simplex table until the optimal value is found for the optimization problem being analyzed [8]. If there are infeasible constraints (non-negativity constraints that are not met), the Dual Simplex Method can be used instead [9].

Calculations for solving optimization problems can be done manually or with the help of software. Two such software tools are LINGO and POM-QM (Production and Operations Management – Quality Control). LINGO is a simple optimization software for linear and non-linear problems, commonly used to quickly model, solve, and analyze complex problems [10]. POM-QM, developed by Prentice Hall, can be installed on computers or smartphones to assist in decision-making calculations for production and marketing optimization. Therefore, POM-QM can be applied in linear programming materials that focus on decision making [11].

METHODS

The steps carried out in this study are as follows:

a. Problem Identification

The UMKM PD Maha Kayu Sejahtera aims to achieve maximum profit and minimum cost by optimizing the limited availability of *kamper* wood and mahogany wood as raw materials.

b. Selection of Problem-Solving Model
   The model applied to address the identified problem is a linear programming model using the Simplex Method, in order to obtain maximum profit manually, as well as through analysis using the LINGO and POM-QM software.
c. Data Collection
   1. Field Study
      The field study was conducted through interviews and observations. The data required in this study includes:
      a. Types of products
      b. Raw materials used
      c. Availability of raw materials
      d. Production output
      e. Weekly profit per product
      f. Total number of products produced
   2. Literature Review
      The literature review was conducted to gather information related to the problem being investigated. The basic concepts applied involve the Simplex Method and sensitivity analysis to understand the problem-solving approach and calculations related to the issues faced by UMKM PD Maha Kayu Sejahtera.
d. Data Processing and Analysis
   Data processing was carried out using the Simplex Method, both manually and supported by analysis using LINGO and POM-QM software.
e. Model Implementation
   The linear programming model was implemented using the Simplex Method. The steps in linear programming using the Simplex Method include the following [5][10]:
   1. Transform the objective function along with its constraints.
   2. Identify the pivot column, which is the column with the most negative value in the objective function.
   3. Identify the pivot row, which is the row with the smallest positive ratio (limit ratio).
   4. Update the values in the pivot row.
   5. Update the values outside the pivot row.
   6. Perform iterations until the optimal solution is found.
f. Result Evaluation
   The evaluation was conducted by analyzing the results of the Simplex Method in the linear programming model, both manually and using the LINGO and POM-QM software.
g. Implementation of the Selected Solution

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This stage is under the authority of UMKM PD Maha Kayu Sejahtera, which involves considering the results of the method's application. This outcome may also serve as a reference for decision-making. The initial interface displays of the LINGO and POM-QM software used in this study are shown in Figures 1 and 2.

Figure 1. Initial Interface of LINGO

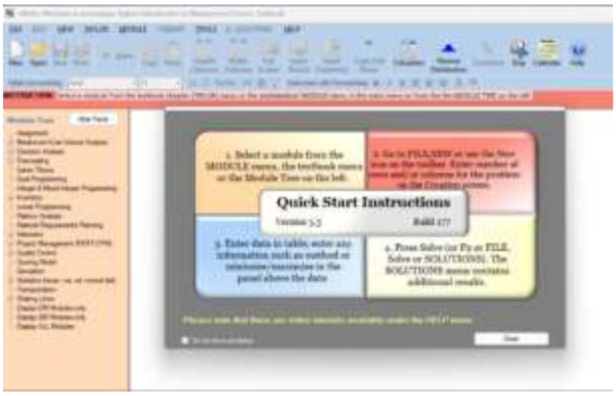

Figure 2. Initial Interface of POM-QM for Windows

The research steps can be seen in the flowchart in Figure 3.

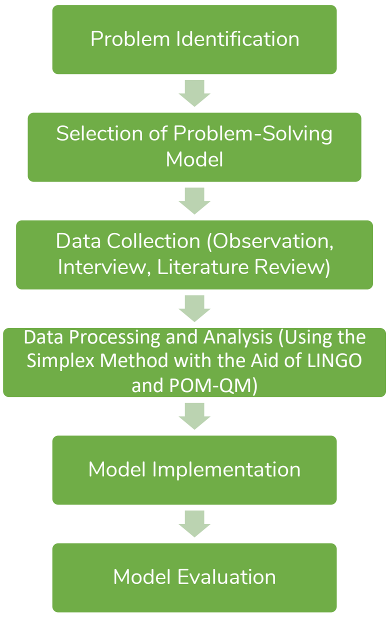

Figure 3. Research Flowchart

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RESULTS AND DISCUSSION

PD Maha Kayu Sejahtera usually produces three furniture products, namely dressing tables, study tables, and dining tables. PD Maha Kayu Sejahtera requires 12 camphor wood and 11 mahogany wood to make 1 unit of dressing table, 1 camphor wood and 2 mahogany wood to make 1 unit of study table, and 1 camphor wood and 1 mahogany wood to make 1 unit of dining table. The total amount of camphor and mahogany wood available is 100 units.

In one week, the machine operates for 8 hours to make dressing tables, 4 hours to make study tables, and 2 hours to make dining tables. The machine can only operate for a minimum of 90 hours. The profit obtained from making dressing tables is Rp 350,000 per unit, for study tables is Rp 250,000 per unit, and for dining tables is Rp 180,000 per unit. Determine how many furniture units should be produced and distributed.

Table 1. Summary of Raw Data for Furniture Production

Raw Materials	Product Types			Maximum Capacity
	Dressing Table	Study Table	Dining Table	
Camphor Wood	12	1	1	100
Mahogany Wood	11	2	1	100
Time	8	4	2	90
Profit	Rp.350.000	Rp. 250.000	Rp. 180.000	

Based on Table 1, it can be seen that producing a dressing table requires 12 units of camphor wood and 11 units of mahogany wood, with a selling price of Rp 350,000 per unit. A study table requires 1 unit of camphor wood and 2 units of mahogany wood, with a selling price of Rp 250,000 per unit. Meanwhile, a dining table requires 1 unit of camphor wood and 1 unit of mahogany wood, with a selling price of Rp 180,000 per unit.

The steps for solving the linear programming problem based on Table 1 are as follows:

$$Z= 350.000X_1 + 250.000X_2 + 180.000X_3$$

Constraint Function :

$$12X_1 + X_2 + X_3 \leq 100$$
$$11X_1 + 2X_2 + X_3 \leq 100$$
$$8X_1 + 4X_2 + 2X_3 \leq 90$$
$$X_1, X_2, X_3 \geq 0$$

The objective function is transformed into:

$$Z-350.000X_1-250.000X_2-180.000X_3 = 0$$

The constraint functions are converted using slack variables, resulting in:

$$12X_1 + X_2 + X_3 + S1 = 100$$
$$11X_1 + 2X_2 + X_3 + S2 = 100$$
$$8X_1 + 4X_2 + 2X_3 + S3 = 90$$

The equations above are entered into the simplex tableau to determine the formulation of the problem, as shown in Table 2 below.

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Table 2. Simplex Method Formulation

Var	X_1	X_2	X_3	S_1	S_2	S_3	RHS
Z	-350.000	-250.000	-180000	0	0	0	0
S_1	12	1	1	1	0	0	100
S_2	11	2	1	0	1	0	100
S_3	8	4	2	0	0	1	90

In table 3 Determining the Pivot Column. The pivot column is the column in the Z row that has the most negative value (the largest in magnitude among negative values).

Table 3. Iteration 1

Var	X_1	X_2	X_3	S_1	S_2	S_3	RHS
Z	-350.000	-250.000	-180.000	0	0	0	0
S_1	12	1	1	1	0	0	100
S_2	11	2	1	0	1	0	100
S_3	8	4	2	0	0	1	90

→ Pivot Column

Based on Table 3, it can be seen that column X_1 is the pivot column and also serves as the entering variable, because the value in column X_1 has the largest negative number, which is –350,000.

Calculating the ratio of RHS/X_1:

S1: 100 / 12 ≈ 8.33

S2: 100 / 11 ≈ 9.09

S3: 90 / 8 = 11.25

Table 4. Iteration 2 (X_1 enters, S_1 leaves)

Var	X_1	X_2	X_3	S_1	S_2	S_3	RHS
Z	0	-220833	-150833	-29166	0	0	2.916.667
X_1	1	0.0833	0.0833	0.0833	0	0	8.33
S_2	0	1.0833	0.0833	-0.9167	1	0	8.33
S_3	0	3.3333	1.3333	-0.6667	0	1	23.33

Entering column: X_2

Ratio:

X_1: 8.33 / 0.0833 = 100

S2: 8.33 / 1.0833 ≈ 7.69 ✅

S3: 23.33 / 3.3333 ≈ 7.00 ✅ (smaller)

Table 5. Iteration 3 (X_2 enters, S_3 leaves)

Var	X_1	X_2	X_3	S_1	S_2	S_3	RHS
Z	0	0	62500	15000	0	-66250	4.462.500
X_1	1	0	0.05	0.1	0	-0.025	7.75
S_2	0	0	-0.35	-0.7	1	-0.325	0.75
X_2	0	12	0.4	-0.2	0	0.3	7

Entering column: X_3

Ratio:

X_1: 7.75 / 0.05 = 155

S2: Since the result for S_2 is negative, it is not included in the calculation.

X_2: 7 / 0.4 = 17.5 ✅

Table 6. Iteration 4 (X_3 enters, S_2 leaves)

Var	X_1	X_2	X_3	S_1	S_2	S_3	RHS
Z	0	-156250	0	46250	0	-113125	5.556.250
X_1	1	-0.125	0	0.125	0	-0.0625	6.875
X3	0	2.5	1	-0.5	0	0.75	17.5
X_2	0	1	0.4	-0.2	0	0.3	7

Based on Table 6, it can be seen that each row value has changed according to the calculation. Then, in order to eliminate the negative values in the Z row, an improvement needs to be made. The result of this improvement can be seen in Table 7 below.

Table 7. Final Improved Result

Var	X_1	X_2	X_3	S_1	S_2	S_3	RHS	IDK
Z	0	0	0	0	0	0	8.100.000	max
S_1	8	-1	0	1	0	-0.5	55	
S_2	7	0	0	0	1	-0.5	55	
X_3	4	2	1	0	0	0.5	45	

Based on Table 7, the maximum profit obtained by PD Maha Kayu Sejahtera is Rp 8,100,000 per week. Next, to verify the accuracy of the results obtained, testing was carried out using LINGO and POM-QM for Windows v5. The results obtained from the software were then documented.

a. Open the LINGO software, and enter the mathematical model input (see Figure 4).

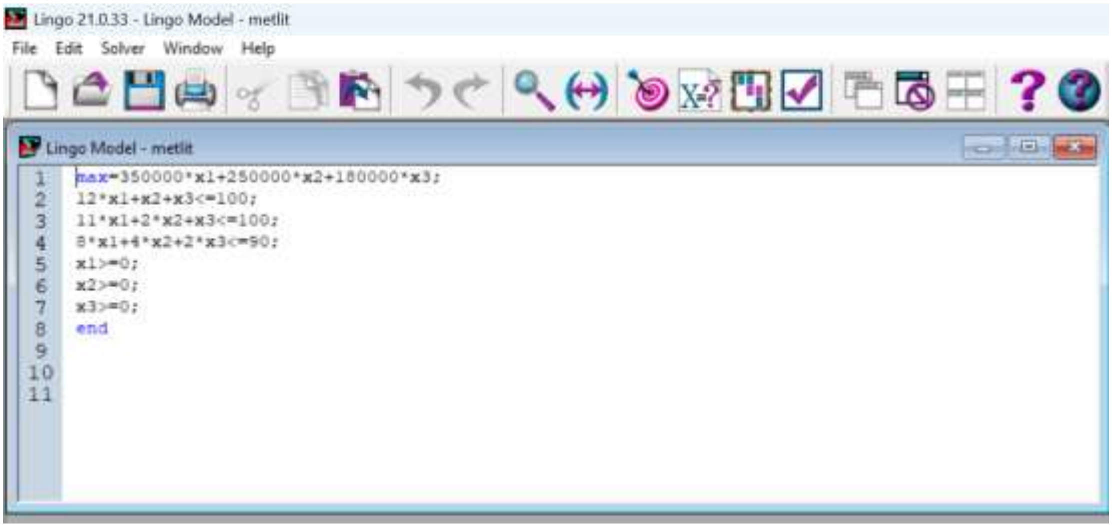

Figure 4. LINGO Software Data Input

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Based on Figure 4, it is known that the input data represents the objective function in the form of a maximization, namely:

$Z=350.000X_1 + 250.000X_2 + 180.000X_3$

Subject to the following constraints:

$12X_1 + X_2 + X_3 \leq 100$

$11X_1 + 2X_2 + X_3 \leq 100$

$8X_1 + 4X_2 + 2X_3 \leq 90$

$X_1 \geq 0, X_2 \geq 0, X_3 \geq 0$

b. Output Data

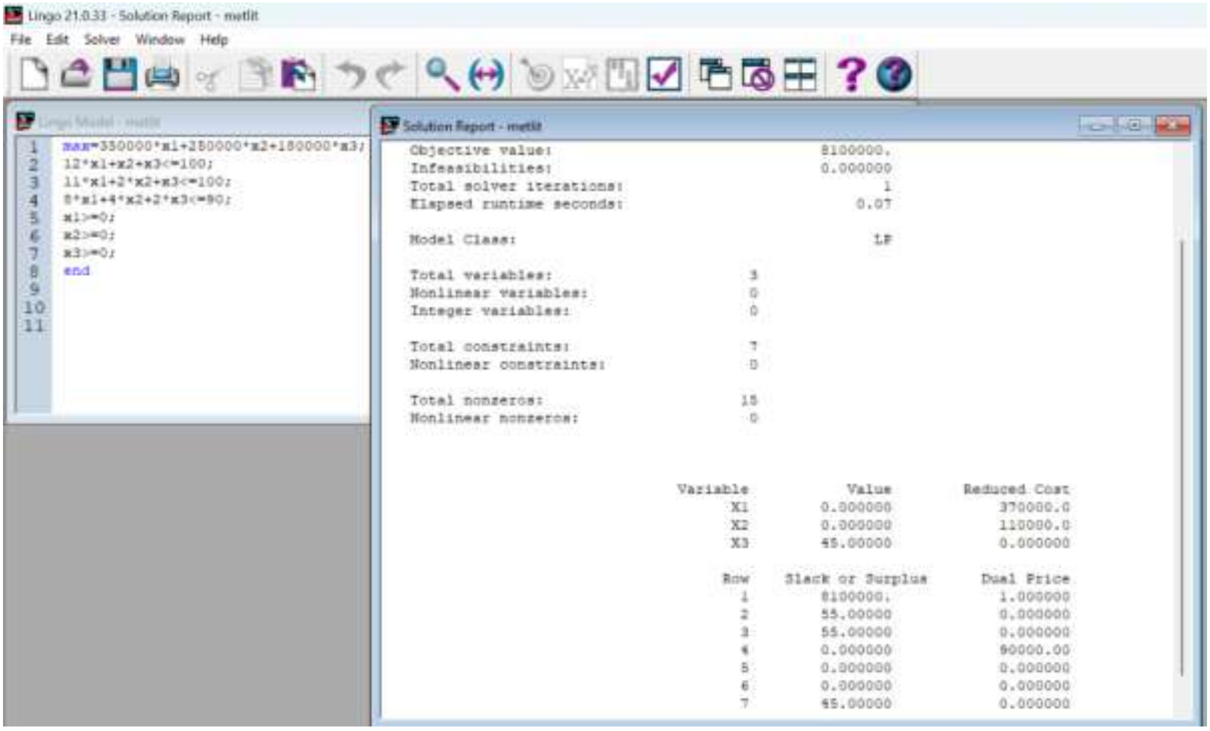

Figure 5. LINGO Software Output Data

Based on Figure 5, the output generated by the LINGO software is Rp 8,100,000, which is the same as the result obtained from the manual calculation. Next, testing was carried out using the POM-QM for Windows v5 program.

c. Open POM-QM for Windows v5, select Model Tree, and navigate to Linear Programming. Then, set the constraints and variables according to the problem (see Figure 6).

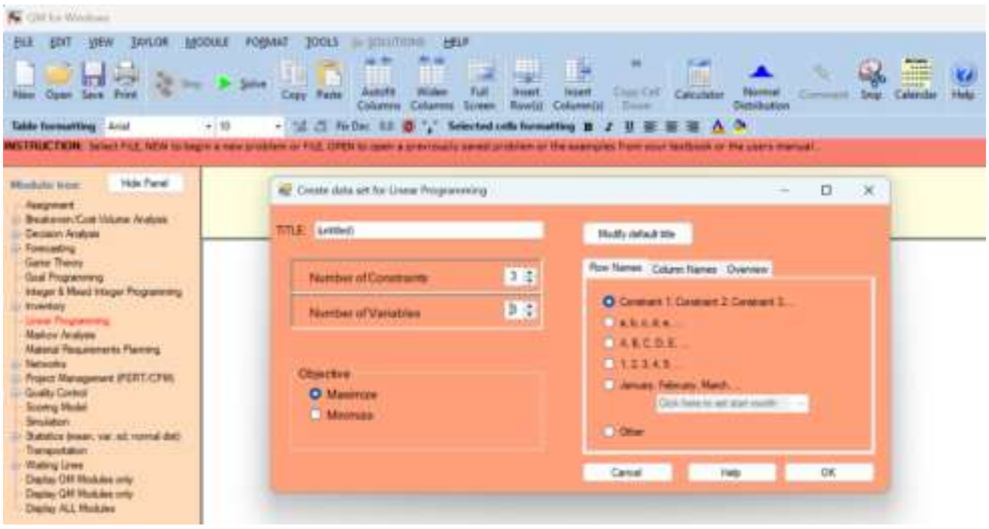

Figure 6. Module Tree and Linear Programming

d. The next step is to input the data into the provided columns. (See Figure 7)

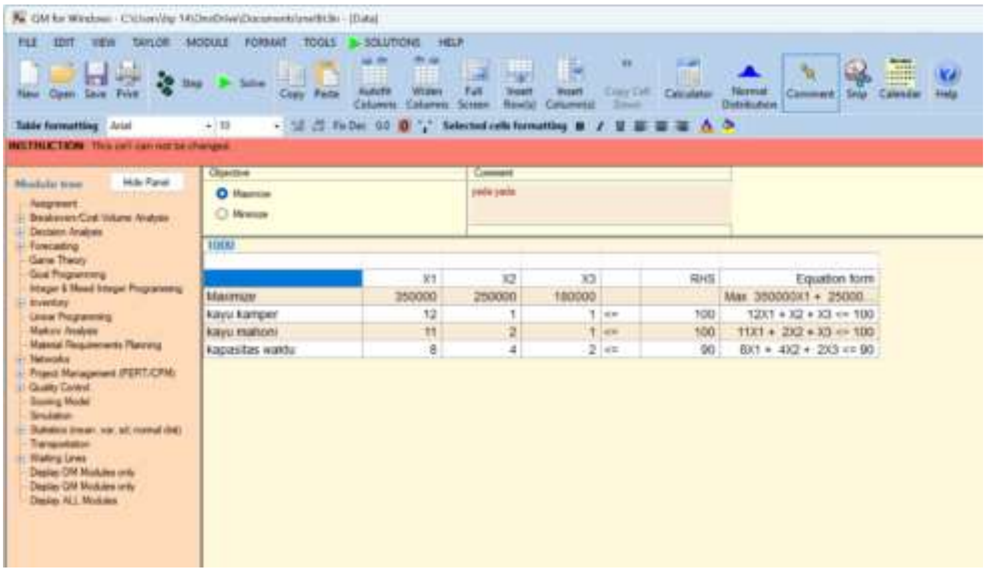

Figure 7. Data Input in POM-QM Linear Programming

e. Once the data input is correct, click the Solve button, and the solution to the linear programming problem using the Simplex method will appear. *(See Figure 8)*

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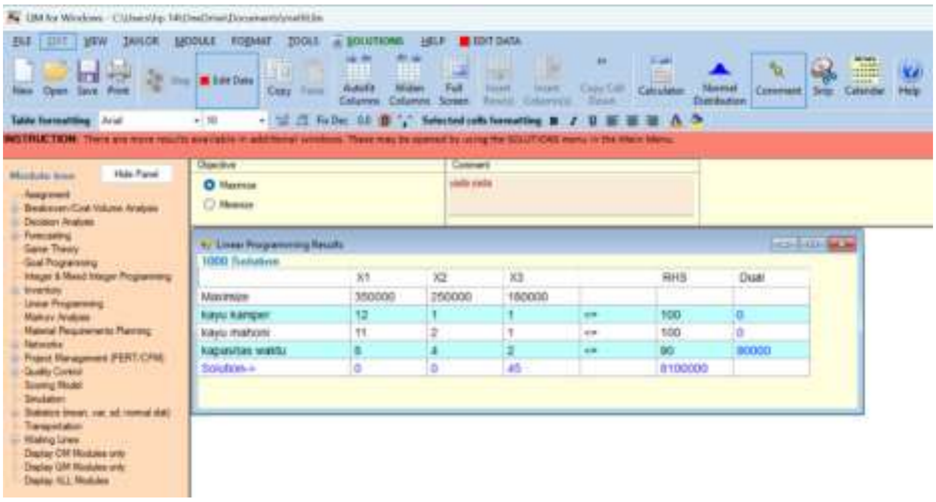

Figure 8. Solution to the Linear Programming Problem Using the Simplex Method

Based on the analysis of the documentation, the use of LINGO and POM-QM for Windows in applying linear programming can assist UMKM PD Maha Kayu Sejahtera in efficiently calculating the maximum profit from limited available resources. Both the manual calculation and the use of LINGO and POM-QM for Windows produced the same profit value, which is Rp 8,100,000 per week of production.

CONCLUSION

Based on the research results, it can be concluded that the application of the linear programming model using the Simplex method, whether through manual calculation or by using LINGO and POM-QM for Windows software, can effectively help solve the problems faced by UMKM PD Maha Kayu Sejahtera in an accurate, fast, and efficient manner. Both manual calculations and the use of LINGO and POM-QM for Windows yielded the same result, which is Rp 8,100,000. Furthermore, the use of the Simplex method can serve as a valuable consideration for decision-making, as it can accelerate PD Maha Kayu Sejahtera's ability to increase sales and optimize product output.

REFERENCE

1. Azizah, L. N. (2024). Maksimasi keuntungan UMKM CV Kayana Mandiri menggunakan metode simpleks berbantuan POM-QM. *Jurnal Ilmiah Teknologi Informasi dan Komunikasi*, *15*(2), 277–285.
2. Alam, T. B., Megasari, A., Amalia, S. A., Maulani, G., & Mahuda, I. (2021). Menggunakan pemrograman linear melalui metode simpleks. *Jurnal Statistika dan Ekonomi*, 1(2), 190–207.
3. Agustina, R., Nainggolan, R. S., & Panggabean, S. (2023). Meningkatkan UMKM Jus Buah Bu Ida dengan mengoptimumkan penjualan menggunakan metode simpleks

dalam linear programming. *Jurnal Riset Rumpun Matematika dan Ilmu Pengetahuan Alam*, 3(1), 52–68. https://doi.org/10.55606/jurrimipa.v3i1.2223

4. Firdaus, R. A., DU, H. D., P, F. A., & Pamungkas, G. P. (2024). Penerapan metode algoritma simpleks pada optimalisasi produksi busi. *Jurnal Minfo Polgan*, 13(1), 230–240. https://doi.org/10.33395/jmp.v13i1.13598
5. Gultom, R. G., Gultom, R. C. B., & Panggabean, S. (2023). Optimalisasi laba produksi pangan menggunakan program linier dengan metode simpleks dan POM-QM for Windows di Warung Cek Nur. *Jurnal Riset Rumpun Matematika dan Ilmu Pengetahuan Alam*, 3(1), 14–32. https://doi.org/10.55606/jurrimipa.v3i1.2196
6. Hartono, J., & Purwanto, A. (2022). Penggunaan metode simpleks untuk optimasi produksi pada industri mebel skala kecil. *Jurnal Teknik Industri Indonesia*, 21(3), 145–154. https://doi.org/10.31294/jtii.v21i3.7654
7. Hidayat, T., & Aziz, F. A. (2023). Strategi perencanaan produksi berbasis linear programming untuk peningkatan profit UMKM. *Jurnal Ilmiah Manajemen dan Bisnis*, 10(4), 233–241. https://doi.org/10.33368/jimb.v10i4.1542
8. Prasetyo, E., & Wulandari, S. (2024). Pemanfaatan software POM-QM dalam penentuan kombinasi produksi optimal pada UMKM konveksi. *Jurnal Matematika dan Aplikasinya*, 8(1), 59–66. https://doi.org/10.26740/jma.v8n1.p59-66.
9. Ramdani, D. M., Gorat, R., & Wijaya, A. (2025). Keuntungan maksimum dengan program linear pada UMKM Noga Sari. *[Nama jurnal tidak tersedia]*, 3, 37–45.
10. Nugroho, A. A., Pramukti, S., & Setyaningrum, R. (2025). Optimalisasi keuntungan pada usaha mikro kecil dan menengah (UMKM) Pempek Cik Lin menggunakan model integer linear programming dan software Lingo. *[Nama jurnal tidak tersedia]*, 7(2), 1318–1326.
11. Nurhidayah, I., & Mas'ud, M. I. (2023). Optimasi keuntungan produksi menggunakan pendekatan linear programming di UMKM Mubarok Snack. *Jurnal Sains dan Teknologi: Jurnal Keilmuan dan Aplikasi Teknologi Industri*, 23(1), 185. https://doi.org/10.36275/stsp.v23i1.613
12. Sari, M. D., & Nugraha, R. (2023). Penerapan linear programming dalam penjadwalan produksi guna memaksimalkan keuntungan UMKM. *Jurnal Rekayasa dan Manajemen Sistem Industri*, 11(1), 25–34. https://doi.org/10.14710/jrmsi.11.1.25-34
13. Sitio, S. L. M., & Zakaria, H. (2023). Optimalisasi keuntungan produk furniture menggunakan metode simpleks dan software POM-QM berbasis website. *Faktorexacta*, 16(1), 1–9. https://doi.org/10.30998/faktorexacta.v16i1.13554
14. Utami, L., & Rahman, M. F. (2022). Analisis optimasi produksi menggunakan metode simpleks pada usaha mikro pengolahan makanan. *Jurnal Ilmiah Teknik Industri*, 14(2), 101–109. https://doi.org/10.23917/jiti.v14i2.11278.
15. Zakiyah, E. F., Kasmo, A. B. P., & Nugroho, L. (2022). Peran dan fungsi usaha mikro kecil dan menengah (UMKM) dalam memitigasi resesi ekonomi global 2023. *Jurnal Cakrawala Ilmiah*, 2(4), 1657–1668. https://doi.org/10.53625/jcijurnalcakrawalailmiah.v2i4.4482