American International Journal of Business Management (AIJBM)
ISSN- 2379-106X, www.aijbm.com Volume 07, Issue 01 (January -2024), PP 34-42

Optimization of Production Results from Panciro Village Tempe Manufacturing Factory Using Simplex Method

Zainal Abidin[1], Natali Ikawidjaja[2], Faisal Rizal Zaenal[3], Andi Tenri Uleng Akal[4], Ince Adz Zahra Annur. SB[5], Agil Alhamdi[6], St. Rahmelia[7], Safril Usman[8], Al Ikhwan Febrian[9]

[1,3]*Lecturer at Institute Technology and Business of Nobel Indonesia, Makassar*
[2] *Lecturer at STIE Ciputra, Makassar, Indonesia*
[4] *Lecturer at STIE Trie Dharma Makassar, Indonesia*
[5,6,7,8] *Students at Institute Technology and Business of Nobel Indonesia, Makassar*
**Corresponding Author: Zainal Abidin*

ABSTRACT: Tempeh is a typical Indonesian food whose basic ingredient is soybeans. Tempeh has many health benefits because it is high in nutrition. Currently, in Indonesia there are around 81 thousand tempe making businesses which produce 2.4 million tons of tempeh per year. The tempe industry produces around Rp. 37 trillion in added value, but many tempeh entrepreneurs still have difficulty calculating production, such as the Pansiro village tempeh factory. The research was carried out with the aim of analyzing the optimal profit value from tempe production. This research was conducted in Panciro Village, South Sulawesi Province, Indonesia. The method used is linear programming with the POM-QM software application as a comparison for manual calculations. Based on the calculation results, it can be concluded that the optimal profit if the factory produces tempeh is IDR. 675,000 with large tempeh 50 pies and small tempeh 25 pies.

Keywords: Simplex Method, Optimazation, Production.

I. INTRODUCTION

With business development and intense competition, many problems arise that affect businesses. Business competition is getting tougher, causing many consequences in corporate competition. Companies are required to continuously improve their competitiveness. Companies must be able to quickly change themselves to become stronger and able to respond to market needs [1]. Business development in the 21st century has developed very rapidly and is experiencing continuous metamorphosis. Every business actor in every business category is required to be sensitive to every change that occurs and place an orientation towards customer satisfaction as the main goal. The influence of globalization in the industrial world today has caused competition between companies to become increasingly tight and competitive. Based on this, companies are required to continue to develop so that they are able to face existing competition [2]. Increasingly tight business competition requires business owners to always have a strategy so that their business can survive and continue to develop in this situation. This level of competition forces every business to produce various different innovative ideas to beat the competition, especially for businesses operating in the same industry. Tight competition involving many business actors certainly requires these business actors to be able to adapt to developments in business conditions. In facing this competition, running a business requires a good strategy to help business owners anticipate the impact of these events and be able to compete [3].

Tempe is a typical Indonesian food which is quite popular and has become a culture in all levels of society, both urban and rural communities. Tempeh contains vitamins, minerals, amino acids and is a source of high quality vegetable protein [4]. Tempe is a traditional Indonesian food that is worldwide, first made by people in Central Java and appeared in the 1700s. Tempeh is widely known as a fermented food that comes from soybeans. The soybeans most commonly used in making tempeh are soybeans (Glycine mas), but several other tempeh innovations use beans such as red beans (Phaseolus vulgaris) as a substitute for soybeans. Several regions in Indonesia have their own varieties of soybeans, both local and imported, to be used as the basic ingredient for making tempeh with different protein content [5].

Currently, in Indonesia there are around 81 thousand tempe making businesses which produce 2.4 million tons of tempeh per year. The tempe industry produces around Rp. 37 trillion added value [6]. Indonesia is the largest tempe producing country in the world and the largest soybean market in Asia. As much as 50% of Indonesia's soybean consumption is used to produce tempeh, 40% tofu, and 10% for other products (such as tauco, soy sauce, etc.). Tempeh is widely consumed in Indonesia, but has now spread worldwide. As a result, tempeh is now produced in many places in the world, not only in Indonesia [7]. The tempeh industry can

provide value to the people's economy. The need for large tempeh production can absorb a lot of workers, both in home industries and larger industrial scale. In producing tempeh, things are needed that support the making of tempeh, in the form of tools, materials, people and other objects needed to make tempeh [8].
Every business is created to provide optimal profits, including the tempe business, but there are still many business people who do not understand how to calculate so that their business can produce maximum profits. One of the most commonly used methods in determining optimal production points is the simplex method [9]. The method used to solve the problem is the simplex method. However, basically entrepreneurs do not know whether to calculate the maximum profit from the production process using the simplex method, so this researcher will try to help tempe entrepreneurs to calculate profits using the simplex method so that entrepreneurs can find out the maximum profit. The simplex method is a linear programming problem solving method that is used to make decisions to combine products to be sold in order to produce maximum profits [10].

II. LITERATURE REVIEW

To solve linear programming problems (LPP), the simplex method is a popular and widely used method. The simplex model in Simulink to facilitate visualization and simulation in System Generator is used to achieve fast implementation. This is an efficient tableau-based representation and the clock frequency achieved by the design is compared with general-purpose software. The simplex method is an efficient and widely used LPP problem solver. Since being proposed by George B. Dantzig in 1947, it has dominated the region for more than sixty years [11].

There are certain steps required to solve the LPP using the Simplex method so that it can be implemented in Standard form and a linear program is required before completing the optimal solution. There are several important conditions for LPP completion and optimization:

1. If the objective function is in the form of minimization then it must be changed to maximization
2. All linear constraints must be ≤ inequality,
3. All variables must be non-negative.

The three requirements above must be met by converting the given linear program using basic algebra and substitution and then determining the slack variable, namely. To convert inequality constraints into equality constraints, there are several additional variables that are included in the linear constraints of the linear program. The slack variable always has a coefficient of +1 when the model is in standard form. For optimality, a slack variable is introduced. By using the concept of slack variables, the objective function coefficients can be modified. Due to the nature of the problem, this method can be easily implemented on a computer and this method overcomes the limitations of graphical methods and unnecessary iterations in the search [11].

III. RESEARCH METHOD

A. Research Design

The research design is explanatory research with quantitative methods, namely a research approach that uses a lot of numbers, starting from collecting data, interpreting the data obtained, and presenting the results (Arikunto, 2006).

B. Object of research

This research took as its object the tempeh entrepreneurs in Panciro Village, Gowa Regency, South Sulawesi Province, Indonesia.

C. Data analysis technique

To solve the main problems faced in this research, an analytical method was used, namely descriptive analysis, namely analysis that describes the results of secondary data. This research uses an analysis tool, namely the simplex method using POM-QM for Windowa software.

IV. RESULT

Based on interview data from the owner of the tempe production factory in Panciro Village, decision variables can be grouped or identified, namely:

1. Large Tempeh:
a. Yeast 10 gr
b. Soybeans 2 Kg
2. Small Tempeh:
a) Yeast 7 gr
b) Soybeans 1.5 kg

This raw material is needed every time large tempeh and small tempeh are made by tempeh entrepreneurs in Panro:r village

1. The profit per piece obtained is:
a) Large Tempe Rp. 10,000 / pcs
b) Small Tempe Rp. 7,000 / pcs
2. Raw material inventory:
a) Yeast: 500 gr
b) Soybeans: 125 kg

To determine the formulation of existing data, the symbols X1 X2 and Z are used where:
X1: the number of measurements for large tempeh to be produced
X2: the number of measurements for small tempeh to be produced
Zmax: the amount of profit from large tempeh and small tempeh each time it is produced

The aim of the Panciro Village tempe production factory is to find out the profits that will be obtaine every time it produces large and small tempeh with the resources or supplies of raw materials it has So the formulation of the mathematical model is as follows:

$$\text{Maximize } Z = 10000X1 + 7000X2$$

Limited raw materials or resources can be formulated regarding the following limitations:
1. The yeast used is 10 grams for large tempeh (X1), and 7 grams for small tempeh (X2) and the available capacity is 500 grams of yeast.
2. The soybeans used are 2 kg for large tempeh (X1), and 1.5 kg for small tempeh (X2) and the available capacity is 125 kg of soybeans.

Table 1. Types of products, profits and inventory owned

Raw material	Types of products		Inventory
	Big Tempe	Small Tempe	
Yeast	10 gr	7 gr	500 gr
Soya bean	2 kg	1,5 kg	125 kg
Profit	Rp. 10.000	Rp. 7.000	

Source: processed data

From the data in table 1, a linear programming solution to the maximum problem is created, the steps for solving it are as follows:

1. $10X_1 + 7X_2 \leq 500$
$10X_1 + 7X_2 = 500$
2. $2X_1 + 1{,}5X_2 \leq 125$
$2X_1 + 1{,}5X_2 = 125$

The objective function is changed to an implicit function, namely shifting elements from the right to the left, so that the objective function becomes:

$$Z - 10.000X1 - 7.000X2 = 0$$

This limitation function is changed by providing a slide variable which will be useful for knowing the limitations in capacity by adding additional variables which will be:

1. $10X_1 + 7X_2 = 500$
2. $2X_1 + 1{,}5X_2 = 125$

The equation above is entered into the simplex table. After the formulation is changed, it is arranged in the first iteration table as follows:

Basic Variables	Z	X_1	X_2	S_1	S_2	Column Value	Index
Z	1	-10.000	-7.000	0	0	0	0
X_1	0	10	7	1	0	500	50
X_2	0	2	1,5	0	1	125	62,5

1. New Key Row:

New Key Row = $\frac{New\ Key\ Row}{Elemen\ Cell}$

Old Key Row (X_1) = $\frac{10 \quad 7 \quad 1 \quad 0 \quad 500}{10}$

X_1 = 1 $\frac{7}{10}$ $\frac{1}{10}$ 0 50

2. For S_2:

New Row S_2: Old Row S_2 – (Corresponding row column value x New key row)

New Row S_2:

(2 1,5 0 1 125) – (2) x (1 $\frac{7}{10}$ $\frac{1}{10}$ 0 50)

S_2 :

0 $\frac{1}{10}$ 0 $\frac{4}{5}$ 25

3. For New Z:

New Row Z;

Olw Row Z – (Corresponding key column value x New key row)

New Row Z:

(-10.000 -7.000 0 0 0) – (-10.000) x (1 $\frac{7}{10}$ $\frac{1}{10}$ 0 50)

Table 3. Second Iteration

Basic Variabel	Z	X_1	X_2	S_1	S_2	Column Value
Z	1	0	0	1000	0	500
X_1	0	1	$\frac{7}{10}$	$\frac{1}{10}$	0	50
X_2	0	0	$\frac{1}{10}$	0	$\frac{4}{5}$	25

Based on table 2, row Z no longer has a negative value so the resulting solution is optimal, so that when the Panciro Village tempeh production factory wants to obtain maximum profits, it will add:

1. Large tempeh production of 50 picis
2. Small tempeh production of 25 picis
3. Maximum profit will be achieved at: Rp. 10,000 x 50 + Rp. 7,000 x 25 = Rp. 675,000

The following are the solving steps using linear programming from the POM-QM for Windows application:

1. The initial display when the application is activated will automatically be redirected to the module menu, so to solve linear programming, select the linear programming module.

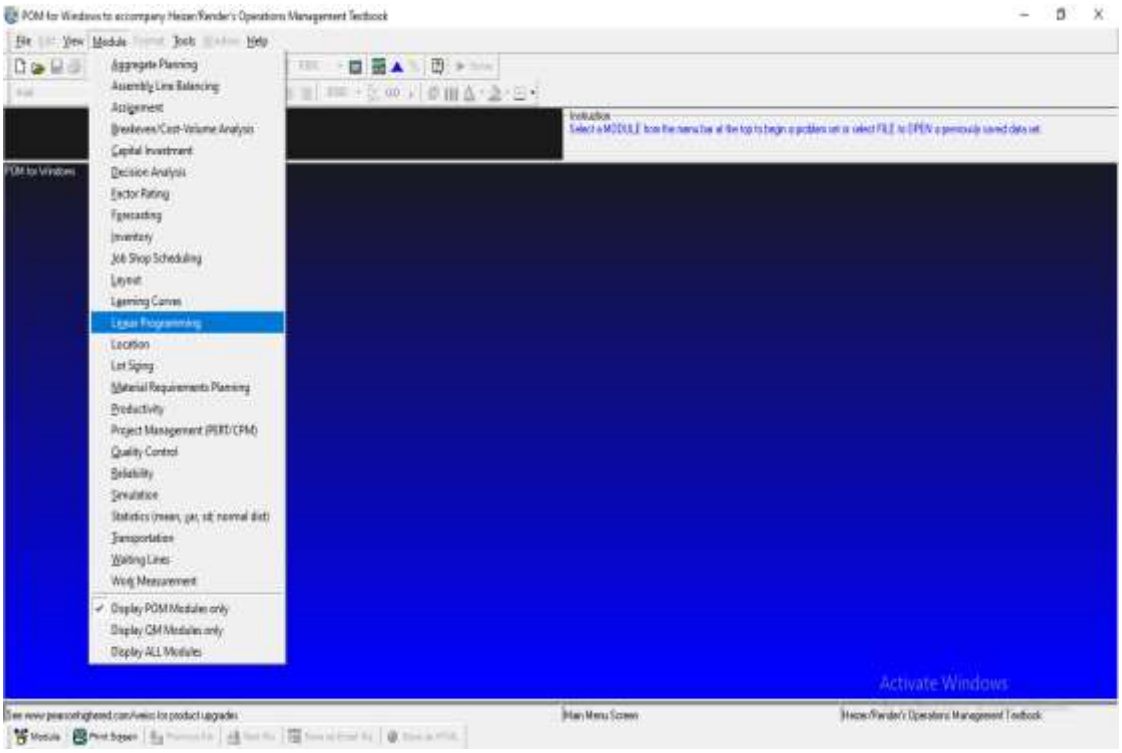


Figure 1. Initial display of the POM-QM application

2. Then click control n or create a new file (File -> New)

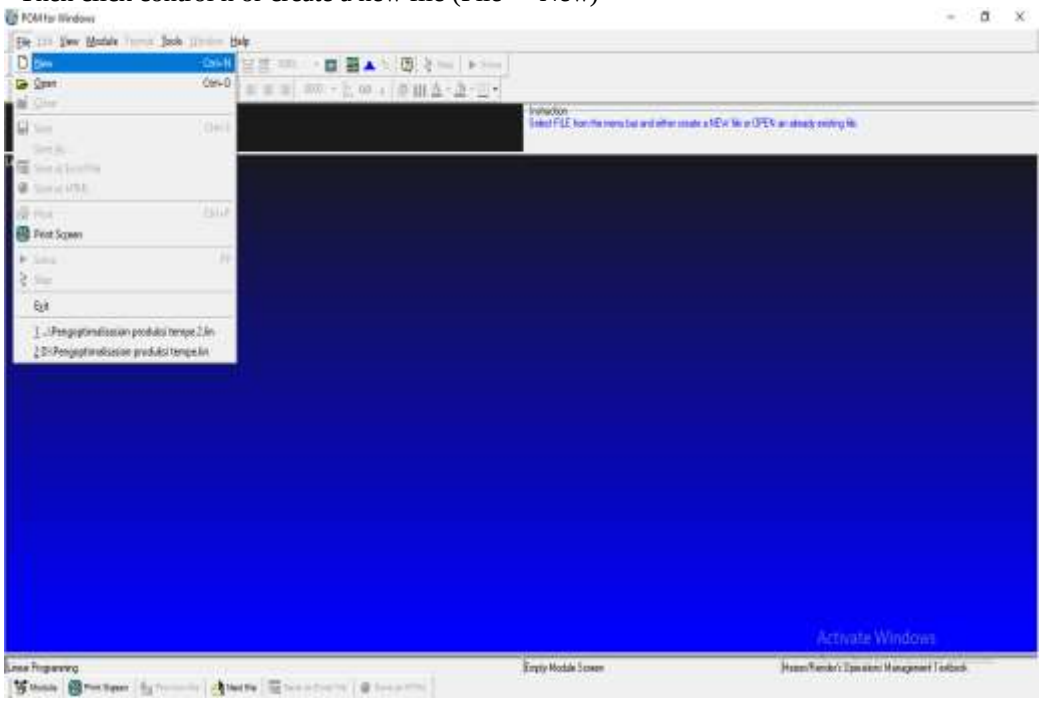


Figure 2. Display of creating a new file in the POM-QM application

3. Then enter the data file to be processed such as changing the title, enter the constraints or limits according to the number of decision variables, row names and column names.

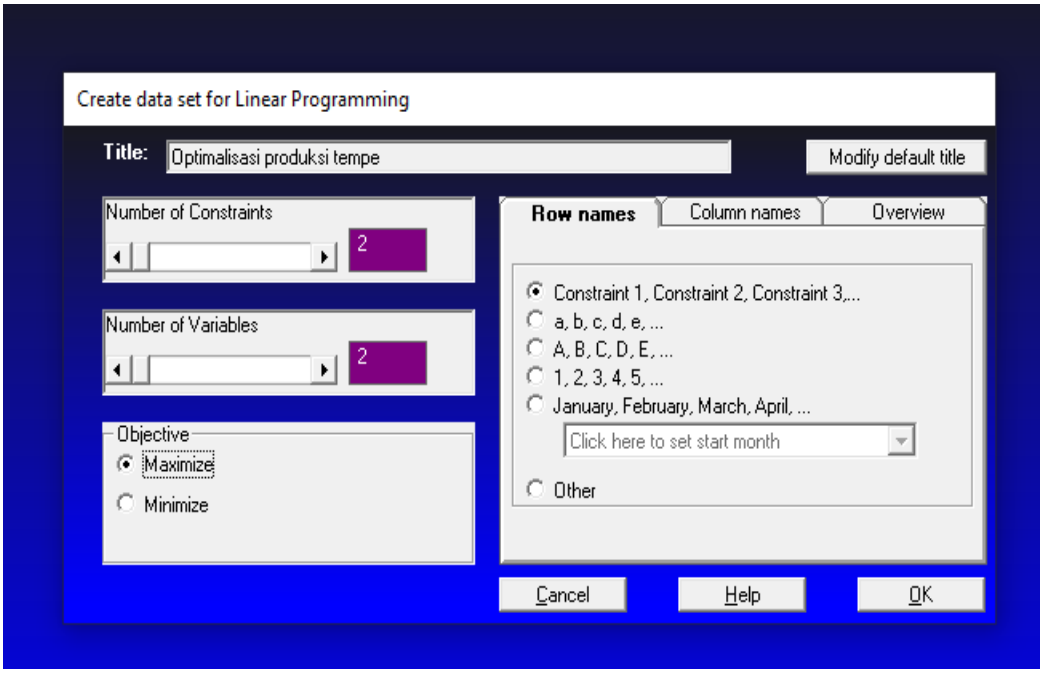


Figure 3. Data input display in Linear Programming

4. After that, enter the data obtained from the interview results and so on into the columns provided.

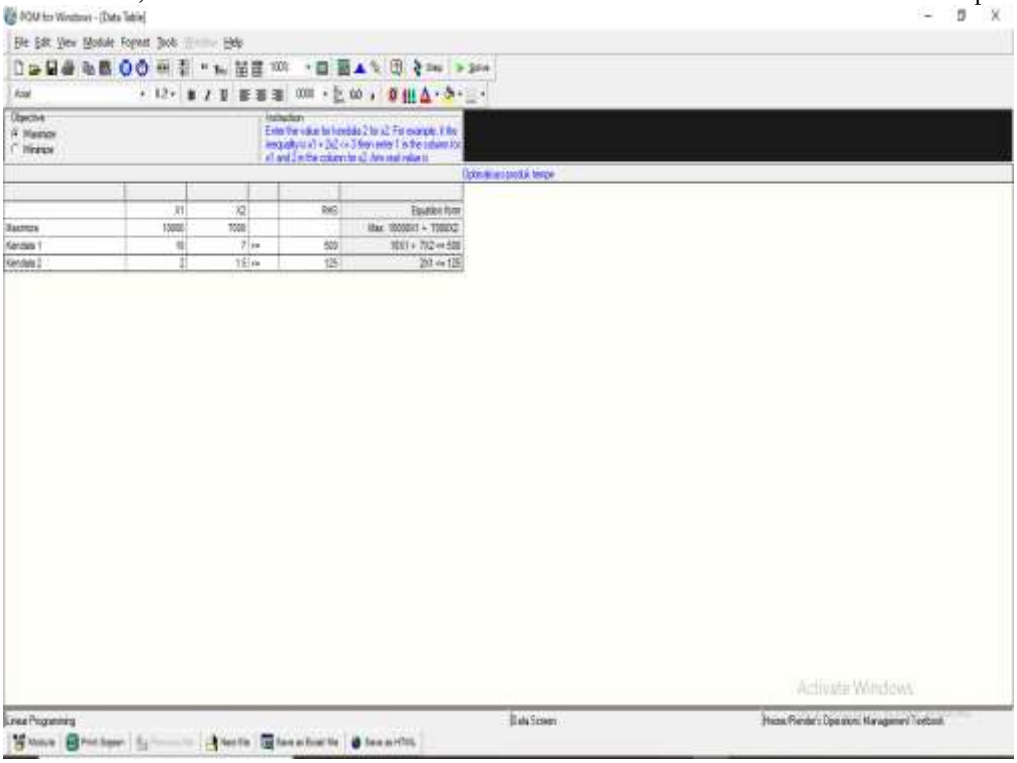
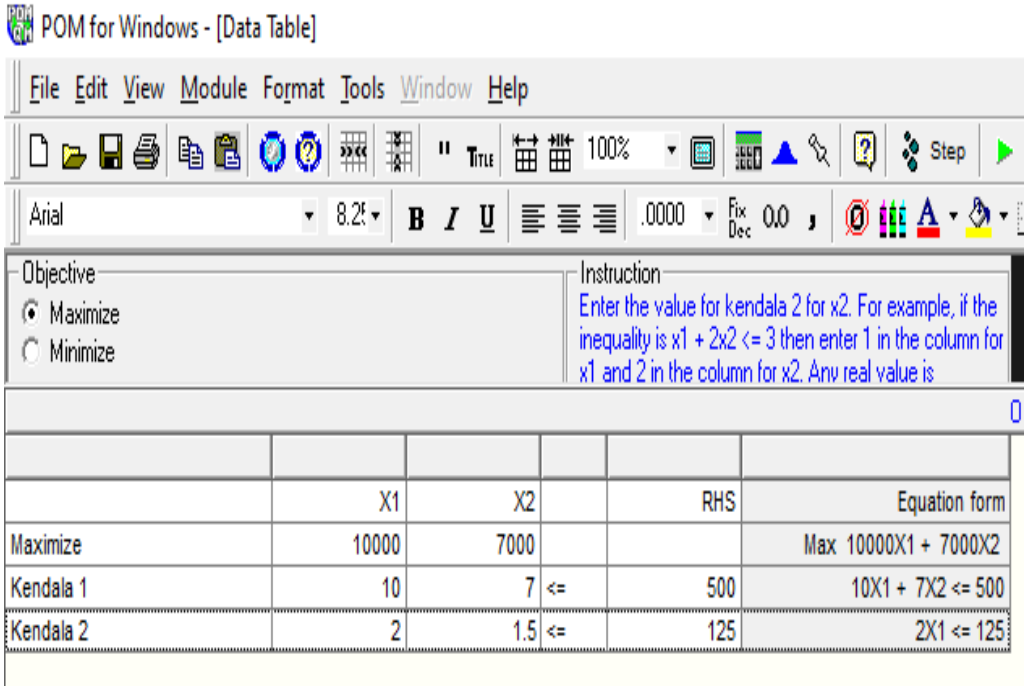


Figure 4. Display of data input as obtained



	X1	X2		RHS	Equation form
Maximize	10000	7000			Max 10000X1 + 7000X2
Kendala 1	10	7	<=	500	10X1 + 7X2 <= 500
Kendala 2	2	1.5	<=	125	2X1 <= 125

Figure 5. Display of data input as obtained (Zoom)

5. After the data has been entered, select the solve button, then select the display that says "Iterations". Then you will automatically get solutions to solve linear programming problems using the simplex method.

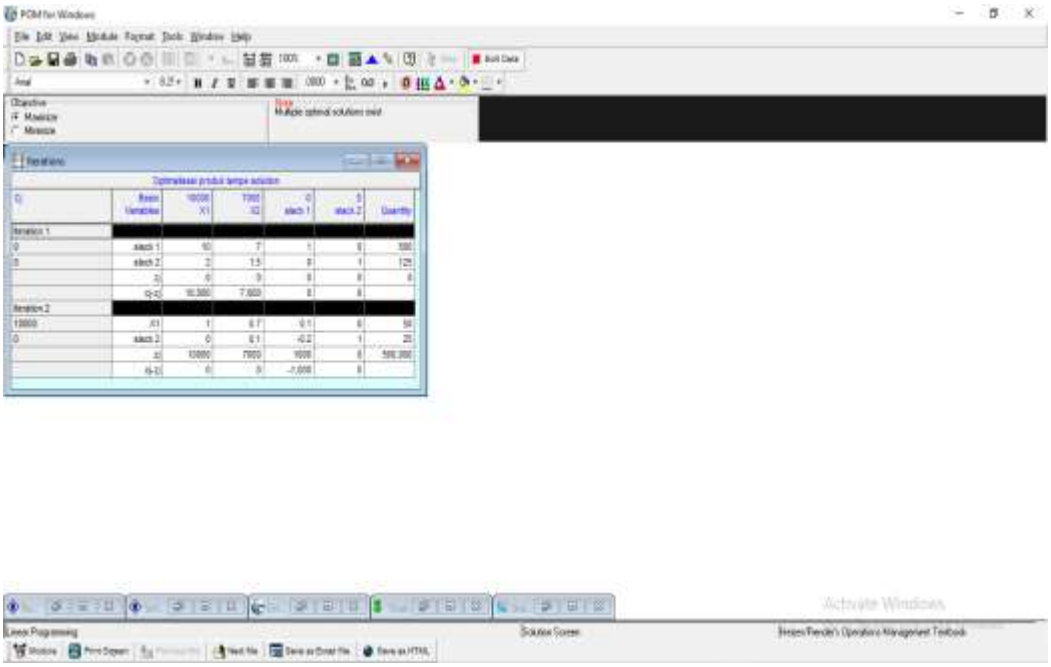
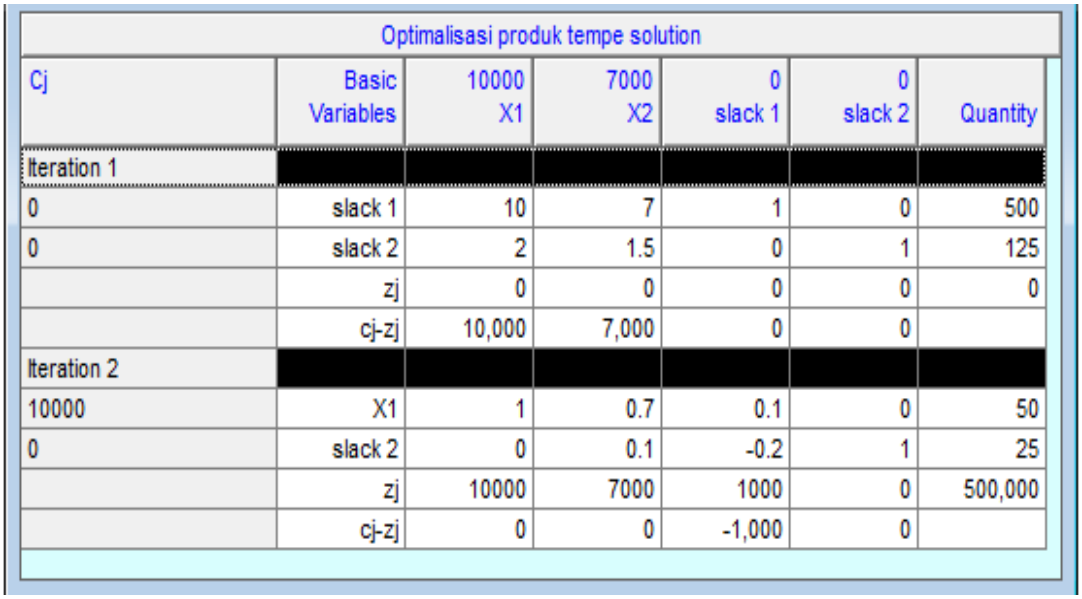


Figure 6. Iterations solution display in the simplex method



Optimalisasi produk tempe solution

Cj	Basic Variables	10000 X1	7000 X2	0 slack 1	0 slack 2	Quantity
Iteration 1						
0	slack 1	10	7	1	0	500
0	slack 2	2	1.5	0	1	125
	zj	0	0	0	0	0
	cj-zj	10,000	7,000	0	0	
Iteration 2						
10000	X1	1	0.7	0.1	0	50
0	slack 2	0	0.1	-0.2	1	25
	zj	10000	7000	1000	0	500,000
	cj-zj	0	0	-1,000	0	

Figure 7. Iterations solution display in the simplex method (Zoom)

V. DISCUSSION

The results of the analysis show that the application of linear programming in optimizing the Panciro village tempe production factory can help maximize profits from the limited raw materials available. The product that produces greater profits is large tempeh with a profit of 10,000 per tempeh point, while for small tempeh the profit generated is 7,000 per tempeh.

Based on the results of the analysis by applying the linear programming model method with the simplex method, the maximum profit obtained by the Panciro Village tempeh production factory is 675,000 per production from the combination of large and small tempeh production quantities. The number of additional tempeh that must be produced in order to obtain maximum profits is 50 large tempeh and 25 small tempeh.

VI. CONCLUSION

Based on the results of research and discussion in this study, it can be concluded that:

1. The maximum profit obtained by the Panciro Village tempeh production factory is 675,000 per production from the combination of large and small tempeh production quantities.
2. The number of additional tempeh that must be produced in order to obtain maximum profits is 50 large tempeh and 25 small tempeh.

REFERENCES

[1]. H. A. Sutanto, "Analisis Efisiensi Teknis Bank Pembangun," *JEJAK*, vol. 8, no. 1, Mar. 2015, doi: 10.15294/jejak.v8i1.3851. Joko Setiyono1 dan Sutrimah. Analisis Teks Dan Konteks Pada Iklan Operator Seluler (Xl Dengan Kartu As). Jurnal Pedagogia ISSN 2089-3833 Volume. 5, No. 2, Agustus 2016.

[2]. Kotler, Philip. 2005. Manajemen Pemasaran. Jilid 1 dan 2. Jakarta : PT Indeks. Kelompok Gramedia.

[3]. Analisis Strategi Pemasaran Untuk Meningkatkan Penjualan Pada Usaha Ibu Bagas di Kecamatan Mamuju Irdha Yanti Musyawarah1 , Desi Idayanti2. Forecasting: Jurnal Ilmiah Ilmu Manajemen Vol 1, No 1 (2022) ISSN (cetak) 2621-7406 ISSN (online) 2656-6265.

[4]. Anisya Agustina, Hanifah Dinda Difanie.Sm , Octavia Chotimah, Sarah Yulinda, Miftahul Khairani, Indayana Febriani Tanjung. Proses Pembuatan Tempe Home Industry Berbahan Dasar Kedelai (Glycine max L. Merr) Di Kecamatan Sawit Seberang Kabupaten Langkat. BEST JOURNAL. Vol.6 No.1 Hal. 15-21 ISSN (Print) : 2614 – 8064 Januari 2023 ISSN (Online): 2654 – 4652.

[5]. Kristiadi, OH, et al. Tempe Kacang Kedelai Sebagai Pangan Fermentasi Unggulan Khas Indonesia: Literature Review. Jurnal Andaliman: Jurnal Gizi Pangan, Klinik dan Masyarakat, 2022. 2(2): 48 – 56 ISSN (Media Online) 2777-1121.

[6]. Tempe: Persembahan Indonesia untuk Dunia – Jakarta: Badan Standardisasi Nasional, 2012.

[7]. Ellia Kristiningrum dan Danar Agus Susanto. Kemampuan Produsen Tempe Kedelai dalam

Menerapkan SNI 3144:2009. Jurnal Standardisasi Volume 16 Nomor 2, Juli 2015: Hal 99 - 108

[8]. Badilah Bin Rawin, ,Mudrikah, Siti Julaeha. Watewor.Com : Wankid Tempe Worldwide (Monitoring Ketersediaan Faktor Produksi Tempe Wanasaba Kidul Berbasis Aplikasi Guna Menuju Perekonomian Yang Produktif, Kompetitif Dan Inklusif). Jurnal PENA Volume 7 Nomor 2 E-ISSN 2722-7685.

[9]. Damaris Lalanga , Landerius Marob, , Wehelmina T. Onmayc. Penggunaan Metode Simpleks Terhadap Keuntungan Harian pada Usaha Rumah Makan Viola Batunirwala Di Kota Kalabahi. JSLK 3 (2) 29-34 Jurnal Saintek Lahan Kering (2020) International Standard of Serial Number 2622-1020.

[10]. Ping-Qi Pan. Simplex Method Chapter · October 2014 DOI: 10.1007/978-3-642-40754-3_3 CITATION 1 READS 3,775 1. Southeast University (China.

[11]. Mohammad Rashid Hussain, Mohammed Qayyum, Mohammad Equebal Hussain. Effect of Seven Steps Approach on Simplex Method to Optimize the Mathematical Manipulation. International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-7 Issue-5, January 2019.

Corresponding Author: Zainal Abidin
[1,3]Lecturer at Institute Technology and Business of Nobel Indonesia, Makassar